

## Effects of Lexical Class and Word Frequency on L1 and L2 English-based Lexical Connections

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### Abstract

The questions addressed in the study concerned the way two word-related factors (i.e., lexical category and word frequency) interplayed with two learner-related characteristics (i.e., proficiency and word familiarity) and influenced 1) L1 and L2 users' knowledge of vocabulary, 2) their preference to build specific types of lexical connections among the words they know, and 3) their ability to maintain networks of associations as an indicator of the connectivity of their lexicons. Three groups of participants—L1 speakers of English, L2 advanced, and L2 intermediate users of English—responded in writing to a word association test containing words balanced for lexical class (nouns, verbs, adjectives) and frequency of occurrence (high, mid, low). The findings revealed a complex picture of interactions between the word-related and learner-related factors but, whenever the effects of the variables could be disentangled, proficiency and lexical class had a stronger influence on the organization of the L1 and L2 lexicons than word frequency alone.

**Keywords:** Lexical connectivity; word associations; structure of the L1 and L2 mental lexicon; effects of lexical class, word frequency, proficiency level, and word familiarity.

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### 1. Introduction

Native (L1) and non-native (L2) speakers' associative connections have been of interest to researchers from different areas of study for several decades now. In the early twentieth century, word associations (WAs) in L1 research were primarily used for the purposes of psychoanalysis (Goldfarb & Harpen, 1984). In the 1960s, however, a number of researchers, including Deese (1962, 1965), Kolers (1963), Polio (1963),

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Szalay and Brent (1967), Szalay and Windle (1968), Cramer (1968) and others were among the first to consider linking WAs to issues of lexical semantics by using WA tests to investigate the organization of the mental lexicon. About the same time, researchers interested in the comparison between the L1 and L2 lexicons started looking at features such as the homogeneity of associations produced by L1 and L2 users (Kurcz, 1966) and the effect of language on bilinguals' associative connections (e.g., Riegel, Ramsey, & Riegel, 1967; Rozenzweig, 1961). Since then, the uses of WA tests in L2 lexical research have tremendously expanded and their research methodologies have greatly improved. Yet, there are still aspects of the L2 associative connections that have not been explored sufficiently well to allow researchers to identify the linguistic and non-linguistic factors that may influence L2 learners' associative preferences for storage and retrieval of vocabulary (Fitzpatrick, 2006).

Every word is a union of features that define it in a unique way and this understanding of a *word* is reflected in the numerous attempts to operationalize what it means to know a word. Among the features that form lexical knowledge, some scholars (e.g., Miller, 1999; Nation, 1990, 2001; Richards, 1976; Singleton, 1999) include building associative connections and knowing what company a word keeps with other words in one's lexical store. Thus, word associations have been valued by linguists and psycholinguists as data that provide useful information about how the mental lexicon is organized and what types of semantic information are accessed when a person hears or reads a word. In other words, if the word *blanket*, for example, elicits the word *a cover*, this suggests that when a person comes across the word *blanket*, information about its superordinate category is accessed. If we find that *blanket* also elicits *warm*, *soft*, *old*, and *blue*, it suggests that certain properties of the object are also made available. If it prompts *bed*, *home*, *dorm*, and *hotel*, it means that the information accessed includes locations where *blankets* can be typically found. Thus, researchers have realized that, by looking at a person's word associations, they can investigate a variety of semantically-related information that is accessed in the absence of a supporting semantic-pragmatic context. They have also realized they can gain valuable insights into associatively-related information, determined by the repeated co-occurrence of two words that may or may not share meaning relations (e.g., *sunshine – life*) (Moss, Ostrin, Tyler, & Marslen-Wilson, 1991). In other words, many researchers (e.g., Deese, 1965; Moss et al., 1991) have successfully argued that WAs contain a "conglomeration of different types of features" (Hutchison, 2003, p. 787) which are accessed in an association task and are rich and revealing of both form and meaning information stored in the mental lexicon.

By and large, when it comes to factors influencing the features of an associative domain, it is only logical to assume that characteristics of words, in addition to learner characteristics, would have impact on the way language users build connections among the words in their lexicons. Interestingly, Deering (1963, cited in Cramer, 1968), for example, established that it is the stimulus word (SW) variables, rather than participant variables, that determine the critical features of an L1 associative domain. Following this conclusion, several word characteristics have been well examined in L1 WA studies, including the affectivity of the stimulus, the effects of SW semantic levels on the association responses, the impact of form class on associative responses, and so on. Unfortunately, word effects have not been addressed as consistently in L2 WA studies as they have been researched in L1 contexts and, in that, insufficient attention has been paid to how word effects influence L2 learners' lexical organization. To fill in this research gap in the L2 WA line of studies, two word features—namely, lexical class and frequency of occurrence—and their effects on L1 and L2 associative behavior are the center of attention in the present study. In addition to the lexical variables, the effect of two characteristics pertaining to the L2 learners themselves—i.e., level of language proficiency and word familiarity—are also of interest to the investigation from both empirical and pedagogical points of view. The underlying assumption behind this choice of linguistic and non-linguistic variables is that only if language educators know how certain features describing the lexicon interact with characteristics describing the L2 learners, can they

meaningfully predict what factors affect an individual's preference for developing certain types of associative links that may facilitate both storage and retrieval of vocabulary.

The following paragraphs provide a brief overview of some considerations regarding the effects of word frequency and lexical class on language users' associative connections in L1 and L2 WA studies, focusing on studies comparable to the type of associative connections analyzed in the present research. The review of the literature aims at pointing out the relationship between the L1 and L2 lines of research, the interpretation of their findings, and how they inform the field's current understanding of the impact of the two word-related and learner-related factors chosen for investigation in this study. Next, the study itself is discussed, followed by a discussion of the main findings, addressing their importance and implications primarily from a learning and teaching point of view.

### **Disentangling the Effects of Word Frequency from Word Familiarity**

Researchers unanimously agree that both word frequency and degree of word familiarity influence the way vocabulary knowledge is stored in the mental lexicon; however, in earlier research, there have been few attempts to disentangle the one from the other. In other words, L1 associative research has had a long tradition of exploring the effects of high frequency vocabulary on associative responses, but it seemed to be a common practice to determine familiarity by the frequency of occurrence of sets of tested items based on some source of a frequency count, where the assumption is that one's knowledge of a word increases relative to the rate at which a word occurs in a given language (Stolz & Tiffany, 1972). Consequently, many L1 and L2 researchers (e.g., Meara, 1978; Rozenzweig, 1961; Sanford & Svetics, 1994; Söderman, 1993, etc.) followed the practice of selecting their test words from frequency count lists or norm lists, for example Kent and Rosanoff's (1910) norm list consisting of primarily high frequency words. This practice, in turn, created inaccuracy in their conclusions regarding the L1 or L2 lexicon as a whole since; in fact, those conclusions were relevant to only the high-frequency layer of the lexicon.

In an attempt to separate familiarity from frequency and evaluate students' knowledge of mid- and low-frequency words (which are as important aspects of a person's lexicon as high-frequency words are), some L1 researchers began using the 4-level scale of word familiarity, proposed by Dale (1965), who distinguished between 4 stages of knowing a word:

Stage 1: "I never saw it before."

Stage 2: "I've heard of it, but I don't know what it means."

Stage 3: "I recognize it in context – it has something to do with ...."

Stage 4: "I know it." (p. 398)

The scale is often used as a pre-check of self-reported word knowledge, especially in studies aimed at examining participants' judgments about words they claim to have complete knowledge of (familiar words), partial (frontier words) or no knowledge of (unfamiliar words) (Shore & Durso, 1990). The scale or its version, modified by Paribakht and Wesche (1993), also known as the "vocabulary knowledge scale," is sometimes used in L2 lexical studies to account for familiarity effects, especially when words from a range of frequency bands are used as test items.

In brief, word familiarity has been recognized as a factor which influences associative response patterns in recent studies. Thus, conceptualization of familiarity shifted from *assumptions* about familiarity, based on the use of high-frequency SWs (see, e.g., Nissen & Henriksen, 2006; Söderman, 1993; Sökmen, 1993), to *evidence* of familiarity, based on participants' ratings and verification of familiarity with

SWs from a range of frequency bands (see Wolter, 2001; Zareva, Schwanenflugel, Nikolova, 2005; Zareva, 2007, 2010). Nonetheless, it would be fair to say that there have been a few attempts in L2 associative research (e.g., Söderman, 1993 [experiment 2]; Wolter, 2001; Zareva *et al.*, 2005; Zareva, 2007) to disentangle word familiarity from word frequency by (1) including words from several frequency bands and (2) pre- or post-testing L2 learners' knowledge of the tested words. There is some consensus, though, that word frequency should be expected to influence the way language users connect words from different frequency bands in their mental lexicons. However, to my knowledge, the magnitude of this effect has not been researched in a second/foreign language context, which is why the present study will focus on examining its impact as a word-related variable that is separate from familiarity (a learner-related variable).

### Effects of Lexical Class on L1 and L2 Users' Lexical Associations

Early L1 WA research was concerned with the effects of a number of word features (e.g., lexical class, word frequency, etc.) as well as individual characteristics (e.g., age, word familiarity, etc.) on the type of lexical connections individuals build in their mental lexicon. By and large, there have been a number of different attempts to classify the types of lexical connections from several perspectives. Researchers from the tradition of semantic field theory agree that the relations which order a field are of two types: *paradigmatic*, words that are substitutable for one another in a well-formed syntactic string (e.g., synonyms, antonyms, meronyms, hyponyms, etc.), and *syntagmatic*—words that collocate well in a grammatical string and have semantic affinities (e.g., somebody can ask a *quick* question but not a *rapid* or *fast* question) (Kittay & Lehrer, 1992).

However, many L1 WA researchers (e.g., Ervin, 1961; Deese, 1962, 1965; Stolz & Tiffany, 1972) took a broader view on the nature of associative relations between words by adopting a distinction between paradigmatic and syntagmatic relations based on lexical class only—that is, *paradigmatic* responses are ones that share same lexical category with the SW and *syntagmatic* responses are those that belong to a different lexical class than the SW. This approach is broader than the semantic field view in that it supports the linguistic assumption that paradigmatic associations can potentially occupy equivalent positions within utterances, while the syntagmatic ones usually occupy different positions within phrases and sentences and, more often than not, tend to be contiguous. In general, each approach to the classification of associative links individuals establish to organize the networks of their vocabulary connections comes with its own set of advantages and disadvantages. However, in the view of this author, it is more important to consider the two approaches as complementing one another, rather than competing with one other, especially in light of the fact that any analysis by form class membership is only a first approximation of the type of semantic relationships existing between words, which can be further broken down into more finely-grained semantic and lexico-syntactic subcategories.

Considering the general distinction between paradigmatic and syntagmatic associations among words as a way of maintaining structure of the mental lexicon, it has been found that the effects of word frequency (as a determinant of familiarity) on the number of syntagmatic and paradigmatic associations vary according to the lexical category of words. On the whole, certain grammatical categories seem to elicit a higher proportion of paradigmatic responses than other categories (Miller & Fellbaum, 1991). For example, Deese' experimental work (1962; 1965) showed that nouns elicit the greatest number of paradigmatic responses, followed by high-frequency adjectives, and verbs. He also found that syntagmatic responses were most often elicited by adverbs, followed by adjectives, verbs, and nouns.

Additionally, the type of associations has consistently shown to vary as a function of the age of the participants. When compared to the responses obtained from adults, typical responses obtained from

children showed changes in rather regular ways with an increase of age. For example, Ervin (1961) observed that young English-speaking children gave mostly syntagmatic responses, whereas older children and adults gave more associations that were from the same lexical category with the SW. Earlier L1 research (e.g., Ervin, 1961) interpreted this shift from predominantly syntagmatic to predominantly paradigmatic associative connections as a developmental phenomenon related to maturation and sophistication of cognitive processes. However, subsequent research (e.g., McNeill, 1966, 1970) suggested that the shift in association patterns with increasing age may be explained either by the acquisition of new features of words (which would result in individuals choosing an association that shared the maximum number of features with stimulus given word) or by change in the strategies used in searching and matching stimulus-responses features.

Stolz and Tiffany (1972) confirmed the first hypothesis, arguing that cognitive skills, as well as knowledge of words and the acquisition of more features and meanings develop dramatically with age. Therefore, isolating the effects of one of the factors and ignoring the effects of the other would result in an incomplete account of the shift in associative pattern. The researchers also argued that young children respond with overwhelmingly syntagmatic associations not because their cognitive processes are immature but because their familiarity with some words is relatively low or non-existent. Their experiments revealed that, while the associations to unfamiliar adjectives given by adults patterned very much like the ones given by young children to common adjectives, their associations to familiar adjectives were similar in patterns with the ones provided by older children. Therefore, the authors concluded that the primary cause of the response shift was greater familiarity with word features rather than cognitive development alone. This conclusion resonates well with the main claim of the present study.

As pointed out in the L2 literature (e.g., Nissen & Henriksen, 2006; Söderman, 1993; Wolter, 2001), even though word class influence has not been completely explored in L2 associative studies, no researcher has ever discarded the possibility of lexical class being an important factor in the way L2 users organize the connections among the words in their lexical store. Regrettably, few L2 associative studies have considered using test words from several lexical categories and the ones which did (e.g., see Fitzpatrick, 2006; Nissen & Henriksen, 2006; Piper & Leicester, 1980; Wolter, 2001; Zareva, 2007, 2010) seemed to have come to somewhat contradictory findings. For example, Nissen and Henriksen's (2006) findings echoed to a large extent Wolter's (2001) findings that the L2 lexicon is dominated overall by syntagmatic connections; while Zareva's (2007) findings seemed to agree with the results of Piper and Leicester's (1980) study in that the type of associative links crucially depends on the language proficiency of the participants and their level of familiarity with words. In other words, while beginning L2 learners of English tend to connect words mostly syntagmatically (Piper & Leicester, 1980), at more advanced levels of proficiency (for instance, intermediate and advanced levels of proficiency), L2 learners' lexicons tend to closely resemble NSs' preference for paradigmatic-over-syntagmatic connections (Piper & Leicester, 1980; Zareva, 2007, 2010). It should be pointed out here that the different findings may largely be due to methodological differences between the studies and the somewhat different classification criteria employed by different researchers. These issues will be briefly addressed later in the paper.

To summarize, for almost a century, L1 researchers pioneered the application of WA tests to studying the lexical organization of the mental lexicon of L1 speakers of different languages; hence, the theoretical background, the research lines, as well as the findings from L1 WA studies have served as a foundation for the development of L2 studies. Similarly, L2 associative studies adopted from L1 research not only the methodologies and methods of analysis of associative responses but also, until recently, tended to lean more towards confirming the findings from L1 studies as applied to the organization of the L2 lexicon, rather than challenging the relevance of some of the L1 assumptions to the L2 context. In an attempt to take a more consistent and constructive approach to studying the influence of two linguistic and non-

linguistic features on several aspects of the organization of the mental lexicon, the current study set out to examine the following research questions:

1. How do word characteristics, in particular lexical category and word frequency, influence the lexical connections in L1 and L2 speakers of English maintain for familiar words?
2. How do learner characteristics, namely proficiency and word familiarity, influence language users' lexical connections of familiar vocabulary?
3. Do these word-related and learner-related characteristics interact and, if "yes," how do they influence the L1 and L2 lexical organization?

Knowing more about the combined effect of the linguistic and learner-related variables will better the field's understanding of the way these variables affect L2 lexical connections and raise awareness of their importance in shaping well-organized and functional L2 lexicons.

## 2. Method

### 2.1. Participants

Altogether, 108 students—both NSs and L2 learners of English—participated in the study. The NSs ( $n = 36$ , males [ $n = 14$ ] and females [ $n = 22$ ]) were undergraduate students (mean age=21.7) of different majors enrolled in introductory courses in linguistics at two U.S. universities.

The L2 learners of English, both males ( $n = 31$ ) and females ( $n = 41$ ) at an average age of 24.5, were L1 speakers of seventeen different languages (i.e., Chinese, Japanese, Korean, Cantonese, Portuguese, Spanish, French, Russian, Bulgarian, Taiwanese, Thai, Vietnamese, Indonesian, Nepali, Albanian, Hungarian, and Kriol). At the time of the experiment, they were attending either ESL Programs ( $n = 30$ ) to prepare themselves for admission to different degree-granting academic programs or were actively pursuing undergraduate ( $n = 14$ ) and graduate degrees ( $n = 28$ ) at U.S. universities. All L2 participants had learned English in their respective native countries through formal instruction ( $M_{Advanced} = 9.9$  and  $M_{Intermediate} = 8.5$  years of instruction) and had lived in the U.S. or other English-speaking countries for an average of 1.8 years.

The L2 participants were placed in two proficiency groups—an advanced learner group ( $n = 36$ ) and an intermediate learner group ( $n = 36$ )—based on their *TOEFL* scores. The participants in the advanced group had an official *TOEFL* score mean of 584 on paper-based format (range 550 – 630) and 95 on an internet-based format (range 84 – 99) which, based on the concordance tables developed by the *TOEFL* program (see [http://www.ets.org/Media/Tests/TOEFL/pdf/TOEFL\\_iBT\\_Score\\_Comparison\\_Tables.pdf](http://www.ets.org/Media/Tests/TOEFL/pdf/TOEFL_iBT_Score_Comparison_Tables.pdf)) roughly corresponds to 563 – 597 points on a paper-based test. The participants placed in the intermediate learner group had a mean paper-based *TOEFL* score of 477 (range 427– 500) and a mean internet-based test score of 68 (range 64 – 71), corresponding to 507 – 527 paper-based test score.

### 2.2. Materials and procedure

The test instrument, adopted from Zareva (2010), contained 36 SWs, balanced for lexical class and frequency of occurrence: that is, 12 SWs were selected from each of the three lexical categories (nouns, verbs, adjectives), with four from each frequency band (low, mid, high) (see Appendix A). The frequency of each word was identified by its standard frequency index (SFI) from *The Educators Word Frequency Guide* (Zeno, Ivens, Millard, & Duvvuri, 1995), which is based on a corpus of 14 million words from over 60,000 texts that students in the United States are likely to encounter throughout their years of schooling.

The SFI is a logarithmic transformation of the frequency of a word per million tokens in a corpus of an infinite size. The words were listed in an alphabetical order in the test to avoid clusters of words from the same lexical class or frequency of occurrence. Since lexical class ambiguity is inherent in the English language, whenever a word could belong to more than one lexical category, the intended lexical class was listed next to the item (e.g., *hunger* [n.]). This was an important step in the test design given the fact that the classification of the associations is largely based on their relationship to the lexical class of the test word.

The participants completed the test in writing over two sessions in two consecutive days. To avoid priming effects, during the first session, the participants were given the list of words and were asked to write down three associations that first came to their mind when they came across each of the words. The next day, the participants were asked to verify their familiarity with the same list of words on a scale of four options, corresponding to four degrees of word familiarity. Choosing one of the first two options (i.e., [I] I *have not seen* this word before; [II] I *have seen* this word before but I *don't remember* what it means) did not require from them any further explanation, while a choice of any of the other two options (i.e., [III] I *think* this word means \_\_\_\_\_ or [IV] I *know* that this word means \_\_\_\_ ) required from them to verify their familiarity with the word by writing down a synonym or brief explanation. The instructions for the test also pointed out that the participants should respond to the words with respect to their intended lexical class listed next to the items in cases of lexical ambiguity, which was followed by an example.

The participants were given 15 minutes for the first task and 45 minutes to complete the familiarity verification task. In cases where familiarity with a word was not acceptably established, the associations were not included in the analysis. The procedure resulted in collecting a total of 5,578 associations in response to familiar words only ( $n_{NSs} = 2,348$ ,  $n_{Advanced} = 2,106$ , and  $n_{Intermediate} = 1,124$ ).

### 2.3. Familiarity coding and classification procedures of the lexical associations

The requirement that a familiarity response (a synonym or brief explanation) should adequately reflect the semantic and syntactic properties of the SWs was systematically observed in the decisions about the acceptability of the participants' synonyms or explanations. For instance, for a synonym to be considered acceptable, it had to be semantically and syntactically relevant to the SW (e.g., *array* (v.) [SW] – *arrange* [acceptable] but not *arrangement*). When an explanation was provided, the decision about its acceptability was based on the criteria used in lexicography for defining words by part of speech, as outlined by Landau (2001) (e.g., *entrust* [SW] – *give something of value to someone* [acceptable] but not *being trustworthy*). Given that all participants were well-educated adults, there was a reasonable expectation that providing an acceptable explanation of the SWs would prompt them to account for both the formal and meaning characteristics of the tested words.

The classification of the associative responses was based on the criteria described in detail in Zareva et al. (2005) and Zareva (2007) which, for the most part, are criteria proposed by L1 associative researchers and adopted by some L2 researchers (e.g., Piper & Leicester, 1980; Söderman, 1993; Wolter, 2001; Zareva, 2010). In sum, in the absence of phonological associations (also called *clang associations*), the responses were classified into two types—*paradigmatic* if they shared the same lexical class with the SW or *syntagmatic* if they did not. As simple as it might seem, there is no certain way to eliminate the lexical class ambiguity of some associative responses in the English language. Thus, to maintain consistency in the response classification and limit the inconsistencies linked to the syntactic ambiguity of some WAs as much as possible, some additional criteria, borrowed from other similar studies, were applied to the classification.

- 1) In cases in which an association could be classified as either paradigmatic or syntagmatic (e.g., *back* [v.] – *help*), it was coded as (potentially) paradigmatic since the subject population consisted of adults only and the associative data were limited to associations given to familiar vocabulary (Zareva, 2007).
- 2) When a response shared the same lexical class with the SW but clearly formed a sequential syntactic string with it, it was classified as syntagmatic, (e.g., *savor* [v.] – *taste*) (Söderman, 1993).
- 3) Multiword responses (e.g., *beaten* – *cause pain*) were classified according to the lexical class relationship between the head word of the phrase and the SW (Piper & Leicester, 1980; Söderman, 1993; Wolter, 2001).
- 4) When the SW was repeated in the response (e.g., *sweep* (v.) – *sweep dust*), the response was coded as syntagmatic (Piper & Leicester, 1980).
- 5) Derivations (e.g., *cleaning*, *cleaned*, *breathless*, *immoral*, *resignation*, *disagreement*, *scrutinize*, *unfamiliar*, etc.) as well as the irregularly inflected forms (e.g., *better*, *bitten*, etc.) were treated as separate words (Zareva, 2005).
- 6) Spelling variants (e.g., *behaviour* and *behavior*), abbreviated words (e.g., *exam* and *examination*) as well as misspelled but recognizable words (e.g., *sleep* and *sleep*) were included in the associative data.

The consistent application of these detailed classification criteria limited to a large extent any subjective judgments in the coding procedure while, at the same time, allowed for a comparison of the results of the present study with findings from other studies.

### 3. Results

A 3 x 3 x 3 research design was used in the study. The independent variables were language proficiency (NS, L2 advanced learners, and intermediate learners), lexical category (nouns, verbs, adjectives), and word frequency (low, mid, high). The dependent variables were (1) proportion of students who successfully verified their familiarity with the SWs, (2) quality of participants' associative connections, measured by the proportion of their paradigmatic and (3) syntagmatic associations (in the absence of phonological associations), and (4) size of participants' associative domain, measured by the number of associations they could generate to familiar vocabulary.

Table 1 presents the results of the analysis. The multivariate ANOVA indicated several significant two-way interactions—i.e., a significant interaction between proficiency level and lexical category for participants proportion of paradigmatic associations,  $F(4, 81) = 2.592, p < .05, \omega^2 = .04$ , which revealed that the proportion of paradigmatic associations depended neither on language proficiency nor lexical class alone, but on their combined effect. Similarly, the variable was affected by the combined effect of lexical class and word frequency, independent of participants' proficiency level, shown by a significant interaction between these two independent variables,  $F(4, 81) = 3.807, p < .05, \omega^2 = .07$ . The interaction between lexical class and word frequency had a further effect on participants' proportion of syntagmatic associations,  $F(4, 81) = 4.148, p < .05, \omega^2 = .10$ , as well as on the percentage of participants who could acceptably verify their knowledge of the words,  $F(4, 81) = 2.691, p < .05, \omega^2 = .05$ . The rest of the two-way interactions as well as the three-way interaction were non-significant.



Table 1

Analysis of Variance of Proficiency Level, SW Lexical Class, and Word Frequency Effects on Participants' Familiar Vocabulary

Source	df	F-ratios			% of Ss who successfully verified familiarity with the SWs
		size of WA domain	paradigmatic WAs	syntagmatic WAs	
Proficiency level (PL)	2	26.630**	9.277**	2.708	26.607**
Lexical Class (LC)	2	4.794*	81.913**	53.142**	4.871*
Word frequency (WF)	2	49.931**	3.165*	2.601	46.960**
PL x LC	4	.414	2.592*	1.792	1.494
PL x WF	4	.453	.690	.147	.455
LC x WF	4	.090	3.807*	4.148*	2.691*
PL x LC x WF	8	.848	.813	.526	2.042
Error	81				

p\* < .05

p\*\* < .001

Since the interaction between proficiency level and lexical category on the participants' paradigmatic performance was significant, the main effects of lexical category and proficiency level were ignored and, instead, the simple main effects were examined— i.e., the differences in the proportion of paradigmatic responses elicited by stimuli from the class of nouns, verbs, and adjectives for each group of participants. To control for Type I error across the three simple effects, alpha was set for each at .017. There were no significant differences in the proportion of paradigmatic associations among the three groups when the participants responded to nouns and verbs ( $p > .017$ ). However, the participants' performance significantly varied when they generated associations to adjectives,  $F(2, 33) = 4.194, p < .017$ . The pairwise comparisons, with alpha set at .006 to control for Type I error, revealed that when responding to adjectives, the NSs produced a much greater proportion of paradigmatic associations ( $M = 53, SD = 22$ ) than the L2 advanced ( $M = 36, SD = 25$ ) and intermediate learners ( $M = 19, SD = 14$ ); however, only the difference between the NS and intermediate group was significant (95% CI = 12.628, 55.372,  $p < .001$ ). One methodological implication of this finding is that choosing to use only adjectives as SWs would result in findings about the structure of the L2 mental lexicon that would be different from findings based on associative data collected for noun or verb stimuli. Similarly, establishing the proficiency level of L2 participants is as important a factor as the choice of the lexical class of words since differences in the proportion of paradigmatic associations crucially depend on the interaction between both.

Although the interactions between lexical class and word frequency for the proportion of paradigmatic and syntagmatic associations as well as students who could successfully verify their familiarity with the words were significant, their simple main effects turned out to be non-significant. This means that, at least, one of the comparisons was not zero; however, no specific conclusion could be drawn about which simple effect(s) was/were not zero (for more details, see Keppel, 1991).

The size of the participants' associative domains was strongly influenced individually by each of the independent variables, shown by their significant main effects, which highlighted differences among the participants related not only to their proficiency levels,  $F(2, 81) = 26.630, p < .001, \omega^2 = .32$ , but also differences linked to the lexical class of words,  $F(2, 81) = 4.794, p < .05, \omega^2 = .07$ , as well as their frequency,  $F(2, 81) = 49.931, p < .001, \omega^2 = .48$ . Follow-up analyses of the three main effects were conducted to identify the source of the differences. The follow-up tests consisted of all pairwise comparisons between the three proficiency levels (NS, advanced, and intermediate), lexical categories (nouns, verbs, and adjectives) and frequencies (high, mid, low). The Bonferroni procedure was used to control for Type I error across the pairwise comparisons. The comparisons between the proficiency levels indicated that the NSs' and advanced L2 users' sizes of associative domain did not significantly differ, while the intermediate students' results significantly differed from those of the NSs (95% CI = -46.064, -21.937,  $p < .001$ ) and the advanced L2 users (95% CI = -39.341, -15.214,  $p < .001$ ). On average, the NSs and the advanced L2 users' number of associations were about twice as many as the intermediate L2 learners'. Lexical class alone also had specific effects on participants' ability to produce associations. That is, regardless of their proficiency level and frequency of occurrence of the words, the participants could generate a significantly greater number of responses to nouns ( $M = 56, SD = 32, 95\%CI = .853, 24.980, p < .05$ ) and adjectives ( $M = 56, SD = 34, 95\% CI = 1.464, 25.591, p < .05$ ) compared to verbs ( $M = 43, SD = 42$ ). Finally, the size of the participants' associative domain was additionally influenced by word frequency. The high-frequency words ( $M = 79, SD = 21$ ) were responded to better than the mid- ( $M = 46, SD = 30, 95\% CI = 20.131, 44.258, p < .001$ ) and the low-frequency ones ( $M = 30, SD = 26, 95\% CI = 36.381, 60.508, p < .001$ ); and the mid-frequency SWs were significantly different from the high and the low (95% CI = 4.187, 28.314,  $p < .05$ ). In sum, the high-frequency words could prompt the participants to generate a greater number of associations than the mid-frequency words, and the mid-frequency were better responded than the low frequency ones.

The main effect of proficiency level on the proportion of participants who could acceptably verify their familiarity with the words was also significant,  $F(2, 81) = 26.607, p < .001, \omega^2 = .32$ . The follow-up analysis revealed that while the NSs ( $M = 70, SD = 31$ ) and the advanced L2 learners ( $M = 63, SD = 33$ ) did not significantly differ from each other, the L2 intermediate learners ( $M = 37, SD = 31$ ) differed from both groups alike (95% CI = -42.901, -22.155,  $p < .001$  and 95% CI = -35.984, -15.238,  $p < .001$ ).

#### 4. Discussion

The present study focused on examining the influence of two word-related factors (lexical class and word frequency) and two learner-related characteristics (proficiency and word familiarity) on the lexical organization of L1 and L2 users of English (at intermediate and advanced levels of proficiency). Regrettably, rarely has the interplay of these effects been studied systematically in L2 associative studies, though many researchers have acknowledged the possibility that L2 users with differing proficiencies may not respond the same way to high- versus low-frequency words, nor would they maintain the same pattern of associative links to all word classes.

Assuming that the size of any associative domain may provide some indication of how well words have been integrated and linked in relatively short networks of connections, the analysis showed that the size of the participants' associative domains was influenced by characteristics of the participants as well as features of the words themselves. In other words, the observable differences between the average number of associations the participants generated to familiar vocabulary were related not only to their proficiency level, but also to specific word frequencies and lexical class characteristics. Overall, the results confirmed that as proficiency increased to an advanced level, the size of the L2 associative domain (i.e., the links of one word to several other words) started to resemble that of NSs. However, the average size of the

intermediate learners' associative field was far below the advanced learners' and the NSs' alike. In fact, the intermediate participants could hardly link a word they knew to one other word in their lexical store, which is a disturbing finding, especially in light of the fact that only half of the intermediate students reported that they, actually, devote time to vocabulary learning on weekly basis (on average, 2.3 hours a week), while the other half did not report any time spent on vocabulary learning. Thus, at minimum, L2 intermediate learners should be made aware of the value of building associative networks among the words in their mental store because greater connectivity of the lexicon will most likely result in better storage of new words, faster retrieval of known vocabulary and, in turn, more functional L2 lexicons.

Interestingly, the lexical class of the words also showed specific effects on the participants' ability to maintain connectivity of the vocabulary they know. Regardless of their proficiency level and the word frequency, the participants could generate a significantly greater number of associations to nouns and adjectives than to verbs. From a learning point of view, this seems to imply that nouns and adjectives integrate more readily into lexical networks than verbs, since retrieval of associative connections is significantly better for those lexical classes than for verbs. From a teaching point of view, the result comes to suggest that verbs most probably require more time, attention, and work than nouns and adjectives do so that they become as well integrated in students' lexicons as the rest of the content words. In any event, the more important implication of this finding is that it adds support to the existing evidence of the influence of lexical class on people's lexical connectivity and also raises awareness of the possibility that certain words (i.e., nouns and adjectives) connect with other words in richer networks than others (i.e., verbs) and may, respectively, require a different amount of teaching and learning effort to fully integrate them into a developing lexicon.

Finally, the size of the participants' associative connections was additionally influenced by the frequency of occurrence of the words. Quite expectedly, the high-frequency words triggered the greatest number of associations, followed by the mid- and low-frequency ones. However, one cannot ignore the fact that while the NSs and the L2 advanced participants could associate the high-frequency words with two or three other words and the low frequency ones with, at least, one other word, the L2 intermediate learners could generate about one association to the high-frequency familiar vocabulary and an association to the low-frequency words only 30% of the time. This suggests that the intermediate learners should be advised to work not only on expanding their vocabularies in general, but also on expanding the networks of connections they build among the words they know along all frequency bands, because even the high-frequency words they knew were not that well interconnected with other words, let alone the mid- and the low-frequency vocabulary. Along similar lines, Meara (1996) pointed out that when L2 learners develop sufficiently large vocabularies (around 6,000 words and over), the organization of that knowledge, rather than vocabulary size, should begin to assume primary importance. This idea was also confirmed by Zareva et al. (2005) and Zareva (2007) who found that smaller vocabularies (about 6000 words for L2 intermediate learners) are characterized by fewer links among words, which gives the general impression of intermediate learners' lexicons being somewhat loosely connected or, at least, lacking the systematic connectivity found for the advanced learners. Thus, working on the overall connectivity of the lexicon with an emphasis on verbs would benefit both advanced and intermediate learners; however, intermediate learners should be additionally encouraged to work systematically on the interconnectedness of their lexicons across all frequency bands.

Some of the most interesting findings from the analysis are regarding the type of associative connections the participants maintained across various lexical classes and word frequencies. Interestingly, the results revealed that neither proficiency level nor lexical class or word frequency alone could explain certain differences between the participants' paradigmatic and syntagmatic preferences. The syntagmatic relations turned out to be the most difficult to disentangle since the interaction between lexical class and word frequency (rather than proficiency level) seemed to be the distinguishing factor. Unfortunately,

further analysis into the interaction did not allow for finding out at what frequency level(s) different lexical class(es) triggered different proportion(s) of syntagmatic associations. At this point, one can only speculate that the effects of lexical class are stronger than the effects of word frequency, since the main effect of lexical class was significant, while the frequency main effect was not (see Table 1). However, an interaction is an incredibly important finding in any research since it accounts for the residual effects (i.e., the effects remaining after the main effects of the independent variables have been removed) (Rosenthal & Rosnow, 1984); hence, further research should try to unveil the interplay between these two factors and their influence on the syntagmatic responses of all groups.

As to the paradigmatic type of associations, the students' proficiency levels strongly interacted with the words' lexical category and had a significant effect on their same class associations. Further, the analysis showed that the groups differed in their production of same-class associations only when they responded to adjectives, but not to nouns or verbs, with the difference between the NSs and the intermediate learners being noticeable. In other words, the results suggest that NSs of English tend to connect their adjectives to other adjectives in their mental lexicon, while L2 users (64% of the advanced group and 81% of the intermediate group) link the adjectives to other lexical classes regardless of their frequency of occurrence. Otherwise, for all participants, verbs were predominantly syntagmatic (i.e., linked to words of other lexical classes) and elicited on average 59% syntagmatic associations, while nouns were the exact opposite and evoked on average 85% associations to other nouns. In addition, this distribution of responses to the various lexical classes and the fact that the L2 participants tended to generate mostly syntagmatic responses to adjectives may explain, for instance, why they have been found to maintain a predominantly syntagmatic pattern of associations with lexically balanced test samples (e.g., Piper & Leicester, 1980; Wolter, 2001). However, it is surprising that very often the syntagmatic dominance has been attributed to lack of stability of the L2 mental lexicon or explained away by arguing underdeveloped L2 lexicons. Only recently have some researchers started to argue that syntagmatic connections may play an important role in L2 learners' lexical organization as the paradigmatic ones do (e.g., Wolter, 2001) and that collocational knowledge, as based primarily on syntagmatic connections, is an essential aspect of ones' language knowledge (Fitzpatrick, 2006).

In the main, the findings from this study support findings from L1 research (e.g., Deese, 1962; Fillenbaum & Jones, 1965; Miller & Fellbaum, 1991) in that the NSs of English in this study maintain an overwhelming paradigmatic dominance for nouns (84%), paradigmatic preference for adjectives (53%) and syntagmatic preference for verbs (51%) for familiar vocabulary. Second language users, especially after having accumulated a vocabulary size of over 6,000 words, simply prefer a slightly different pattern of associative links among words than NSs do as they develop associations between adjectives and other lexical classes. This, however, by no means suggests that their adjectival links are underdeveloped or unstable or that the structure of the L2 English-based lexicon is fundamentally different from the L1 lexicon. This, in fact, allows to hypothesize that the structure of the mental lexicon of NSs and L2 users of English differs in the way they organize their connections for adjectives but not for nouns and verbs.

There are several possible explanations for this peculiar associative behavior that, in my view, deserve to be further examined in future studies. First, it seems reasonable to suggest that the dissimilarity in the way NSs and L2 users attend to adjectives can be attributed to the L2 users being influenced by the response mode of their mother tongue. Piper and Leicester (1980), who studied Japanese L2 learners of English, for example, hinted at this possibility but then hastily dismissed it. However, it would be interesting to further investigate this hypothesis since research concerned with the relationships between the L1 and L2 lexicons has consistently found that a presentation of a stimulus in one of a bilingual's languages primes a response in the other language as well (e.g., Kirsner, Smith, Lockhart, & Jain, 1984; Schwanenflugel & Rey, 1986; Van Hell & De Groot, 1998). Likewise, when a person has good command of two languages, lexical items are activated in both languages with those in the language that

is not required being suppressed (Green, 1998). Additionally, researchers have become increasingly aware that certain task-specific variables are likely to trigger specific L2 language processing strategies and that the nature of the task may also hold important answers to processing issues (e.g., Green, 1998; Moss *et al.*, 1991; Schwanenflugel & Gavisk, 2002). Considering these arguments, it would be reasonable to suggest that the lexical class of words plays a much greater role in the L2 mental organization of lexical knowledge than previously acknowledged and should be taken into account in both L2 teaching and learning.

As to the L2 students' preference to connect adjectives to other words (primarily nouns), this may well be motivated by the L2 itself. For example, Clark (1970) argued that paradigmatic and syntagmatic responses are essentially motivated by the same principle—the principle of simplicity of production, which states “Perform the least change on the lowest feature, with the restriction that the result must correspond to an English word” (p. 280). Thus, it is highly possible that, for L2 learners, the least change operation for adjectives more often entails a completion of syntactic strings in which they realize the selectional features of the adjectives rather than apply paradigmatic rules, such as the minimal contrast rule (e.g., *long* – *short*), the marking rule (e.g., *beaten* – *beat*), the feature deletion and addition rule (e.g., *awful* – *bad*), and the category preservation rule (e.g., *advantageous* – *beneficial*). For example, the most common response the L2 participants gave to the test word *amoral* was *behavior*, which accounted for 11% of the total number of responses elicited by the stimulus, whereas the most commonly produced association by the L1 participants was *moral*, which accounted for 14% of their total number of responses to this word. These examples demonstrate that the NSs applied the minimal contrast rule (in Clark's terms) more often in this case to build a link between the SW and another adjective that formed a minimal contrast pair with it, while the L2 participants seemed to favor the idiom completion rule and linked the SW to another word with which it forms a lexical string. Why the NSs and L2 users have a different associative preference for the class of adjectives, but not for the classes of nouns and verbs, is a valid question that this study cannot answer. However, this natural preference to link words in specific ways suggests that L1 and L2 users may be using different strategies of maintaining connectivity of their lexicons and those strategies should be explored and promoted in both teaching and learning new vocabulary.

## 5. Conclusion

One of the important questions that needs to be addressed when L2 users are compared to NSs is whether generalizations concerning differences between the two broadly-defined groups pertain to fundamental differences in the way the bilingual mind builds lexical connections or whether the influence of certain word and/or learner characteristics result in patterns of lexical links that are more specific to L2 users than NSs. To this end, the present study examined the interplay between two word-related features (word frequency and lexical class) and two learner-related characteristic (proficiency level and word familiarity) with regard to their effects on the way intermediate and advanced learners of English structured their mental lexicons compared to NSs. The organization of the lexicon was studied by analyzing the associative connections the participants built among the words they were familiar with so that we could get better understanding of their natural preference of organizing the lexical networks in their mental lexicons.

Overall, both word-related and learner-related variables proved to have some influence on the participants' lexical connections and very often they interacted with each other in such a subtle way that it made it difficult to disentangle the effects of one from the other. In sum, the results of the analysis lead to several conclusions: first, differences in the way NSs and L2 users of English organize their lexical

connections are most salient at an intermediate level while, at an advanced level, most of those difference diminish or largely disappear. Second, word frequency alone primarily influences individuals' ability to connect words to several other words in their mental lexicon quantitatively. However, lexical class plays a far more important role than frequency in the type of associative links language users build to keep their lexicons organized. The analysis reveals that verbs were predominantly connected to other words (mostly nouns), nouns were predominantly linked to other nouns, while the links for the class of adjectives was group specific. More specifically, the L2 participants at both proficiencies preferably associated adjectives with words from other lexical categories, while the NSs preferably maintained same class associative connections. This finding not only challenges the much-favored explanation of a developmental stage through which L2 learners' vocabularies are going anytime a syntagmatic dominance is detected, but also points to the lexical class that triggers L2 user-specific associative connections—i.e., the class of adjectives. It also implies that teaching vocabulary as well as training L2 learners how to maintain vocabulary connectivity of their lexicons should be guided by the lexical class of words more than anything else. In other words, teaching verbs and adjectives in connection to other lexical words will be more in sync with L2 learners' natural tendency for associating verbs and adjectives with other words. While nouns should be taught in connection to other nouns since L2 learners seem to naturally prefer this kind of paradigmatic connections for the lexical class of nouns.

On a final note, the assumption that the highest level of lexical knowledge is represented by a paradigmatic response pattern for both NSs and L2 users of English was largely challenged by the results of this study. Consequently, the notion of a paradigmatic shift as an indication of better lexical knowledge or organization of the L2 mental lexicon should be reconsidered in light of findings suggesting that different lexical classes and frequency bands promote different types of connections in the mental lexicon of adult NSs and L2 users alike. The present analysis reveals that differences between L1 and L2 associative links are strongly influenced by word-based features and learner-related characteristics. Thus, in my view, knowing more about the interaction between these two sets of characteristics and their influence on the organization of lexical knowledge would allow the field to explore productively in teaching the natural tendencies of lexical connectivity L2 learners establish for familiar vocabulary, raise students' awareness of those tendencies, and promote them as an effective strategy for building a well-connected and well-organized mental lexicon.

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## Appendix A

### Stimulus Words and Their Frequency of Occurrence

<i>Frequency</i>	<i>Nouns</i>	<i>SFI</i>	<i>Verbs</i>	<i>SFI</i>	<i>Adjectives</i>	<i>SFI</i>
low	rigidity	20.8	gambol	22.1	putative	22.1
	masochism	22.1	entrust	32.9	amoral	25.5
	edifice	35.5	savor	35.0	point-blank (adj.)	26.9
	cassava	38.4	unnerve	36.5	lackadaisical	34.0
mid	coinage	39.6	forgo	36.6	middling (adj.)	35.5
	drawback (n.)	41.9	concede	39.4	naïve advantageous	41.7
	pillar	43.1	fathom (v.)	40.4	defensive	43.4
	bracelet	43.8	array (v.)	46.4		46.3
high	experimentation	46.6	weaken	46.6	toxic	46.4
	studio	49.7	sweep (v.) refuse (v.)	50.7	beaten	50.6
	hunger (n.)	53.4		57.1	official (adj.)	55.5
	blanket	54.3	back (v.)	70.3	second (nmrl.)	65.3