# Second Language Word Associations: <br> How Japanese Make Mental Links Between <br> English Words They Have Learned 

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## 1. Introduction

Over the past several decades there has been an increased interest in the study of how second language learners organize words in their mental lexicon. A large number of these recent studies focus on the ways in which learners make associations between words they have learned. These associations are usually determined by means of word association tests (WATs) where subjects are asked to respond with the first word that comes to mind when they hear particular stimuli. Results from these tests are useful in aiding theoreticians in the development of mental lexicon models, as well as providing teachers with information of pedagogical importance.

The purpose of this study is to explore the associations second language users make between words in their mental lexicon by carrying out the word association test as outlined in McCarthy (1990:152). The results will be interpreted according to McCarthy's three points of evaluation and will show that: 1) word association tests provide interesting information on how learners make mental links between learned words; 2) phonological links are not necessarily a factor of respondent level; and 3) Japanese WAT responses do not coincide with the common, overall paradigmatic, responses listed in McCarthy's 3.2 but rather with the recent research showing a Japanese tendency toward syntagmatic responses. Furthermore, the study will also illustrate that the types of associations made are not necessarily a factor of respondent level or word characteristic alone but rather of the frequency with which respondents actively use the stimulus word. Finally, it will be shown that multiple-response WATs are a more accurate means of investigating the ways in which learners make connections between words they have learned.

## 2. Background

Word association tests have been used in cognitive psychology and applied linguistics with such frequency that it is impossible to list any more than a small fraction of them here. However, several of the more notable projects relating to second language word association tests are briefly summarized below:

Meara (1982) - Meara offers a report on the Birkbeck Vocabulary Project. His findings show that second language learners' responses tend to be rather "unhomogeneous" compared to those of native speakers. He also points out the problems in using the Kent-Rosanoff list of stimuli and the need to consider stimulus word-list construction more carefully.

Söderman (1993) - Here the researcher explores the shift from syntagmatic to paradigmatic responses thought to be characteristic of second language learners. Results of WATs on native Finnish EFL students showed that this shift is not very great, though there does seem to be a decrease in phonological associations with high frequency words.

Maréchal (1995) - Singleton (1999) describes Maréchal's study on French WAT results, stating that while most responses were semantically associated, second language learners responded with more phonological associations.

Wolter (2001) - In this study on native Japanese subjects, it was found that stimulus words which were well known by the subject tended to elicit more semantic responses while those that were unknown, or not well-known, tended to elicit more phonological responses.

Yoneoka (2001) - Yoneoka addresses the tendency for Japanese subjects to respond more frequently with syntagmatic responses. She compares this tendency with a similar tendency in Korean subjects and discusses the possible linguistic and cultural
reasons for the "anomaly".

## 3. Research Subjects

This study was conducted in language schools and private homes in and around metropolitan Tokyo, Japan. Data were collected from 22 native Japanese EFL learners and 1 multi-lingual native Taiwanese man. The participants ranged in age from mid teens to mid eighties, with the bulk of the sample population falling between the ages of 30 and 55. Respondents were organized into three proficiency-based levels: low (L1-L7), mid (M1-M8) and high (H1-H8).

## 4. Procedure

### 4.1 Initial preparation and definitions

### 4.1.1 Stimulus word selection

Eight stimulus words were chosen in accordance with the suggested criteria in McCarthy (1990:152). The selected stimuli represent both high and low frequency words, abstract and concrete words, and four separate word classes (noun, verb, adjective and preposition). Table 1 lists the selected words and their characteristics:

| Stimulus Word | Frequency | Quality | Word Class |
| :--- | :--- | :--- | :--- |
| book | 115658 | concrete | noun |
| vacation | 3360 | abstract | noun |
| think | 381993 | abstract | verb |
| punch | 62421 | concrete | verb |
| green | 8279 | abstract | adjective |
| boring | 266261 | concrete | preposition |
| of | adjective |  |  |
| under | abstract | preposition |  |

Table 1: Stimulus words and their characteristics

The frequencies listed above were obtained from the Cobuild/Birmingham Bank of English corpus. In order to ensure that the majority of respondents recognize all the stimuli, words with extremely low frequencies (ie. under 1000) were avoided. For the purposes of this paper words were classified as either "high" or "low" frequency, relatively, within their own word class pair. Thus, for example, book was classed as "high frequency" while vacation was classed as "low".

### 4.1.2 Defining classes of association

### 4.1.2.1 Semantic

Semantic associations are associations based on word meaning as opposed to word form.

Syntagmatic: These included any responses that were of a different word class than
the stimulus word and whose link to the stimulus could be clearly explained by the respondent. Also included here were responses of same word class that exhibited a very strong collocational link to the stimulus (ex. book + shelf and summer + vacation). Paradigmatic: Any responses that were of the same word class as the stimulus word and did not exhibit a strong collocational link were considered paradigmatic. The link must be clearly explained by the respondent. Subclasses of paradigmatic links include: - synonymy (x means the same as y)

- antonymy (x means the opposite of y)
- hyponymy ( x is a kind of y ; also referred to as "subordination")
- co-hyponymy ( x and y are both kinds of z ; also referred to as "co-cordination")
- hypernymy (x has y as one of its kinds; also referred to as "superordination")
- meronymy ( x is a part of y ; also referred to as "partonymy")


### 4.1.2.2 Formal

These are associations based on word form rather than meaning.
Phonological: Sometimes referred to as "clang" responses, these are associations made on the basis of sound only. This includes such things as rhyme and the "bathtub effect". Some examples include: up - cup, of - have, think - thank. In these cases the respondent agrees that it is purely a phonological association.

Orthographic: Words linked based on the spelling or physical shape of the word are considered orthographic responses (ex. night - weigh, there - three)

### 4.1.2.3 Other

This catchall category can be sub-divided into:

Random: These are responses where there is no clear link and the subject fails to adequately explain the connection. This category also includes responses that are simply a repetition of the stimulus word as well as responses to words that the subject misheard.

No response: The subject left the space blank.

### 4.2 Administration of the test

### 4.2.1 Main word association test

Following McCarthy (1990:152), the oral-written method was chosen as a means of administration. Response forms were distributed and subjects were asked to write the first three ${ }^{1}$ single words that came to mind upon hearing each of the stimuli. Subjects were instructed to answer in English but not to think too long or deeply about their responses. They were also instructed not to worry about spelling and informed that there were no wrong answers.

### 4.2.2 Follow up: interview and "frequency of word usage" survey

Immediately after administering the test, short interviews were conducted in which the respondents could make comments on the nature of any unclear associations. Following the interviews a short "frequency of word usage" survey was administered (Table 2):

[^0]

Table 2: Frequency of word usage survey

### 4.3 Analysing the data

On completion of the survey the respondents' first responses only - as in a traditional single-response WAT - were tallied, classified according to type of association, and entered into a spreadsheet. Percentages of each association type were calculated for each respondent. Response lists for each stimulus can be found in Appendix 1.

The data were analyzed: 1) as a whole; 2) in groups according to respondent proficiency level; and 3) in groups organized according to stimulus word characteristics. The data were then analysed according to frequency of stimulus usage. All mean
results were subjected to statistical analysis - ANOVA or t-test, as appropriate - to determine the significance of the findings. Full details of the statistical analysis can be found in Appendix 2.

Finally, the above data was then re-analysed using all three responses of each subject. The results of this multiple-response analysis were then compared to the results of the previous single-response experiment.

It should be noted that prior to group analysis, subject H4, the multi-lingual native Taiwanese speaker, was isolated from the native Japanese data. H4's responses were so significantly different that it seemed likely they would skew the data of the homogenous Japanese set (see section 5.3.1 below).

## 5. Results and discussion

Although there appears to be some degree of overlap in McCarthy's evaluation questions an attempt will be made to isolate salient features of the study as they apply to each point.

### 5.1 Initial results: McCarthy's first evaluation point

Does such a word-association test tell you anything about how your learners are making mental links between words they have learnt? $(1990: 152)$

### 5.1.1 Quantitative results

The summarized general results of the WAT are shown below in Table 3:


Table 3: Summary of single response WAT results

An overall analysis of the types of associations illustrate that the WAT does indeed provide information about how respondents make links between words they have learned. More specifically, results of the test show a tendency for subjects to make semantic associations over formal ones (Sem $=88.1 \%$, Form $=5.9 \%$; significance: $p=$ $1.25^{-24}$ ). In fact, with 1 low-level, 3 mid-level and 4 high-level respondents, semantic associations accounted for $100 \%$ of all responses.

Further inspection of semantic responses reveals a higher degree of syntagmatic responses over paradigmatic $(\operatorname{Syn}=50.0 \%$, Par $=38.1 \%$; significance: $p=$ 0.022). How these figures relate to the universal norms of WAT will be discussed in section 5.3 below.

With regard to formal associations all counts were of a phonological nature. There were no discernable instances of orthographic links. This is likely due to the nature of the oral-written method of administration. Without visual stimulation, orthographic associations are less naturally activated.

In addition to the general syntagmatic tendencies of the above data, interesting, albeit less clear, patterns have also emerged showing relations between word characteristic and type of association (Table $4^{2}$ ).

|  | Frequency | Quality |  | Word Class |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Association | High Low | Con Abst |  | Noun Verb |  | Adj | Prep |  |
|  |  |  |  |  |  |  |  |  |
| Syntagmatic | 49 | 38 | 43 | 44 | 16 | 23 | 27 | 21 |
| Paradigmatic | 28 | 42 | 41 | 27 | 27 | 16 | 14 | 11 |
| Phonological | 7 | 3 | 3 | 7 | 0 | 3 | 0 | 7 |
| Orthographic | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Random | 6 | 5 | 1 | 10 | 1 | 2 | 3 | 5 |

Table 4: Association type counts based on word characteristic

A brief discussion of each follows:

Stimulus word frequency: The resulting response counts indicate that higher frequency words elicited more syntagmatic responses $(\mathrm{Syn}=49 ; \mathrm{Par}=28)$ while lower frequency

[^1]words elicited more paradigmatic $(\operatorname{Par}=42 ; \operatorname{Syn}=38)$. It is interesting, however, that more phonological (7) and random (6) responses were encountered with high frequency words than with low (3 and 5 respectively). This result, which seems contrary to intuition, may be due to the nature of the individual words (see 5.1.2 below).

Stimulus word quality: Here abstract words, if only marginally, elicited more syntagmatic responses (44) than did concrete words (43). It can also be seen that the concrete words elicited more paradigmatic responses (41) than did abstract words (27). This is interesting in that unlike with frequency-based associations - where the theoretically more difficult words, the low frequency words, elicited more paradigmatic responses - the theoretically easier words, the concrete words, elicited the most paradigmatic responses. An explanation for this could be that the abstract-paradigmatic count has been, in effect, artificially lowered by the somewhat larger proportion of random and phonological responses made with abstract words. It is, however, not surprising to see such high counts of phonological (7) and random (10) falling in the abstract category, abstract words being theoretically more difficult and therefore more likely to be unknown by the respondent.

Stimulus word class: Nouns elicited the largest number of paradigmatic responses (27) while adjectives elicited more syntagmatic responses (27). These results are not very surprising considering that adjectives are modifiers of nouns and thus perhaps more collocational by nature. The most surprising result however is that nouns elicited significantly less syntagmatic responses (16) than they did paradigmatic (27). This may be due in part to a bias resulting from the location of most of the WATs in this study.

As many of them are situated in a classroom environment it is not unreasonable to expect the stimulus book to elicit other classroom nouns, ie. paradigmatically associated words, that are very likely present in the respondent's direct line of sight. With regard to vacation, it is interesting to note that trip, travel and holiday, words that Japanese learners tend to prefer over vacation, figured prominently in the responses.

### 5.1.2 Qualitative results

Results of the brief interviews, in addition to assisting in the general classification of responses, were useful in identifying problematic stimulus words. A primary example would be the word of. Several respondents reported that they could not identify this word on hearing it in isolation and thus resorted to phonological association. This would account for the above quantitative data showing an unexpected relation between high frequency words - of which of is a member - and phonologically related responses.

Other problems were identified in the interview as resulting from polysemy and homophony. In particular, the stimulus word boring was understood both as the adjective, uninteresting, and the verb, drilling. The common Japanese difficulty with /l/ and /r/ further complicated the matter by causing some participants to hear the stimulus word as bowling. Punch was interpreted variously as a verb (to hit or to make a hole) or a noun (a punch or fruit punch). In these cases the interview allowed the researcher to decide what type of association was being made. For instance, given the response glove by subject M1, the explanation, "we use boxing gloves to punch," clearly shows that punch is being viewed as a verb and is thus indicative of a syntagmatic association.

The interviews also provided other interesting information regarding the associations learners make. The interviews, as well as comments made throughout the test, illustrate that learners often make links between words via their native language mental lexicon (ML1). This ML1 connection manifested in several cases of borrowed word connections as well as pleas for translation. That is, in some cases, respondents were making Japanese associations to the English words and then attempting to translate them. For example, subject M1 responded to the stimulus of with talent. Abu-chan, a famous Japanese personality, or "talent", is a clear phonological link to of. Similarly, of elicited fly from subject H5, a direct translation of $a b u$, the Japanese word for the insect. Another example of this is M3's association of enthusiastic with the stimulus punch. This was sparked by the Japanese expression "panchi ga kiteru" (It's got punch!). In some cases the subjects made ML1 connections but not knowing the equivalent English word, requested translation assistance from the researcher. This ML1 mediation supports the theoretical claims of researchers who believe the second language mental lexicon (ML2) is parasitic on the ML1 (Hall, 1992) or that learners draw on ML1 conceptual knowledge when formulating ML2 associations (Wolter, forthcoming).

### 5.2 Analysis based on level: McCarthy's second evaluation point

At lower levels, are phonological similarities playing an important role? (1990:152)

### 5.2.1 Quantitative analysis

Based on statistical analysis of the data in Table 3 above, the only statistically significant correlation between level and type of association that can be made is with
regard to random responses (Table 5).

| Association | Low | Mid | High | Significance |
| :--- | ---: | :--- | :--- | :--- |
|  |  |  |  |  |
| Syntagmatic | 44.6 | 56.3 | 48.2 | not significant |
| Paradigmatic | 33.9 | 34.4 | 46.4 | not significant |
| Phonological | 8.93 | 3.13 | 5.36 | not significant |
| Orthographic | 0 | 0 | 0 | NA |
| Random | 12.5 | 7.81 | 0 | 0.010889 |

Table 5: Summary of association mean percentages by level

The quantitative results of this WAT do not clearly indicate that low level respondents rely on phonological associations any more than do higher level respondents.

### 5.2.2 Qualitative adjustments to the above data

Returning to the interviews and to an examination of the words producing the highest percentages of phonological responses, it was noted above that the stimulus word of proved problematic for learners of all levels. Several high level respondents, particularly those with notable pronunciation difficulty, reported not being able to recognize the word on hearing it. Observing the possibility that this particular stimulus word may have artificially inflated the percentage of high level phonological associations a brief look at the counts with the problematic of removed may shed more light on the subject:

|  | Low |  | Mid |  | High |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | \# | \% | \# | \% | \# | \% | p value |
| All stimuli | 5 | 8.9 | 2 | 3.1 | 3 | 5.4 | 0.334 |
| Omitting of | 3 | 5.4 | 1 | 1.6 | 0 |  | 0.108 |

Table 6: Phonological association means

Even with the problematic word removed no statistically significant results illustrating a clear tendency for low level learners toward phonological responses can be seen. However, the fact that high level respondents produced phonological associations does seem to indicate that phonological associations are sometimes resorted to when the stimulus word is unrecognizable. This point will be addressed further in section 5.4

### 5.3 Analysis of semantic responses: McCarthy's third evaluation point

Do the results bear out the characteristic types of response discussed in 3.2? (1990:152)

The following two sections discuss the syntagmatic and paradigmatic associations made by subjects of the WAT and show their relation to the characteristic responses in McCarthy (1990:39-40).

### 5.3.1 Syntagmatic responses: the Japanese anomaly

Coulthard et al. (2000:23) and Aitchison in McCarthy (1990:39; section 3.2)
state that in general most native speakers tend to respond with coordinate (ie. paradigmatic) associations during WATs. This also seems to be the general tendency for western EFL students (Söderman, 1993).

As has been shown above, the results here (Syn = 50\%, Par = 38.1\%; significance: $\mathrm{p}=0.02$ ) do not coincide with this statement. The results do, however, support the growing body of evidence that seems to indicate a general tendency for Japanese respondents to respond with syntagmatic associations (Yoneoka, 2001; Soekman, 1993; Orita, 1999).

It will also be remembered from section 4.3 that respondent H 4 , a multi-lingual
native Taiwanese speaker, was isolated from the Japanese data set. In contrast to his Japanese co-participants, his responses $(S y n=25 \%$, Par $=75 \%)$, do clearly bear out the characteristic paradigmatic response tendency mentioned in McCarthy's section 3.2.

### 5.3.2 Paradigmatic responses

With regard to paradigmatic responses, the results of the study also fail to support McCarthy's characteristic associations. Table 7 below lists the paradigmatic subcategories and total number of responses as they occurred in the data.

| Type | book | green | under | think | vacation |  | punch | boring | Total |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Meronym | 7 |  |  |  |  |  | 7 |  | 14 |
| Synonym |  | 1 |  | 1 | 9 | 1 |  | 1 | 13 |
| Antonym |  |  | 8 |  |  |  |  | 3 | 11 |
| Co-hyponym | 2 | 5 |  | 1 |  |  |  |  | 8 |
| Hyponym | 2 |  |  | 1 |  |  | 2 |  | 5 |
| Hypernym |  | 2 |  |  |  |  |  |  | 2 |
| Other | 1 | 1 |  | 1 | 7 | 2 | 5 | 5 | 22 |

Table 7: Subcategories of paradigmatic association

It will be noted that while co-hyponym (co-ordinate) associations do seem to play a role in the subjects' paradigmatic responses, that role is far from being the most common. Also of note is that there were many paradigmatic responses that defied classification. These were indeed of the same grammatical class, and therefore paradigmatic, but could not reasonably be placed in any particular subcategory. Furthermore, they did not collocate with the stimulus word strongly enough to warrant classifying them as syntagmatic. For example, vacation elicited a number of place names that are difficult to classify in relation to the stimulus. The fact that these paradigmatic, but "syntagmatically-leaning", responses occur in relatively high counts coincides well with
the Japanese syntagmatic tendency mentioned in section 5.3.1.

### 5.4 Word usage survey

There is one important point that has not been adequately addressed in the above discussion. This is the apparent lack of connection between low level subjects and phonological associations. As was hinted at in section 5.2.2, with regard to high level phonological associations, it may not be so much level, as familiarity with the stimulus word that determines the type of association elicited. Stolz and Tiffany (1972), in support of this view, discovered that adult subjects tend to respond in a more "child-like" manner to unfamiliar stimuli.

More recent research (Wolter, 2001; Mattheoudakis, 2003) has explored the relationship between respondents’ degree of individual word knowledge of the stimulus word and type of association made. In these studies respondents were asked to complete a survey in which they comment on how well they know the particular stimulus word. Both Wolter (2001) and Mattheoudakis (2003) found that words listed by respondents as unknown or not well known elicited more phonological and random responses. Conversely, stimuli listed as more well-known elicited a greater number of semantic responses.

The abovementioned studies examine the degree to which the respondent is familiar with a particular word, and thus might well be considered a test of the respondents' degree of passive knowledge. However, this passive knowledge alone may not be enough to create strong links between words in the mental lexicon. It may be that links between a stimulus word and its responses are strengthened in relation to the frequency in which the stimulus word is actually used (see Aitchison, 1994:213).

In a slight variation of Wolter’s (2001) "depth of individual word knowledge", this part of the study compares the different types of elicited responses against the frequency with which respondents' actively use the stimulus words.

Results of the frequency of word usage survey were grouped into two categories: low frequency usage, which consists of "never" and "rarely" scores; and high frequency usage, consisting of "sometimes" and "often" scores. As Table 8 below indicates, there is a strong correlation between both phonological and random responses and low frequency usage. This coincides well with Wolter's (2001) experiment, reinforcing his results from an active usage perspective, and goes a long way in explaining the high-level respondents' phonological associations mentioned in 5.2.2.

| Association | Low | High | Significance |
| :--- | ---: | ---: | ---: |
| Syntagmatic | 37.7 |  | 62.3 |
| not significant |  |  |  |
| Paradigmatic | 45 | 55 | not singificant |
| Phonological | 79.2 | 20.8 | 0.0475186 |
| Orthographic | 0 | 0 | NA |
| Random | 92 | 8 | 0.00004 |

Table 8: Frequency of usage mean percentages (single response)

### 5.5 Re-examining the data in light of multiple responses

Word association tests most commonly request respondents to list one response for each stimulus word encountered. However, there is a significant amount of research supporting the idea that people, in fact, activate multiple words in response to words they hear (Aitchison, 1994: 217). In light of this multiple activation, one might argue that the first response word in a word association test may not always necessarily
be the most representative of the general patterns of word linkage in the mental lexicon. Allowing for multiple responses in a WAT can provide interesting information regarding some of these other activated words.

Comparison of the Table 3 above and Table 9 below illustrates a general marked difference between percentages of the single response WAT and those of the multiple.

|  |  | Semantic |  |  |  | Lexical |  |  |  | Other |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Response Total | Syntagmatic |  | Paradigmatic |  | Phonological |  | Orthographic |  | Random |  | Chain * |  |
| Respondent |  | \# | \% | \# | \% | \# | \% | \# | \% | \# | \% | \# | \% |
| L1 | 24 | 6 | 25 | 7 | 29.17 | 3 | 12.5 | 0 | 0 | 5 | 20.83 | 3 | 12.5 |
| L2 | 24 | 7 | 29.17 | 7 | 29.17 | 2 | 8.333 | 0 | 0 | 8 | 33.33 | 0 | 0 |
| L3 | 24 | 13 | 54.17 | 8 | 33.33 | 1 | 4.167 | 0 | 0 | 0 | 0 | 2 | 8.333 |
| L4 | 24 | 15 | 62.5 | 2 | 8.333 | 1 | 4.167 | 0 | 0 | 6 | 25 | 0 | 0 |
| L5 | 24 | 10 | 41.67 | 9 | 37.5 | 1 | 4.167 | 0 | 0 | 3 | 12.5 | 1 | 4.167 |
| L6 | 23 | 16 | 69.57 | 7 | 30.43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L7 | 22 | 10 | 45.45 | 9 | 40.91 | 0 | 0 | 0 | 0 | 3 | 13.64 | 0 | 0 |
| Mean \% |  |  | 46.79 |  | 29.83 |  | 4.762 |  | 0 |  | 15.04 |  | 3.571 |
| M1 | 24 | 9 | 37.5 | 11 | 45.83 | 3 | 12.5 | 0 | 0 | 1 | 4.167 | 0 | 0 |
| M2 | 24 | 13 | 54.17 | 11 | 45.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M3 | 24 | 16 | 66.67 | 8 | 33.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M4 | 23 | 10 | 43.48 | 7 | 30.43 | 3 | 13.04 | 0 | 0 | 3 | 13.04 | 0 | 0 |
| M5 | 23 | 14 | 60.87 | 6 | 26.09 | 0 | 0 | 0 | 0 | 3 | 13.04 | 0 | 0 |
| M6 | 24 | 15 | 62.5 | 7 | 29.17 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8.333 |
| M7 | 24 | 10 | 41.67 | 11 | 45.83 | 0 | 0 | 0 | 0 | 2 | 8.333 | 1 | 4.167 |
| M8 | 24 | 15 | 62.5 | 6 | 25 | 0 | 0 | 0 | 0 | 3 | 12.5 | 0 | 0 |
| Mean \% |  |  | 53.67 |  | 35.19 |  | 3.193 |  | 0 |  | 6.386 |  | 1.563 |
| H1 | 24 | 11 | 45.83 | 9 | 37.5 | 2 | 8.333 | 0 | 0 | 1 | 4.167 | 1 | 4.167 |
| H2 | 24 | 10 | 41.67 | 9 | 37.5 | 3 | 12.5 | 0 | 0 | 2 | 8.333 | 0 | 0 |
| H3 | 23 | 15 | 65.22 | 8 | 34.78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H5 | 24 | 12 | 50 | 9 | 37.5 | 2 | 8.333 | 0 | 0 | 0 | 0 | 1 | 4.167 |
| H6 | 22 | 9 | 40.91 | 12 | 54.55 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4.545 |
| H7 | 24 | 15 | 62.5 | 8 | 33.33 | 0 | 0 | 0 | 0 | 1 | 4.167 | 0 | 0 |
| H8 | 24 | 13 | 54.17 | 10 | 41.67 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4.167 |
| Mean \% |  |  | 51.47 |  | 39.55 |  | 4.167 |  | 0 |  | 2.381 |  | 2.435 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H4 | 22 | 7 | 31.82 | 15 | 68.18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

* Chain = responses based on associations with previous response word, not original stimulus

Table 9: Summary of multiple response WAT results

Out of the 22 Japanese respondents, 13 showed a higher percentage of syntagmatic responses when multiple responses were elicited. 7 showed lower percentages and
only 2 showed no difference. With regard to paradigmatic responses, the figures are nearly exactly reversed: 13 respondents showed a lower percentage with multiple-responses, 6 showed higher, while 3 showed no difference.

The fact that these figures are different illustrates that the multiple-response WAT, in accounting for a larger number of activated words in the mind of the respondent, allows for a more detailed and accurate picture of the respondent's formal and semantic associations.

Further support for using multiple-response WATs can be found in an examination of "commonality", or the degree of sameness between subjects' responses. Table 10 below illustrates the number of different responses as a percentage of the total responses for both the single (first responses only) test and the multiple (all responses) test. Higher percentages indicate a greater variety of responses and thus low commonality. Lower percentages indicate less variety and so a high commonality.

|  | 1st |  |  | All |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |
|  |  |  | $\%$ | $\#$ |  |

Table 10: Comparison of commonality between single and multiple WATs

As can be seen, in the case of all but one stimulus word, a greater degree of commonality can be observed in the multiple-responses test. This seems to indicate that the most common, perhaps even the most significant, patterns of word linkage in
the mental lexicon are not always represented in the subject's first response.
Continuing the re-analysis with multiple-responses, Table 11 shows alternate figures for the paradigmatic sub-categories.

| Type | book | green | under | think | vacation | of | punch | boring | Total |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
|  |  |  |  |  |  |  |  |  |  |
| Synonym |  | 4 | 5 | 2 | 17 | 1 |  | 1 | 30 |
| Co-hyponym | 10 | 11 |  | 3 |  |  | 3 |  | 27 |
| Meronym | 14 |  |  |  |  |  | 13 |  | 27 |
| Hyponym | 3 |  |  | 6 |  |  | 8 |  | 17 |
| Antonym |  |  | 13 |  |  |  |  | 3 | 16 |
| Hypernym |  | 5 |  | 4 |  |  | 1 |  | 6 |
| Other | 7 |  |  | 4 | 23 | 8 | 13 | 7 | 62 |
|  |  |  |  |  |  |  |  |  |  |

Table 11: Subcategories of paradigmatic association (multiple responses)

These results, while not greatly different from the above single-response test, do come closer to bearing out the notion in McCarthy that co-hyponym associations are most common.

Finally, and more directly to the point of this study, when the frequency of word usage percentages are recalculated using the multiple-response data and submitted to statistical analysis (Table 12), an additional significant correlation, not apparent in the single-response test, can be seen between syntagmatic and high frequency usage.

| Association | Low | High | Significance |
| :--- | ---: | ---: | :--- |
|  |  |  |  |
| Syntagmatic | 36.1 | 63.9 | 0.0366137 |
| Paradigmatic | 43.1 | 56.9 | not significant |
| Phonological | 81.7 | 18.3 | 0.0251423 |
| Orthographic | 0 | 0 | NA |
| Random | 85.3 | 14.7 | 0.0005095 |
|  |  |  |  |

Low = stimulus marked as "never" or "rarely"
High = stimulus marked as "sometimes" or "often"

Table 12: Frequency of usage mean percentages (multiple responses)

Here, this correlation could only be discovered through multiple-responses.
There is, however, one minor drawback to using multiple-response WATs. The last column in Table 9 above - headed "Chain" - illustrates the occasional tendency for some subjects to respond with a word that is associated not with the stimulus word but with the previous response word. As this "associative priming" occurs relatively infrequently and is easily identifiable, it does little to devalue the use of multiple-response WATs.

## 6. Conclusion

In interpreting the above word association test results according to McCarthy's three evaluation points (190:152), the following conclusions have been made: 1) word association tests do indeed provide information on how learners make mental links between words in their second language mental lexicon; 2) phonological links are not necessarily a factor of respondent level; and 3) Japanese WAT responses do not coincide with the common responses listed in McCarthy's 3.2 but do coincide with the recent research showing a Japanese tendency toward syntagmatic responses. Additionally, it was also shown that: 1) links are not necessarily a factor of respondent level or word characteristic alone but rather of the frequency with which respondents actively use the stimulus word; and 2) multiple response WATs are a more accurate means of investigating the ways in which learners make connections between words they have learned.

## Appendix 1: Response Lists

book


H4

| accountant |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| dictionary |  |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 | 1 | $p-h y p$ |
|  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 | 1 | p-hyp | the books |  |  |  |
| reader |  |  |  | 0 |  |  |  | 0 |  |  |  |  | 1 | 0 | 1 | p-hyp |

## Appendix 1: Response Lists

## green

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | All | Link | Comments |
| colour | 1 | 1 | 1 | 3 | 1 | 1 |  | 2 |  |  |  | 0 | 2 | 5 | p-hyper |  |
| red |  | 1 |  | 1 | 3 |  |  | 3 | 1 |  |  | 1 | 4 |  | p-cohyp |  |
| tree | 1 | 1 |  | 2 | 1 |  |  | 1 | 2 |  |  | 2 | 4 | 5 |  |  |
| yellow |  |  |  | 0 | 1 | 2 |  | 3 |  | 1 |  | 1 | 1 |  | p-cohyp |  |
| forest |  |  | 2 | 2 |  |  |  | 0 | 1 |  |  | 1 | 1 | 3 | s |  |
| grass | 1 |  |  | 1 | 1 |  | 1 | 2 |  |  |  | 0 | 2 | 3 | s |  |
| leaf |  |  | 1 | 1 |  |  | 1 | 1 |  |  | 1 | 1 | 0 |  | s |  |
| vegetable |  |  | 1 | 1 |  |  |  | 0 |  | 1 | 1 | 2 | 0 |  |  |  |
| clean |  |  |  | 0 |  |  |  | 0 |  |  | 2 | 2 | 0 |  | $p-s y n$ | green $=$ fresh = clean |
| field |  |  |  | 0 |  |  |  | 0 | 1 |  | 1 | 2 | 1 | 2 |  |  |
| flower |  | 1 |  | 1 |  |  |  | 0 |  | 1 |  | 1 | 0 |  |  |  |
| garden |  |  |  | 0 |  | 1 |  | 1 | 1 |  |  | 1 | 1 | 2 | s |  |
| park |  |  |  | 0 |  |  | 1 | 1 |  | 1 |  | 1 | 0 |  | s | trees in the park are green |
| traffic light |  |  |  | 0 |  | 1 |  | 1 |  |  | 1 | 1 | 0 |  | s |  |
| wood | 1 |  |  | 1 |  |  | 1 | 1 |  |  |  | 0 | 1 |  | s | wood -> leaf -> green |
| apple |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 | 1 |  |  |
| black |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | p-cohyp |  |
| blackboard | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s |  |
| blue |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | p-cohyp |  |
| car |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | cars can be green |
| clover |  | , |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 | 1 |  |  |
| fresh |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | $p-s y n$ | fresh veggies are green |
| frog |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  |  |  |
| GDSF | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s | green uniform |
| green pepper |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s |  |
| healthy |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | p-syn | green image |
| leaves |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 | 1 | s |  |
| lottery |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 0 |  | s |  |
| moss |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| my pencil |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | writing w/ green pencil now |
| peace |  |  |  |  |  |  |  |  |  | 1 |  | 1 | 0 |  | s |  |
| pepper |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| safe |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p | traffic light colour |
| safety |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s | chained with traffic light |
| signal |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s |  |
| trees | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s |  |

H4

| blue |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| red |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| yellow |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 |  |  |

## Appendix 1: Response Lists

## under

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  | Link | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | All |  |  |
|  |  |  | 1 | 1 | 2 | 2 |  | 4 |  | 1 |  | 1 | 2 |  |  |  |
| ground | 1 |  |  | 1 | 2 | 2 |  | 4 |  |  |  | 0 | 3 | 5 |  |  |
|  | 1 |  |  | 1 | 2 |  |  | 2 | 1 |  |  | 1 | 4 | 4 | p-ant? |  |
| dark |  | 1 |  | 1 |  |  |  | 0 | 1 |  | 1 | 2 | 1 | 3 |  |  |
| down |  | 1 |  | 1 |  | 1 | 1 | 2 |  |  |  | 0 | 0 | 3 | p-syn? |  |
| table |  |  | 1 | 1 | 1 |  |  | 1 |  | 1 |  | 1 | 1 | 3 | s | reg. class prep. Example |
| wear |  |  |  | 0 |  |  | 1 | 1 | 1 | 1 |  | 2 | 1 | 3 | s |  |
| above |  |  |  | 0 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 2 | p-ant |  |
| below |  |  |  | 0 |  | 1 | 1 | 2 |  |  |  | 0 | 0 | 2 | p-syn |  |
| black |  | 1 | 1 | 2 |  |  |  | 0 |  |  |  | 0 | 0 | 2 | s | underground is black |
| desk |  |  |  | 0 | 1 |  |  | 1 |  | 1 |  | 1 | 1 | 2 | s | position now |
| age |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 | 1 | s |  |
| and | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | phon |  |
| bad |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | under $=$ negative |
| boot |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | the underside of a boot |
| bottom |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| car | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s | go under car to fix it |
| cat |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | hmwk cards - cat under table |
| cheap |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | under the regular price |
| constructing |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s |  |
| cover |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | s | R\&R song title "Undercover" |
| deep |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s |  |
| downstairs |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s |  |
| elevator |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | go down/under |
| floor |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | second and third floors |
| hole |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | hole in ground = under |
| jeans |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | jeans go on under part of body |
| level | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s | ranking on a scale |
| line |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s |  |
| minor |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s |  |
| on | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | p-ant |  |
| review |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | business "under review" |
| secret |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s |  |
| side |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s |  |
| sky |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s | under sky in Japanese songs |
| subway |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| underwear |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s |  |
| upper |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | s |  |
| upstairs |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s |  |
| wall | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s | baseball under the wall |
| window |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | drop things from window |
| world |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |


| above |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 | 1 | $p-a n t$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| over |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| up |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Appendix 1: Response Lists

think

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd |  | Total | 1st | All | Link | Comments |
| brain <br> idea difficult mind dream head know meeting philosophy study argue be believe Buddhist consider deeply discussion doubt drink enjoy food future happy heart image imagine juice knowledge mental neat not now person pink plan positive Rodan sad ship sleep spirit thank thinking thought understand very hard white wise | 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 | 18 | 1 <br> 1 <br> 0 <br> 1 <br> 1 <br> 1 <br> 0 <br> 1 <br> 1 <br> 0 <br> 0 <br> 1 <br> 1 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 1 <br> 1 <br> 1 <br> 1 <br> 1 | $\begin{aligned} & 2 \\ & 1 \\ & 2 \\ & 1 \\ & 1 \end{aligned}$ | 1 1 1 1 1 1 | 1 <br> 1 1 <br> 1 | $\begin{aligned} & 4 \\ & 1 \\ & 3 \\ & 2 \\ & 1 \\ & 1 \\ & 1 \\ & 1 \\ & 0 \\ & 1 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \end{aligned}$ | 3 <br> 1 <br> 1 <br> 1 <br> 1 |  | 1 1 2 1 1 1 1 | 2 <br> 3 <br> 1 <br> 0 <br> 0 <br> 1 <br> 1 <br> 0 <br> 2 <br> 1 <br> 0 <br> 1 <br> 1 <br> 1 <br> 1 <br> 1 <br> 1 <br> 1 <br> 0 <br> 1 <br> 1 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 1 <br> 1 | 3 4 2 0 1 1 1 0 1 0 0 0 1 0 0 1 0 0 0 1 0 1 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 1 0 1 0 0 0 1 0 0 0 | 7 5 4 3 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | s <br> s <br> s <br> s <br> p-hyp <br> s <br> p-cohyp <br> s <br> $s$ <br> p-hyp <br> p <br> p <br> $p^{--s y n}$ <br> s <br> p-syn <br> S <br> s <br> p-hyp <br> phon <br> p <br> s <br> s <br> s <br> s <br> s <br> p-hyp <br> chain <br> s <br> s <br> s <br> rand <br> s <br> s <br> phon <br> s <br> s <br> s <br> chain <br> phon <br> p <br> s <br> phon <br> rand <br> s <br> p-cohyp <br> s <br> rand <br> s | thinking about difficult things <br> always think at meeting <br> I think therefore I am <br> zazen - no thinking <br> think - say - discuss <br> now hungry, thinking food think about future <br> heart $=$ mind - thinking <br> good thinkers are neat <br> now thinking <br> people think, animals don't <br> famous statue "The Thinker" <br> sink - a ship sinks thinking makes you tired musicians think about spirit |

## Appendix 1: Response Lists

## vacation

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  | Link | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | All |  |  |
| summer holiday trip happy relax travel airplane beach car fun sea ski sun <br> Sunday airport animal camp Canada cat day off exciting expectations family Japan lake off Okinawa overseas resort sleep walking want what you | 1 <br> 1 <br> 1 <br> 1 <br> 1 | $\begin{aligned} & 1 \\ & 1 \\ & 1 \end{aligned}$ <br> 1 <br> 1 <br> 1 <br> 1 | 1 1 1 1 1 1 1 1 | $\begin{aligned} & 1 \\ & 2 \\ & 3 \\ & 3 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 1 \\ & 1 \\ & 0 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 1 \\ & 1 \\ & 1 \\ & 1 \\ & 1 \end{aligned}$ | 2 1 1 1 1 1 1 | 3 2 1 1 | 1 1 1 1 2 1 1 | 5 <br> 3 <br> 1 <br> 0 <br> 2 <br> 1 <br> 1 <br> 2 <br> 0 <br> 1 <br> 1 <br> 2 <br> 1 <br> 1 <br> 0 <br> 0 <br> 0 <br> 1 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 1 <br> 0 <br> 1 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br> 0 <br>  | 1 <br> 2 <br>  <br> 1 <br> 1 <br>  <br> 1 | 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 | 2 2 2 0 1 1 1 0 1 1 1 0 1 0 0 0 1 0 0 1 1 1 1 0 0 1 1 0 1 0 0 0 0 | 3 3 4 1 1 2 0 1 1 1 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 1 0 0 0 | 8 7 6 3 3 3 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 | s $p-s y n$ $p-s y n$ $s$ $s$ $s$ $p-s y n$ $p$ $p$ $p$ $p$ $p$ $s$ $p$ $p$ $p$ $p$ rand $s$ $p$ rand $p-s y n$ $s$ $p$ $p$ $p$ $p$ $s$ $p$ $p$ $p$ $p$ $s$ $s$ $s$ $s$ | lots of expectations for vac. time with family place for vacation <br> sleep in a hotel on vacation free time to walk want to go on vacation |
| H4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 0 0 0 |  |  |  | 0 0 0 | 1 |  | 1 | 1 | 0 1 0 |  | s |  |

## Appendix 1: Response Lists

of


## Appendix 1: Response Lists

## punch

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  | Link | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | All |  |  |
| boxing |  |  | 2 | 2 |  |  |  | 0 | 4 | 1 |  | 5 | 4 | 7 | p -mer |  |
| fight | 2 | 1 |  | 3 |  |  |  | 0 | 1 |  | 1 | 2 | 3 | 5 | p-mer |  |
| hit | 1 |  |  | 1 |  |  | 1 | 1 |  | 1 | 2 | 3 | 1 | 5 | p-hyp |  |
| strong |  |  |  | 0 | 1 | 2 |  | 3 |  |  | 1 | 1 | 1 | 4 |  |  |
| attack | 1 | 1 |  | 2 |  |  | 1 | 1 |  |  |  | 0 | 1 | 3 | p-hyp |  |
| kick |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 | 0 | 3 | p-cohyp |  |
| hurt |  |  |  | 0 | 1 | 1 |  | 2 |  |  |  | 0 | 1 | 2 |  | get hurt when punched |
| pain | 1 |  |  | 1 | 1 |  |  | 1 |  |  |  | 0 | 2 |  | p |  |
| beat |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p |  |
| black |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | bruise from punch |
| boxer |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | p |  |
| boxing gym |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | p |  |
| cheek |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | p |  |
| colour |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | strong colour has punch |
| damage |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | p |  |
| delicious | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | phon | delicious for "dangerous" |
| dog |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  |  | anime dog's name |
| drink |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | p-hyper | fruit punch |
| enthusiastic |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  |  | japns = "punch ga kiteru" |
| fighting |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p-mer |  |
| fruits |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s | punch (drink) |
| glove |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | boxing gloves to punch |
| hand |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s |  |
| hands |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| happening |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | don't like punch happening |
| hole |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | punch a hole |
| hook |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | p |  |
| house |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | rand |  |
| kangaroo |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | p |  |
| lady |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p | strong ladies punch |
| man |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s | men fight |
| perm |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | "punch" perm = afro |
| power |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| punch |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | rand |  |
| sick |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s |  |
| straight | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s |  |
| tone |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | phon |  |
| train |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | rand |  |
| tree |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | rand |  |
| upper |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s |  |
| violence |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p |  |
| you |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s | joke - punch the researcher |

H4

| fruit |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| strength |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 | 1 | $s$ |  |
| strike |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 | 1 | s |  |
| 1 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Appendix 1: Response Lists

## boring

|  | Low Level |  |  |  | Mid Level |  |  |  | High Level |  |  |  | Total |  | Link | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Response | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total | 1st | All |  |  |
| ball | 2 | 1 | 1 | 4 |  |  |  | 0 |  |  |  | 0 | 2 | 4 | rand | bowling |
| pin |  | 1 | 2 | 3 |  | 1 |  | 1 |  |  |  | 0 | 0 | 4 | rand | bowling |
| ground |  |  |  | 0 | 2 | 1 |  | 3 |  |  |  | 0 | 2 | 3 | s | drilling |
| interesting | 1 | 1 |  | 2 |  |  |  | 0 |  |  |  | 1 | 1 | 3 | p-ant |  |
| not interesting |  |  |  | 0 |  |  | 1 | 1 |  | 1 |  | 1 | 0 | 2 | p-syn |  |
| study |  |  |  | 0 |  |  | 2 | 2 |  |  |  | 0 | 0 | 2 |  |  |
| tired |  |  |  | 0 | 1 |  |  | 1 | 1 |  |  | 1 | 2 | 2 |  |  |
| athletics |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 | 1 | s | drill hole to make ath complex |
| bad | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | p |  |
| bear |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s | have to put up with stuff |
| black | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s | not interesting |
| build |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | make a building by drilling |
| church |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s |  |
| comedy |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s |  |
| congress |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  |  |  |
| court |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | rand | bowling |
| difficult |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s | digging is difficult |
| dull |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | p-syn |  |
| economy |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  |  | not interesting |
| escape |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | s | escape boring things |
| every day |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  |  | sometimes boring |
| family |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | rand | bowling |
| finger |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | rand | bowling |
| hobby |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | rand | bowling |
| hole |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s | drilling |
| in the train |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s |  |
| killing time |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | s |  |
| lonely |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | p |  |
| NHK |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | p |  |
| not |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s |  |
| nothing |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s | nothing to do is boring |
|  |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s | drilling |
| play | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | rand | bowling |
| policy |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | boring thing |
| reading |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s |  |
| run |  | 1 |  | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | rand | bowling |
| school lesson |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | s |  |
| sitting |  |  |  | 0 |  |  | 1 | 1 |  |  |  | 0 | 0 |  | s |  |
| sleep |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | s | boring things -> sleep |
| sleeping |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s |  |
| sleepy |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  |  |  |
| slip |  |  | 1 | 1 |  |  |  | 0 |  |  |  | 0 | 0 |  | rand | bowling |
| soccer | 1 |  |  | 1 |  |  |  | 0 |  |  |  | 0 | 1 |  | s |  |
| spa |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s | drilling for water |
| sport |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  |  | bowling |
| strike |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | rand | bowling |
| subway |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  | s | drilling |
| teacher |  |  |  | 0 |  |  |  | 0 | 1 |  |  | 1 | 1 |  |  | high school is boring |
| temple |  |  |  | 0 |  |  |  | 0 |  |  | 1 | 1 | 0 |  | chain |  |
| TV |  |  |  | 0 |  | 1 |  | 1 |  |  |  | 0 | 0 |  | s |  |
| uneasy |  |  |  | 0 |  |  |  | 0 |  | 1 |  | 1 | 0 |  | p | negative just like boring |
|  |  |  |  | 0 | 1 |  |  | 1 |  |  |  | 0 | 1 |  | s |  |

H4

| tiresome |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| uninteresting |

## Appendix 2: Details of Statistical Analysis

## Comparison of Semantic and Formal Association Means

| Sem Form |  |  | t-Test: Two-Sample Assuming Unequal Variances |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| L1 | 62.5 | 25 |  |  |  |
| L2 | 62.5 | 12.5 |  | Variable 1 | Variable 2 |
| L3 | 87.5 | 12.5 | Mean | 88.06818182 | 5.681818 |
| L4 | 62.5 | 12.5 | Variance | 155.9117965 | 55.46537 |
| L5 | 87.5 | 0 | Observations | 22 | 22 |
| L6 | 100 | 0 | Hypothesized Mean Difference | 0 |  |
| L7 | 87.5 | 0 | df | 34 |  |
| M1 | 87.5 | 12.5 | t Stat | 26.57893903 |  |
| M2 | 100 | 0 | $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ one-tail | $1.25 \mathrm{E}-24$ |  |
| M3 | 100 | 0 | $t$ Critical one-tail | 1.690924198 |  |
| M4 | 75 | 12.5 | $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ two-tail | $2.49144 \mathrm{E}-24$ |  |
| M5 | 87.5 | 0 | t Critical two-tail | 2.032244498 |  |
| M6 | 100 | 0 |  |  |  |
| M7 | 87.5 | 0 |  |  |  |
| M8 | 87.5 | 0 |  |  |  |
| H1 | 87.5 | 12.5 |  |  |  |
| H2 | 87.5 | 12.5 |  |  |  |
| H3 | 100 | 0 |  |  |  |
| H5 | 87.5 | 12.5 |  |  |  |
| H6 | 100 | 0 |  |  |  |
| H7 | 100 | 0 |  |  |  |
| H8 | 100 | 0 |  |  |  |

Comparison of Syntagmatic and Paradigmatic Association Means

| Syn Par |  |  | t-Test: Two-Sample Assuming Unequal Variances |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| L1 | 13 | 50 |  |  |  |
| L2 | 25 | 38 |  | Variable 1 | Variable 2 |
| L3 | 38 | 50 | Mean | 50 | 38.06818 |
| L4 | 38 | 25 | Variance | 446.4286 | 274.9594 |
| L5 | 63 | 25 | Observations | 22 | 22 |
| L6 | 75 | 25 | Hypothesized Mean Difference | 0 |  |
| L7 | 63 | 25 | df | 40 |  |
| M1 | 25 | 63 | t Stat | 2.083692 |  |
| M2 | 50 | 50 | $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ one-tail | 0.021811 |  |
| M3 | 100 | 0 | t Critical one-tail | 1.683851 |  |
| M4 | 38 | 38 | $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ two-tail | 0.043621 |  |
| M5 | 63 | 25 | t Critical two-tail | 2.021075 |  |
| M6 | 88 | 13 |  |  |  |
| M7 | 25 | 63 |  |  |  |
| M8 | 63 | 25 |  |  |  |
| H1 | 38 | 50 |  |  |  |
| H2 | 50 | 38 |  |  |  |
| H3 | 63 | 38 |  |  |  |
| H5 | 50 | 38 |  |  |  |
| H6 | 38 | 63 |  |  |  |
| H7 | 50 | 50 |  |  |  |
| H8 | 50 | 50 |  |  |  |

## Appendix 2: Details of Statistical Analysis

Comparison of Syntagmatic Means by Level

| Low | Mid | High |
| ---: | ---: | ---: |
| 12.5 | 25 | 37.5 |
| 25 | 50 | 50 |
| 37.5 | 100 | 62.5 |
| 37.5 | 37.5 |  |
| 62.5 | 62.5 | 50 |
| 75 | 87.5 | 37.5 |
| 62.5 | 25 | 50 |
|  | 62.5 | 50 |


| Anova: Single Factor |  |  |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | :---: | :---: |
|  |  |  |  |  |  |  |
| SUMMARY |  |  |  |  |  |  |
| Groups | Count | Sum | Average | Variance |  |  |
| Low | 7 | 312.5 | 44.64286 | 513.3929 |  |  |
| Mid | 8 | 450 | 56.25 | 758.9286 |  |  |
| High | 7 | 337.5 | 48.21429 | 74.40476 |  |  |


| ANOVA |  |  |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: |
| Source of Variation | SS | df |  | MS | F | P-value |
| F crit |  |  |  |  |  |  |
| Between Groups | 535.7143 | 2 | 267.8571 | 0.575758 | 0.571789 | 3.521893 |
| Within Groups | 8839.286 | 19 | 465.2256 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 9375 | 21 |  |  |  |  |

Comparison of Paradigmatic Means by Level

| Low 50 | Mid $62.5$ | High 50 | Anova: Single Factor |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 37.5 | 50 | 37.5 | SUMMARY |  |  |  |  |  |  |
| 50 | 0 | 37.5 | Groups | Count | Sum | Average | Variance |  |  |
| 25 | 37.5 |  | Low | 7 | 237.5 | 33.92857 | 141.369 |  |  |
| 25 | 25 | 37.5 | Mid | 8 | 275 | 34.375 | 524.5536 |  |  |
| 25 | 12.5 | 62.5 | High | 7 | 325 | 46.42857 | 89.28571 |  |  |
| 25 | 62.5 | 50 |  |  |  |  |  |  |  |
|  | 25 | 50 |  |  |  |  |  |  |  |
|  |  |  | ANOVA |  |  |  |  |  |  |
|  |  |  | Source of Variatior | SS | df | MS | F | P -value | F crit |
|  |  |  | Between Groups | 718.3442 | 2 | 359.1721 | 1.349789 | 0.283056 | 3.521893 |
|  |  |  | Within Groups | 5055.804 | 19 | 266.0949 |  |  |  |
|  |  |  | Total | 5774.148 | 21 |  |  |  |  |

Comparison of Phonological Means by Level

| Low | Mid | High | Anova: Single Factor |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 25 | 12.5 | 12.5 |  |  |  |  |  |
| 12.5 | 0 | 12.5 | SUMMARY |  |  |  |  |
| 12.5 | 0 | 0 | Groups | Count | Sum | Average | Variance |
| 12.5 | 12.5 |  | Low | 7 | 62.5 | 8.928571 | 89.28571 |
| 0 | 0 | 12.5 | Mid | 8 | 25 | 3.125 | 33.48214 |
| 0 | 0 | 0 | High | 7 | 37.5 | 5.357143 | 44.64286 |
| 0 | 0 | 0 |  |  |  |  |  |
|  | 0 | 0 |  |  |  |  |  |


| ANOVA |  |  |  |  |  |  |
| :--- | :---: | ---: | :---: | :---: | :---: | :---: |
| Source of Variatior | SS | df | MS | F | P-value | F crit |
| Between Groups | 126.8263 | 2 | 63.41315 | 1.160802 | 0.33448 | 3.521893 |
| Within Groups | 1037.946 | 19 | 54.62876 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 1164.773 | 21 |  |  |  |  |

## Appendix 2: Details of Statistical Analysis



Comparison of Phonological Means by Level (minus "of")

| Low | Mid | High |  |
| ---: | ---: | ---: | :---: |
| 14.3 | 0 | 0 |  |
| 14.3 | 0 | 0 |  |
| 0 | 0 | 0 |  |
| 14.3 | 14.3 | 0 |  |
| 0 | 0 | 0 |  |
| 0 | 0 | 0 |  |
| 0 | 0 | 0 |  |
|  | 0 |  |  |

Anova: Single Factor

SUMMARY

| Groups | Count | Sum | Average | Variance |
| :--- | ---: | ---: | ---: | ---: |
| Low | 7 | 42.85714 | 6.122449 | 58.30904 |
| Mid | 8 | 14.3 | 1.7875 | 25.56125 |
| High | 7 | 0 | 0 | 0 |

ANOVA

| Source of Variatior | SS | df | MS | F | P-value | F crit |
| :--- | ---: | ---: | ---: | :---: | :---: | :---: |
| Between Groups | 139.4547 | 2 | 69.72735 | 2.505413 | 0.108216 | 3.521893 |
| Within Groups | 528.783 | 19 | 27.83068 |  |  |  |
|  |  |  |  |  |  |  |
| Total | 668.2377 | 21 |  |  |  |  |

## Appendix 2: Details of Statistical Analysis

Comparison of Frequency of Word Usage Means

| Syntagmatic Responses |  |  |  |  |
| :--- | :---: | ---: | ---: | ---: |
|  | Low (N/R) |  |  |  |
|  | High (S/O) |  |  |  |
|  | $\#$ | $\%$ | $\#$ | $\%$ |
| book | 1 | 10 | 9 | 90 |
| green | 6 | 42.9 | 8 | 57.1 |
| under | 5 | 38.5 | 8 | 61.5 |
| think | 1 | 5.88 | 16 | 94.1 |
| vacation | 2 | 33.3 | 4 | 66.7 |
| of | 2 | 25 | 6 | 75 |
| punch | 6 | 100 | 0 | 0 |
| boring | 6 | 46.2 | 7 | 53.8 |
|  |  |  |  |  |
| Mean | 3.625 | 37.7 | 7.25 | 62.3 |


| Paradigmatic Responses |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Low (N/R) |  | High (S/O) |  |
|  | \# | \% | \# | \% |
| book | 2 | 16.7 | 10 | 83.3 |
| green | 3 | 37.5 | 5 | 62.5 |
| under | 4 | 50 | 4 | 50 |
| think | 1 | 33.3 | 2 | 66.7 |
| vacation | 2 | 13.3 | 13 | 86.7 |
| of | 2 | 66.7 | 1 | 33.3 |
| punch | 12 | 92.3 | 1 | 7.69 |
| boring | 3 | 50 | 3 | 50 |
| Mean | 3.625 | 45 | 4.875 | 55 |


| Phonological Responses |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: |
|  | Low (N/R) |  | High (S/O) |  |
|  | $\#$ | $\%$ | $\#$ | $\%$ |
| book | $*$ | $*$ | $*$ | $*$ |
| green | $*$ | $*$ | $*$ | $*$ |
| under | 1 | 100 | 0 | 0 |
| think | 1 | 100 | 0 | 0 |
| vacation | $*$ | $*$ | $*$ | $*$ |
| of | 1 | 16.7 | 5 | 83.3 |
| punch | 2 | 100 | 0 | 0 |
| boring | $*$ | $*$ | $*$ | $*$ |
|  |  |  |  |  |
| Mean | 1.25 | 79.2 | 1.25 | 20.8 |


| Random Responses <br> Low (N/R) |  | High (S/O) |  |  |
| :--- | ---: | ---: | ---: | ---: |
|  | $\#$ | $\%$ | $\#$ | $\%$ |
| book |  | $*$ |  | $*$ |
| green |  | $*$ |  | $*$ |
| under |  | $*$ |  | $*$ |
| think | 1 | 100 | 0 | 0 |
| vacation | 1 | 100 | 0 | 0 |
| of | 3 | 60 | 2 | 40 |
| punch | 1 | 100 | 0 | 0 |
| boring | 3 | 100 | 0 | 0 |
|  |  |  |  |  |
| Mean | 1.8 | 92 | 0.4 | 8 |

Single Responses
t-Test: Two-Sample Assuming Unequal Variances

|  | Variable 1 | Variable 2 |
| :--- | ---: | ---: |
| Mean | 37.71103 | 62.28897 |
| Variance | 848.5633 | 848.5633 |
| Observations | 8 | 8 |
| Hypothesized Mean Difference | 0 |  |
| df | 14 |  |
| t Stat | -1.68746 |  |
| P $(\mathrm{T}<=\mathrm{t})$ one-tail | 0.056829 |  |
| t Critical one-tail | 1.76131 |  |
| $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ two-tail | 0.113658 |  |
| t Critical two-tail | 2.144787 |  |

t-Test: Two-Sample Assuming Unequal Variances

|  | Variable 1 | Variable 2 |
| :--- | ---: | ---: |
| Mean | 44.97596 | 55.02404 |
| Variance | 679.3392 | 679.3392 |
| Observations | 8 | 8 |
| Hypothesized Mean Difference | 0 |  |
| df | 14 |  |
| t Stat | -0.77103 |  |
| P(T<=t) one-tail | 0.226754 |  |
| t Critical one-tail | 1.76131 |  |
| P(T<=t) two-tail | 0.453508 |  |
| t Critical two-tail | 2.144787 |  |

t-Test: Two-Sample Assuming Unequal Variances

|  | Variable 1 | Variable 2 |
| :--- | ---: | ---: |
| Mean | 79.16667 | 20.83333 |
| Variance | 1736.111 | 1736.111 |
| Observations | 4 | 4 |
| Hypothesized Mean Difference | 0 |  |
| df | 6 |  |
| t Stat | 1.979899 |  |
| P(T<=t) one-tail | 0.047519 |  |
| t Critical one-tail | 1.94318 |  |
| P(T<=t) two-tail | 0.095037 |  |
| t Critical two-tail | 2.446912 |  |

t-Test: Two-Sample Assuming Unequal Variances

|  | Variable 1 | Variable 2 |
| :--- | ---: | ---: |
| Mean | 92 | 8 |
| Variance | 320 | 320 |
| Observations | 5 | 5 |
| Hypothesized Mean Difference | 0 |  |
| df | 8 |  |
| t Stat | 7.424621 |  |
| P(T<=t) one-tail | $3.72 \mathrm{E}-05$ |  |
| t Critical one-tail | 1.859548 |  |
| $\mathrm{P}(\mathrm{T}<=\mathrm{t})$ two-tail | $7.44 \mathrm{E}-05$ |  |
| t Critical two-tail | 2.306004 |  |

# Appendix 2: Details of Statistical Analysis 

Comparison of Frequency of Word Usage Means

| SyntagmaticResponses <br> Low (N/R) | High (S/O) |  |  |  |
| :--- | ---: | ---: | ---: | ---: |
|  | $\#$ | $\%$ | $\#$ | $\%$ |
| book | 4 | 12.12 | 29 | 87.88 |
| green | 19 | 41.3 | 27 | 58.7 |
| under | 20 | 43.48 | 26 | 56.52 |
| think | 2 | 4.545 | 42 | 95.45 |
| vacation | 4 | 20 | 16 | 80 |
| of | 4 | 23.53 | 13 | 76.47 |
| punch | 21 | 95.45 | 1 | 4.545 |
| boring | 17 | 48.57 | 18 | 51.43 |
|  |  |  |  |  |
| Mean | 11.38 | 36.13 | 21.5 | 63.87 |


| Paradigmatic Responses Low (N/R) |  |  | High (S/O) |  |
| :---: | :---: | :---: | :---: | :---: |
|  | \# | \% | \# | \% |
| book | 5 | 15.63 | 27 | 84.38 |
| green | 7 | 36.84 | 12 | 63.16 |
| under | 9 | 50 | 9 | 50 |
| think | 1 | 9.091 | 10 | 90.91 |
| vacation | 7 | 16.67 | 35 | 83.33 |
| of | 8 | 88.89 | 1 | 11.11 |
| punch | 35 | 94.59 | 2 | 5.405 |
| boring | 4 | 33.33 | 8 | 66.67 |
| Mean | 9.5 | 43.13 | 13 | 56.87 |

t-Test: Two-Sample Assuming Unequal Variances

|  | Variable 1 | Variable 2 |
| :--- | ---: | ---: |
| Mean | 43.130187 | 56.86981 |
| Variance | 1077.2403 | 1077.24 |
| Observations | 8 | 8 |
| Hypothesized Mean Difference | 0 |  |
| df | 14 |  |
| t Stat | -0.837237 |  |
| P(T<=t) one-tail | 0.2082615 |  |
| t Critical one-tail | 1.7613101 |  |
| P(T<=t) two-tail | 0.4165229 |  |
| t Critical two-tail | 2.1447867 |  |


| Phonological Responses |  |  |  |  |
| :--- | :---: | ---: | ---: | ---: |
|  | Low (N/R) |  | High (S/O) |  |
|  | $\#$ | $\%$ | $\#$ | $\%$ |
| book | $*$ | $*$ | $*$ | $*$ |
| green | $*$ | $*$ | $*$ | $*$ |
| under | 1 | 100 | 0 | 0 |
| think | 3 | 100 | 0 | 0 |
| vacation | $*$ | $*$ | $*$ | $*$ |
| of | 4 | 26.67 | 11 | 73.33 |
| punch | 2 | 100 | 0 | 0 |
| boring | $*$ | $*$ | $*$ | $*$ |
|  |  |  |  |  |
| Mean | 2.5 | 81.67 | 2.75 | 18.33 |


| Random Responses |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Low (N/R) |  | High (S/O) |  |
|  | \# | \% | \# | \% |
| book | * | * | * | * |
| green | * | * | * | * |
| under | * | * | * | * |
| think | 3 | 100 | 0 | 0 |
| vacation | 4 | 100 | 0 | 0 |
| of | 7 | 50 | 7 | 50 |
| punch | 4 | 100 | 0 | 0 |
| boring | 13 | 76.47 | 4 | 23.53 |
| Mean | 6.2 | 85.29 | 2.2 | 14.71 |

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[^0]:    ${ }^{1}$ Initial analysis was conducted on first responses only (see sections 4.3 and 5.1-5.4. Later analysis included multiple responses (see section 5.5)

[^1]:    2 Data were left as counts rather than converted to percents so as to facilitate comparing of data both across and down the table.

