

Word Association Links in Japanese and German Students of English as a Foreign Language, and their Relation to English Lexical Development

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日本人とドイツ人英語学習者による語彙の連想心的結合と英語の語彙発達との関係

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要 旨

成人の脳にある膨大な量の言語情報の中から、効率的に適切な言語が検索されたり、認識されたりすることから、脳にある語彙は体系的に整理されていると考えられている。特に、英語母語話者を対象に実施された語連想テストによって、どのように語彙が脳に保持されているのか、という点に関する理解はかなり進んできた。しかしながら、外国語あるいは第二言語として英語を学ぶ学習者については、あまり研究はされていない。本論文では、日本人学生、ドイツ人学生、会社員の35名を対象に、英語の語彙の心的結合の特徴と、心的結合と英語の語彙発達との関係について、筆者が実施した小規模な準実験を報告する。結果は、参加者による語連想のタイプにおける傾向及び、どのように語彙の心的結合が英語の熟達度と第二言語の総合的な語彙発達に関係するのか、という点について示唆を与えている。本研究結果は、語学教師が第二言語の語彙指導を行う際、十分な情報に基づいて教授方法を決めることを可能にするという点で意義がある。

1. INTRODUCTION

How are words stored in your brain? Although researchers are far from a comprehensive answer to this question, considerable progress has been made in our understanding of the linguistic brain, particularly through word association testing carried out on native English speakers (see Aitchison 2003 and McCarthy 1990). Researchers refer to the brain's system of word storage and retrieval as the *mental lexicon*, a metaphorical term for the network of links between the stored words and data in the human brain (McCarthy 1990). Due to the vast amount of linguistic information contained in the adult brain, and

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the efficiency by which appropriate items are retrieved and recognized, it is assumed that words in the brain are systematically organized. The various ways these words are associated with each other in the mind have been identified and classified by psycholinguists working in the field. They include collocation, co-ordination, synonymy, and super-ordination; along with phonological, orthographic, word-class, and encyclopedic links (Table 1). While research on these links in the L1 mental lexicon abounds, relatively little attention has been paid to learners of English as a foreign or second language. This paper reports on a small-scale quasi-experimental study conducted by the author which investigates the nature of mental links between English words of 35 Japanese and German university students and company employees, and the relation of these links to their English lexical development.

The results of this research help to provide insights into how the L2 mental lexicon is organized and how it develops as the word-store increases. Through this understanding, language teachers may be able to develop more effective ways of teaching new words so that they are assimilated into the L2 lexicon as efficiently as possible. To this end, the findings of this study are viewed in terms of implications for classroom practices. Further to this, the value of word-association testing as a means to improve vocabulary teaching is discussed, along with suggestions for additional research in the field.

2. WORD ASSOCIATION

Word association can be investigated by giving an individual a prompt word and asking him to report the first word which comes to mind in response to the prompt. Table 1 shows a selection of typical word-association responses, along with the corresponding category of association.

Table 1 : Typical Word-association Responses with Categorisation

Relation	Link	Stimulus	Response
Syntagmatic	Collocation	<i>smoke</i>	<i>detector</i>
	Colligation	<i>on</i>	<i>fire</i>
Sense (Paradigmatic)	Co-ordination	<i>heart</i>	<i>stomach</i>
		<i>boil</i>	<i>egg</i>
		<i>jog</i>	<i>dog</i>
	Super-ordination	<i>yellow</i>	<i>color</i>
	Antonymy	<i>slowly</i>	<i>fast</i>
	Synonymy	<i>smile</i>	<i>laugh</i>

The categorization of these associations is examined in more detail in the following sections. The links between items in the mental lexicon can be broadly divided according to two organizing principles, namely syntagmatic and sense, or paradigmatic relations.

2. 1 Syntagmatic Relations

Syntagmatic organization views text as a kind of chain, with each word representing a link connected to the words preceding and following it. Some words and phrases are more likely to occur together than others. This phenomenon is known as collocation, for example some collocates for *smoke* are *signal*, *screen* and *detector*. Collocates do not necessarily have to be directly adjacent to one another, but can also occur across a number of words, this is known as cross-sentence collocation. Grammatical collocation, distinct from semantically-based collocation, is known as colligation. For example, some colligates for the preposition *on* are *fire*, *top*, *form* and *the table*. Words which are frequently found within close quarters in a text are said to have a strong collocational link. The number of acceptable collocates for a given item is limited and this restriction of choice is proof of the idiom principle (IP) (Sinclair, 1991), whereby language is seen to be made up of and comprehended in chunks rather than word by word. The speaker can choose from a large number of semi-pre-constructed phrases, each representing a single choice, from which to construct text. As well as semantic and grammatical connections between words, another form of link is the degree of similarity between the meanings of two words. These are known as sense relations.

2. 2 Sense Relations

Sense, also known as paradigmatic, relations refer to the degree of semantic similarity between candidates for any given position within a text. In contrast to the idiom principle, each and every word in a text is a choice from a paradigm of competing possible items. Using the example '*Have you eaten all the bread?*', the third position could be filled by one of a number of different words, for example *had*, *sold*, *used*, and *made*. This view of text production corresponds to the open choice principle (OCP) (Sinclair 1991). It requires more individual choices to be made during text construction and is resultantly both more challenging and creative than IP which involves fewer choices and higher conformity. Use of OCP is therefore seen as a sign of increased linguistic competence and this may explain why there is a tendency for native speakers and higher-level students to produce word associations paradigmatically and for lower level students to produce them syntactically (Carter, 1987). Perhaps the early L2 lexicon is organized by syntactic means whereby learners produce pre-learnt continuous chunks of language with little reference to grammatical rules. Indeed, Coulthard et. al (2002) postulate that collocational links may well be the dominant form of word association in many non-native speakers. Unlike syntagmatic relations, sense relations are divided into several sub-categories. These are examined in sections 2.2.1-2.2.3.

2.2.1 Hyponymy

An organizing principle of inclusion, hyponymy creates taxonomies of words where groups of co-hyponyms form lexical sets, and larger groups make up lexical fields. For example, *times of day* is the super-ordinate of *morning*, *afternoon*, *evening* and *night*. Meronymy refers to the 'part of' relationship, for example, *clutch*, *gear stick* and *steering wheel* are all meronyms sharing the super-ordinate *car*. In word association tests on native speakers, super-ordinate responses were found to be less common (Aitchison, 2003).

2.2.2 Synonymy

This is a relationship of sameness of meaning. For example, *smile* and *grin* or *begin* and *start*. There are however, no pure synonyms in that they are completely interchangeable in all possible contexts, situations and geographical locations (McCarthy, 1990) without a change in literal or associative meaning. McCarthy points out that, "it would be unwise to declare any two items to be exact synonyms" (1990:16). Synonymy is a loose relationship on a cline of varying degree of interchangeability.

2.2.3 Antonymy

A particularly strong sense relation, antonymy refers to opposing meaning or lack of shared meaning. A number of different kinds of antonymy have been identified which are summarized in Table 2.

Table 2 : *Antonymic relations*

Complementarity	These are adjectives which cannot be graded using adverbs of degree. The presence of one automatically excludes the other. For example, <i>alive/dead</i> and <i>pregnant/not pregnant</i> .
Gradable Antonymy	These are unlike compliments in that they can be graded using adverbs. For example, <i>hot, warm</i> and <i>cold</i> . While a spring day can be a <i>little warm</i> , a woman cannot be a <i>little pregnant</i> .
Converses	These pairs imply the reversal of the other. For example, <i>interviewee</i> and <i>interviewer</i> .
Mutual incompatibles	These are members of sets of items where being one rules out the possibility of being any of the other members of the set. For example, <i>days of the week</i> , <i>months of the year</i> or <i>colors</i> .

2.3 Semantic Fields, Lexical Sets and Co-ordinates

Semantic fields are large groups of words belonging to a broad topic area, genre of discourse or field of knowledge. Naturally there are a great many such fields reflecting the diversity of the physical and psychological world in which we live. Lexical sets are somewhat smaller clusters of semantically related items. For instance, *hook*, *bait*, *scales* and *strike* all belong to the same lexical set. Co-ordinates are words belonging to the same

semantic field or set which are at the same level of detail. For example, *washing machine*, *microwave*, *toaster* and *dishwasher*, belonging to the lexical set *kitchen appliances*. Antonyms also come under this heading. Co-ordination is the most common response in native-speaker word association test results (Aitchison, 2003).

There is a large body of behavioral evidence indicating that words are stored in semantic fields and that co-ordinates are closely associated. Able speakers sometimes make tongue slips, apparently selecting the wrong item from a semantic set, for example, *chess* instead of *drafts* or *cheese* instead of *butter*. In the example *my tummy hurts*, the speaker has mixed two roughly semantic equivalents; *stomach* and *tummy*. While *how are you going* is a blend of *how are you doing* and *how is it going*. In the last two examples the brain has evidently considered at least two possible items to clothe the semantic skeleton of the target meaning and has then failed to select between the two, producing a blended version (Aitchison 2003). A person in the 'tip of the tongue' (TOT) state can sense that, although the desired word or expression has not been retrieved yet, the word is known and will be recalled shortly. In tests, subjects in this state could usually name words with similar meaning to the target word (Brown and McNeil, 1996). In addition, tests carried out on aphasic patients have also confirmed the strong links between co-ordinates (Aitchison, 2003). It seems clear that co-ordination plays an important role in word storage and retrieval in the brain.

2.4 Encyclopedic Links

As well as words being related to each other, it is thought that additional information relating to the world at large is stored along with each lexical item (Coulthard et. al, 2002). McCarthy expands on this by saying that the world is related by links to an encyclopedia of world knowledge and that this information may provide links between words, bringing in to play factors such as origins, causes, effects, histories, and contexts. He refers to the taxonomic classification of semantic relations as "a gross oversimplification compared with the complexities of how words are stored in the mind" (McCarthy, 1990:41). It has also been suggested that word associations are derived from visual images as well as meaning. Related shapes and mental pictures are stored in the brain according to our experiences and things we have seen (Nattinger, 1988). When I consider my own associations with the word *money*: *dollar*, *green*, *FTSE*, *greed*, *capitalism*, *John Maynard Keynes* and *my high school economics teacher's gravy-stained tie*, it is clear that an individual's views, experience and general knowledge of the world play a key role in linking ideas and words together.

2. 5 Word Class Links

Strong links between co-ordinates such as *tea, coffee, sugar* and *milk* (nouns); *stroll, walk, jog* and *run* (verbs) and *pricey, steep, cheap as chips* and *value for money* (adverbials) point to groupings of items according to word class. Aitchison notes that, “when people pick the wrong word in mistake for another, they almost always preserve the class of the target” (2003: 103). She goes on to cite word association research where nouns elicit nouns around 80 percent of the time, verbs and adjectives doing so just over 50 percent. In addition, TOT experiments have shown guesses at the target word to retain word class 50 per cent of the time for nouns and verbs and 60 per cent for adjectives (Hotopf, 2003). Storing words according to word class and meaning (lemma) makes good sense because “a speaker can then pick easily from a topic area, comparing several possible words which are linked closely together” (Aitchison, 2003: 241). However, McCarthy (1990) points out that the mental lexicon also shows signs of phonological and orthographic organization.

2. 6 Phonological and Orthographic Links

“TOT”-state subjects often recall the total number of syllables, the stressed syllable and general rhythmic structure of the target word (McCarthy, 1990:35). The first and last syllables are very often also known, an observation labeled “the bathtub effect” by Aitchison (2003: 138). Malapropism is the mistaken selection of a word which is similar sounding, but semantically unconnected to the target word. For example, *bottom* instead of *cotton* or *global warning* instead of *global warming*. The selected word typically has a similar phonological shape to the target word, with evidence of the bathtub effect usually in operation, only the middle part of the word contains a different sound (Aitchison, 2003). This suggests that words are categorized according to phonological shape, particularly according to the sounds of their beginnings and endings. It may well be that this helps with listening comprehension. Indeed, Aitchison points out that this method of categorization means that “hearers can compare candidates and find the best fit for what they have heard” (2003 : 241).

There is evidence too that native speakers store words according to their spelling. McCarthy illustrates the point, “Most adult native speakers of English could fairly quickly call up sets of words with similar spellings (e.g. Words ending in ‘-ough’)...something of a feat if we remind ourselves that tens of thousands of items are held in store”(1990: 138-9). He also suggests that lower level students of L2 are more inclined to associate words by the way they sound (1990: 39-42) rather than what they mean. The reason may be that the first system of organization to develop of the L2 lexicon is phonetic. Indeed, student's receptive skills usually develop ahead of production.

2. 7 Double Entry Lexical Organization

Those who have suffered stroke or other forms of damage to areas of the brain responsible for language processing typically have trouble naming objects. They verbalize semantically or phonetically related words instead (Aitchison, 2003), giving yet further evidence for both the semantic, and phonetic, lexical organization of the brain. Aitchison points out that a dual system of organization is necessary because “the component dealing with semantics and word class is arranged conveniently for production, whereas the phonology is organized primarily for speedy recognition” (2003: 241). She likens each item to a coin, where one side contains information relating to lemma and the other to form or phonological shape.

3. 0 HYPOTHESIS

In accordance with the literature, the word association test data for the current study is expected to exhibit the following characteristics:

- i. Responses will include the word association links described in 2.0.
- ii. Responses from lower-level subjects will show a higher proportion of phonological links than at higher levels (see 2.6).
- iii. Super-ordinate responses will be less common than other responses (see 2.2.1).
- iv. Preservation of word class, particularly nouns will be observed (see 2.5).
- v. Collocational word associations will be the most common response (see 2.2).
- vi. Responses from lower-level subjects will show a higher proportion of collocational links than higher level ones which will display more paradigmatic links (see 2.2).

4. 0 METHOD

There were 35 participants in the study, consisting of Japanese and German nationals aged between 18 and 50. They included men and women from a variety of language learning backgrounds and levels. All of the German participants were university students and many of the Japanese were company employees learning English for careers in business. Participants were asked to self-report their English proficiency level as either elementary, intermediate, or advanced. A summary of the participants' L1 and English

Table 3 : Participant L1 and approximate level.

L1/Level	Elementary	Intermediate	Advanced	Total
Japanese	2	11	5	18
German	0	0	17	17
Total	2	11	22	35

proficiency levels are shown in Table 3.

Eight test items were chosen so as to include a grammar/function word, two items from the everyday physical environment and a familiar yet relatively low-frequency word. The test items include a variety of word classes. The test items were as follows:

- | | | |
|-----------|-----------|-----------|
| a. On | d. Boil | g. Slowly |
| b. Heart | e. Jog | h. Smile |
| c. Cotton | f. Yellow | |

In a classroom setting, participants were asked to write down the first word which occurred to them after hearing and reading the stimulus. Those taking part were also asked to give their current level of English, choosing from beginner, intermediate and advanced.

5.0 ANALYSIS

5.1 Categorization

Occasionally it proved difficult to determine whether syntactic or paradigmatic relations were at work. Taking, for example the response of *health* to the prompt *heart*. Arguably the link could be seen as orthographic since the first 3 letters are identical. Conversely, it might be cross-sentence collocation as in *a strong heart is vital for good health*. Alternatively, it could be labeled an encyclopedic link because the subject understands the importance of a strong heart for overall health. Without a follow-up interview it is impossible to be sure which label is accurate and unfortunately assumptions had to be made on behalf of responders. However, in a number of cases it was possible to question participants about their responses. There also were problems with the classification of co-ordinates, for example *marathon* seems a tenuous co-ordinate of *jog* and whereas *liver* is certainly a co-ordinate of *heart*, it is less

Table 4 : Summary of abbreviations

Association	Abbreviation	Classification notes
Collocation	<i>colo</i>	Expanded to include multi-word items such as compound words, idioms, binomials and trinomials. Also includes colligations.
Hyponymy	<i>hypo</i>	
Synonymy	<i>syno/cor</i>	Synonyms also counted as co-ordinates.
Antonymy	<i>anto/cor</i>	For ease of purpose, this category excludes that of mutually incompatibles which were labeled just co-ordinates. Antonyms also counted as co-ordinates.
Co-ordination	<i>cor</i>	Including synonyms and antonyms.
Encyclopedic	<i>enc</i>	Including general knowledge and personal experience.
Phonological/Orthographic	<i>phon</i>	Expanded to include derived words from the same root.

clear whether *blood* falls into the same set. To indicate the type of link present, responses were labeled using the abbreviations in table 4.

5.2 Overall

Table 5 shows some typical responses from the test data. As can be seen, some stimuli elicited a wider range of word association links than others. For instance, *jog* produced 6 different kinds whereas *on* produced only 3.

Table 5 : *Selection of the most common responses*

Link	Stimulus							
	on	Heart	cotton	boil	jog	yellow	slowly	Smile
<i>col</i>	time	love	t-shirt	egg	shoes	flowers	walk	happy
<i>cor</i>	off	liver	wool	fried	run	red	fast	laugh
<i>hyp</i>	–	body	cloth	cook	sports	color	–	face
<i>enc</i>	–	arrow	slavery	noisy	American	favorite	turtle	friends
<i>ant</i>	off	–	–	–	–	–	fast	–
<i>syn</i>	–	–	–	–	run	–	carefully	laugh
<i>phono</i>	–	hurt	–	–	dog	–	–	smiley

Table 6 gives a summary of the different kinds of word associations produced in the data. Antonymic and synonymic responses were also counted as co-ordinates. The results show that a range of different word associations are in evidence. They also highlight the importance of collocation and co-ordination in word associations.

Table 6 : *Distribution of word associations as a percentage of total responses per stimulus. (Values rounded to the nearest whole number)*

Link	Prompt								Average
	<i>on</i>	<i>heart</i>	<i>Cotton</i>	<i>Boil</i>	<i>jog</i>	<i>yellow</i>	<i>slowly</i>	<i>smile</i>	
<i>Collocation</i>	63	66	51	83	29	74	49	37	56
<i>Co-ordination</i>	37	6	9	3	37	17	31	14	19
<i>Hyponymy</i>	0	11	23	11	11	6	0	26	11
<i>Encyclopedic</i>	0	11	17	3	11	3	20	14	10
<i>Antonymy</i>	26	0	0	0	0	0	29	3	7
<i>Synonymy</i>	0	0	0	0	34	0	3	11	6
<i>Phono. /Ortho.</i>	0	6	0	0	11	0	0	9	3

5.2.1 Collocational links

Collocates account for an average of 56 percent of all responses and represent the most common link in the study. This was in line with expectations and the predominance of syntactic linking in non-native speakers (see 2.2). The strength of such links showed

considerable variation. *Boil* produced the strongest collocates such as *egg* and *water* (both with 12 responses). Furthermore, *boil* only elicited 6 different collocate responses. In contrast there were 15 different collocate responses for *yellow*, *submarine* being the most frequent with 4 responses. *On* also seems a weak collocate with only a few, low-frequency collocate responses, *on time* (with 4 responses) being the most common. Cross-sentence collocation was also seen, examples include a *jog in the park* and the binomial *heart and soul*.

Occasionally it was not clear whether a link was encyclopedic or collocational. For example, the response *sweat* to the prompt *jog* might be interpreted as cross-sentence collocation. However, an informal talk with the subject later revealed that upon hearing the prompt, an image of a sweat-soaked jogger had flashed up in her mind. The response was duly accorded the label encyclopedic since it derived from her knowledge or experience of running. A number of participants described similar thought processes behind their responses, thus supporting Nattinger's theory of the importance of visualization (see 2.4) in word association.

5.2.2 Co-ordination

Although co-ordination is the most frequent type of link in native speakers (see 2.3), in the current study it was the second most common link with 19 percent of total responses. The strongest links between co-ordinates was observed between antonyms and synonyms. *Jog* elicited the synonym *run* ten times and *slowly* elicited the antonym *fast* nine times. However, synonymy and antonymy were not a particularly prominent feature of this study with six percent and seven percent of all responses respectively. Weaker links were seen between members of lexical sets. For example, *cotton* prompted the response *wool* only twice and *rayon* once. However, *yellow* resulted in eight responses which belonged to the lexical set *colors*.

5.2.3 Super-ordination

There are eight different super-ordinate responses in the data, accounting for 11 percent of all responses. This is higher than had been expected (see 2.21) and may be due to the nature of the prompt words used. For example, *yellow*, *cotton* and *boil* seem prone to elicit the super-ordinates *color*, *cloth* and *cook* respectively. Some of the links were strong. For example, *heart* elicited *body* four times and *smile* elicited *face* seven times. Other links were weaker, for example *smile* and *emotion* with only 1 response and *yellow* and *color* with two responses.

5.2.4 Phonological and Orthographic Links

This was the least frequent link in the study with 3 percent of responses. Only heart (*heartful, hurt*), smile(*smiley*) and jog (*dog, jogger*) elicited phonological or orthographic responses.

5.2.5 Encyclopedic and Experiential links

Encyclopedic and experiential links represent 10 percent of all responses. These responses typically had very low frequency. *Turtle* for *slowly* was an exception with four responses. The prompt *cotton* produced *America* twice and also *slavery* twice.

5.3 Level

The distribution of responses according to level is shown in Table 7. The following sections include a discussion of these results.

Table 7 : Distribution of words associations as a percentage of total responses per level.
(Values rounded to the nearest whole number)

Link	Level		
	<i>Elementary</i>	<i>Intermediate</i>	<i>Advanced</i>
<i>Collocation</i>	81	65	49
<i>Co-ordination</i>	13	14	23
<i>Hyponymy</i>	6	5	15
<i>Encyclopedic</i>	0	13	9
<i>Synonymy</i>	0	5	6
<i>Antonymy</i>	0	0	11
<i>Phonological/Orthographic</i>	0	3	3
<i>Total :</i>	100	100	100

5.3.1 Collocation

Collocates accounted for 81 percent of responses at beginner, 65 percent at intermediate and only 49 percent at advanced level. This result is fully in line with expectations. As discussed in section 2.2, lower level learners are more inclined to produce word associations syntactically than more advanced learners.

5.3.2 Co-ordination

Beginners, intermediate and advanced learners responded 13 percent, 14 percent and 23 percent of the time respectively with co-ordinates to the prompt word. This was also in line with expectations as more advanced students are more likely to produce word associations paradigmatically than at lower levels (see 2.2). An interesting observation was a total

absence of antonymy at beginner and intermediate levels, but with 11 percent of responses for advanced learners. This may reflect the dominance of collocational linking at lower levels and the gradual shift to paradigmatic relations seen in a more developed lexicon of the advanced student. No synonymy was in evidence for beginners but with only two beginner responders in the study, the validity of this finding is called into question. Intermediate and advanced levels produced little variation with synonymic responses five percent and six percent of the time respectively.

5.3.3 *Super-ordination*

Beginners and intermediates showed little variation in super-ordinate responses, with 6 percent and 5 percent respectively, however advanced respondents showed an increase up to 15 percent of respondents. As with the results for antonyms, this may reflect the shift toward sense relations of the developed mental lexicon.

5.3.4 *Phonological and Orthographic Links*

There was very little variation in phonological and orthographic links over level. This is not in line with expectations of greater frequency of such links at lower levels (see 2.6). This anomalous result might be due to the lack of beginners who took part in the study and the resultant unreliability of the data.

5.3.5 *Encyclopedic and Experiential links*

There were no encyclopedic link responses from the two beginner subjects, whereas such links accounted for nine percent and 13 percent of intermediate and advanced responses respectively. This may be confirmation of the lack of such links in the early development of the L2 lexicon. Although world- knowledge and personal experience is an important organizing principle, large gaps in vocabulary at low levels could prevent word association of this kind.

5.4 Word Class

Table 8 shows the distribution of word associations across word classes as a percentage of total responses per stimulus. On average nouns elicited nouns 69 percent of the time, a little below the predicted figure of 80 percent (see 2.5). Yellow, the only adjective stimulus word in the study elicited adjectives responses only 17 percent of the time while verbs elicited verbs on average only 19 percent of the time, both the result for adjectives and for verbs are well below the value of 50 percent predicted by Aitchison (also see 2.4). Interestingly enough, nouns were the most common form of response for all stimuli with 83

percent noun responses to adjectives, 67 percent to verbs, 57 percent to the preposition *on* and 40 percent of responses to the adverb *slowly*. This might reflect nouns ready collocation with many of the prompt words. For example, *on (the) table*, *boil(ed) egg* and *yellow submarine*. *Slowly* elicited a multitude of nouns associated with movement, for example, *turtle*, *snail*, *car*, *traffic* and *dog*. The large proportion of concrete nouns in the responses lends further support to Nattinger's theory of visualization (see 2.4). Of the verb prompts, *jog* elicited the most verb responses at 28 percent. This was largely due to the single response *run*. Whereas *boil* only attracted 9 percent verb responses. This may be due to the existence of fixed expressions like *boiled egg* and *boiling water* containing this word. It may be that the sound of the word *boil* triggered the collocational response despite the word class of the stimulus word being different.

Table 8 : *Distribution of word associations across word classes as a percentage of total responses per stimulus. (Values rounded to the nearest whole number)*

Stimulus	Same	Different						
		<i>noun</i>	<i>verb</i>	<i>adjective</i>	<i>adverb</i>	<i>prep.</i>	<i>pronoun</i>	<i>Other</i>
<i>On</i>	37	57	3	0	0	–	0	3
<i>Heart</i>	71	–	3	26	0	0	0	0
<i>Cotton</i>	80	–	0	20	0	0	0	0
<i>Boil</i>	9	80	–	11	0	0	0	0
<i>Jog</i>	28	57	–	6	6	3	0	0
<i>Yellow</i>	17	83	0	–	0	0	0	0
<i>Slowly</i>	31	40	20	6	–	0	3	0
<i>Smile</i>	57	–	17	20	3	3	0	0

6.0 CONCLUSIONS

The results of this study indicated that collocation was the most common form of link, especially at lower levels. Visualization also appeared to be an important means of organizing and retrieving vocabulary for respondents. Co-ordination was also seen to be an important link, especially for students at higher levels of English ability. In addition, the results demonstrated that lexical sets were clearly being used to organize the L2 lexicon. Super-ordinates were a significant response, especially at higher levels, with encyclopedic links also in evidence, especially at higher levels. Links between word classes were also shown to be strong, especially between nouns.

6.2 Implications for Language Teachers

6.2.1 A Lexical Approach

The importance of collocation suggests vocabulary lessons which will encourage

students to form syntagmatic links between words and to learn and store pairs and chunks of words together will be particularly effective with students of lower levels. Doing exercises such as identifying collocates and multi-word items in a text, learning vocabulary in lexical chunks such as collocational pairs, fixed expressions and idioms all seem appropriate.

6.2.2 *A Taxonomic Approach*

Due to the importance of co-ordination, super-ordination and lexical sets in vocabulary organization, particularly in more advanced learners, one suspects that new vocabulary presented taxonomically may be more readily assimilated into the more developed L2 lexicon. For example, a theme-based class might aim to cover all items relating to *outdoor pursuits* or another might include ways of *describing the taste of food and drink*. The use of word maps would seem ideally suited here. Since word-class seems to be a strong source of association, items of the same word class should be presented together whenever possible.

It is possible that the use of paradigmatic vocabulary presentation to students of intermediate level and above could even serve to accelerate the process of development of the L2 lexicon by aiding the transition from collocational-based word storage to that of co-ordination. Since this is the most common form of association found in fluent speakers and connected with the use of OCP, it can be assumed to be desirable. The effect of paradigmatic presentation methods on the nature of links used to store words and on linguistic competence of learners represents an exciting area for further study.

6.2.3 *An Encyclopedic Approach*

The importance of encyclopedic links illustrates how words are remembered by connecting them with an area of knowledge. By teaching content-based classes to advanced students on subjects of interest and relevance, words could be presented in a strong context both in relation to each other and the world at large. The mapping of new words to existing schemata should help students grasp and retain vocabulary more efficiently.

6.2.4 *The Use of Visuals*

A way of aiding vocabulary learning at all levels would be to use stimulating visual images in class. For example, a teacher could present a photograph and students would be asked to brainstorm words to describe the picture. The teacher could then compile a list of words during plenary feedback while also weeding out any inappropriate words mistakenly put forward and feeding in a few new items unknown to the class.

7. LIMITATIONS

The full extent to which word association tests can be used as an accurate means of mapping the mental lexicon is somewhat in doubt, and the author acknowledges a number of limitations of the present study. Firstly, the association of single words out of context does not reflect how words are recalled in natural use and therefore might result in some unusual responses. Secondly, single-word responses force us to ignore the potentially numerous other associations a responder might make to a stimulus. Thirdly, with a lack of context, words are completely open to interpretation by the responder. For example, the stimulus *smile* may be understood as a noun or a verb. Without a follow-up interview it is impossible to be sure how the responder has understood a stimulus. Fourthly, the choice of stimuli can influence responses. For example, *on* was likely to elicit an antonymic response whereas *boil* was likely to result in collocational answers. Despite these limitations, these tests can give an indication of trends in types of associations made and how they relate to the level and development of learners. Analysis of these trends allows us to tentatively suggest how students might attempt to strengthen the links they make between words and how teacher can develop more effective vocabulary teaching methods.

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