Word Associations in English as L1 and L2

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WORD ASSOCIATIONS IN ENGLISH AS L1 AND L2

Master's Thesis

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ASOCIJACIJE RIJEČI NA ENGLESKOM JEZIKU KAO J1 I J2

Diplomski rad

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Abstract

The organization of the human mental lexicon has been explored for many years through various psychological experiments. This paper focuses on exploring and comparing the first- and the second-language mental lexicon with the help of a word association test. Native and non-native (Croatian) speakers of English provided their associations to twenty words written in English, which were then analysed according to a modified version of a categorization system proposed by Tess Fitzpatrick. This categorization system allowed for a thorough comparison of response type tendencies in L1 and L2. Furthermore, a separate analysis of the responses produced by lower- and higher-English-proficiency non-native speakers was used to explore the effect of language proficiency on the results. Lastly, the effects of concreteness and imageability of cue words on associations were investigated by comparing the responses elicited by words of different levels of concreteness and words of different levels of imageability. The paper attempts to provide an insight into the organization of an L1 and an L2 mental lexicon and how their similarities and differences are affected by L2 proficiency. Additionally, it includes indications of the influence of concreteness and imageability levels of cue words on the association links activated both in L1 and L2.

Key words: *mental lexicon, word association test, language proficiency, concreteness, imageability*

Sažetak

Organizacija ljudskog mentalnog leksikona istražuje se već niz godina putem raznih psiholoških eksperimenata. Ovaj rad usmjeren je na istraživanje i usporedbu mentalnog leksikona prvog i drugog usvojenog jezika uz pomoć testa asocijacija riječi. Izvorni i neizvorni (hrvatski) govornici engleskog jezika pružili su svoje asocijacije na dvadeset riječi napisanih na engleskom jeziku, koje su zatim analizirane na temelju preinačene verzije sustava kategorizacije koji je predložila Tess Fitzpatrick. Taj je sustav kategorizacije omogućio detaljnu usporedbu sklonosti ka određenom tipu odgovora na J1 i J2. Nadalje, zasebna analiza odgovora koje su pružili neizvorni govornici niže te oni više razine znanja engleskog jezika provedena je kako bi se istražio utjecaj razine znanja jezika na rezultate. Konačno, utjecaj konkretnosti i predočivosti podražajnih riječi na asocijacije ispitan je usporedbom odgovora aktiviranih riječima različite razine konkretnosti i riječima različite razine predočivosti. Ovaj rad nastoji pružiti uvid u organizaciju mentalnog leksikona prvog i drugog usvojenog jezika te prikazati kako na njihove sličnosti i razlike utječe razina znanja J2. Osim toga, uključuje naznake utjecaja razine konkretnosti i predočivosti podražajnih riječi na aktivaciju asocijativnih veza na J1 i J2.

Ključne riječi: *mentalni leksikon, test asocijacija riječi, razina znanja jezika, konkretnost, predočivost*

Contents

1 Introduction

Most of us are not aware that around 42,000 lemmas and 4,200 non-transparent multiword expressions are stored in our minds, and we do not give much thought to how all these items are organized (Brysbaert et al., 2016: 1). The organization of words in the human lexicon has been explored for over a century through various psychological experiments involving word association tests, "tip of the tongue" phenomenon, lexical decision tasks, priming, etc. (Aitchison, 1987: 23-25). An average native speaker of a language can usually retrieve words from the mind in a split second, demonstrating that these large numbers of words are not randomly stacked, but carefully organized. Scholars (cf. Fodor 1983, Aitchison 1987, McCarthy 1990, etc.) generally agree that words are stored in the lexicon in clusters and form a web-like sort of structure with different types of connections. However, the types of connections (or links) in L1 and how they are selected in the mental lexicon are still being explored and compared with those activated in L2. This thesis attempts to explore these issues by analysing and comparing the mental lexicon of native and non-native speakers of English using a word association test. It seeks to find similarities and differences between the L1 and L2 mental lexicon, and explore how (and if) they are affected by language proficiency of non-native speakers. Additionally, it investigates the effect of concreteness and imageability of cue words on associations both in L1 and L2.

2 Theoretical framework

2.1 The mental lexicon

Aitchison (1987) referred to the mental lexicon as a "human word store". Various definitions have been provided by scholars throughout the years and it has proven to be a difficult task. Richards and Schmidt (2002: 327) defined the mental lexicon as "a person's mental store of words, their meanings and associations", while Jackendoff (2002: 39) described it as a finite list of structural elements ("lexical items") that are available to be combined by a language user according to the combinatorial principles ("grammar") of the language. Numerous metaphors have also been used to attempt to describe it, including a dictionary, a thesaurus, an encyclopaedia, a library and a computer (McCarthy, 1990: 34). However, unlike e.g. a printed dictionary, the mental lexicon is constantly changing and receiving new input that needs to be integrated into the existing word store. This involves not only new words, but also new information about the existing words in our lexicon. The connections between this input or

"webs" of meaning and associations, as McCarthy describes them, are constantly shifting and readjusting (ibid.: 42). This is true of both our first language and any other language we might learn.

2.2 The second-language mental lexicon

Early studies (e.g. Meara, 1984) showed significant structural differences of the second-language mental lexicon in comparison with the first-language lexicon. More specifically, they indicated that "(a) the connections between words in the second language learner's mental lexicon are less stable than the connections of native speakers, (b) phonology appears to play a much more prominent organizing role in the L2 mental lexicon than it does for native speakers, and (c) the semantic links between words tend to differ in a systematic way from those of native speakers" (Wolter, 2001: 42). A number of important studies (cf. Carter and McCarthy 1988, Söderman 1992, Wolter 2001, Fitzpatrick 2006, etc.) have also revealed differences in word association behaviour in L1 and L2, but have struggled to find consistent behaviour patterns. Based on their research, Carter and McCarthy (1988: 86) concluded that there was not enough evidence of resemblance between the L1 and L2 mental lexicon, as there are both similarities and differences in the lexical behaviour. On the other hand, more recent studies that attempted to explore the L2 lexicon suggest that the structure of the two lexicons may have more similarities than previously believed, and that they increase with the level of proficiency in the second language (Wolter, 2001: 66).

Informed by, among others, the above-mentioned studies, this paper focuses on the organization of the first- and the second-language mental lexicon by exploring and comparing the association links activated among native and non-native speakers of English in a word association test.

2.3 Word association test

The first recorded experiment on the organization of words in the mind dates back to the 19th century when the pioneering British polymath Francis Galton wrote down 75 words on slips of paper and put them aside until he had forgotten the selected words. A few days later, he glanced at each word at a time and quickly wrote down the first two ideas that came to his mind, while timing his reaction. This experiment, known as the word association test (WAT), served as a basis for numerous psychological studies that followed, and its modified versions are still used today (Aitchison, 1987: 25).

For over a century, WATs have been viewed as a key to our subconscious and used to explore the content and organization of words and concepts in the mind. In early studies, they were used to explore general behaviour patterns and thus diagnose psychological abnormality. More recently, WATs have been used to investigate the development and organization of the mental lexicon (Fitzpatrick et al., 2015: 23).

According to Sinopalnikova (2003: 200), the simplest experimental technique to reveal the association mechanism is a free association test (FAT). It usually consists of a list of words (stimulus/cue words) that is presented to subjects (in writing or orally), which are then asked to respond with the first word that comes to their mind (responses). Compared to other forms of association experiments, such as controlled association tests, priming, etc., free-word association tests provide the broadest information about the structure of content in our minds.

2.4 Types of association links

For many years, scholars (cf. McCarthy 1990, Söderman 1992, etc.) have been categorizing association links as syntagmatic, paradigmatic or clang. However, after pointing out certain issues with the conventional categorization system, Tess Fitzpatrick (cf. 2006, 2007, etc.) proposed an updated set of categories with clearly defined subcategories. The conventional and the Fitzpatrick's categorization system are outlined below.

2.4.1 Conventional categorization

The most popular categorization scheme is the syntagmatic-paradigmatic system which dates back to Saussure (1916) (Thwaites, 2018: 21). The definitions of the categories and response types that they include have varied over the years. The following outline of the conventional response categorization has been informed by the works published by Söderman (1992), Wolter (2001) and Meara (2009).

a) <u>Semantic associations:</u>

1 *Paradigmatic associations* (vertical relationship)

Paradigmatic associations have most frequently been defined as those in which the cue word and the response belong to the same word class. In these cases, the two words usually share a large part of their meaning, and both the cue word and the response can usually occur in the majority of contexts where the other appears and presumably perform the same grammatical

function in a given sentence (*boy → girl, father → son*) (Meara, 2009: 6, Wolter, 2001: 43). They generally include cases of synonymy, coordination, subordination, superordination, etc. However, the precise subcategories have not been defined.

2 *Syntagmatic associations* (left-to-right relationship)

A syntagmatic response is associated with the stimulus through a sequential or collocational relationship and, therefore, usually (but not necessarily) belongs to a word class different from the cue word. Syntagmatic associations typically complete a phrase, i.e. a syntagm (*brush → teeth*) (Söderman, 1992: 157, Meara, 2009: 6).

b) Formal associations:

1 Clang associations

Clang associates are responses which are heavily influenced by the form of the stimulus word rather than its meaning (*cat → hat*). Common types of clang associations include rhyming responses, assonance, responses with the same initial sounds as the stimulus or a similar prominent consonant cluster (Meara, 2009: 6, 22).

2.4.1.1 Previous research and conclusions

Using the syntagmatic-paradigmatic scheme, early studies (cf. Brown and Berko 1960, Ervin 1961, etc.) explored the development of the first-language mental lexicon (Thwaites, 2018: 113). They have shown that children under the age of 7 have a tendency towards producing syntagmatic associations as a first preference to any word of their first language. They also tend to frequently produce clang associates. On the other hand, normal adults generally produce more paradigmatic responses than syntagmatic ones, as well as fewer clang associates (Meara, 2009: 6). This shift from one response category to another is referred to as the syntagmatic-paradigmatic shift, and it usually begins around the age of 7 (Söderman, 1992: 157). It is believed that this phenomenon is related to some type of lexical or cognitive development (Wolter, 2001: 43)

A similar pattern has also been detected in language learners. More specifically, low-level learners have been found to produce a larger number of syntagmatic responses as well as clang associates in comparison with higher-level learners (Söderman, 1992: 158).

2.4.2 Fitzpatrick's categorization

Although it has been used for many years in numerous studies, the categorization of WAT responses as paradigmatic, syntagmatic or clang bears certain issues in practice. Firstly, Fitzpatrick (2006: 11) has argued that it is difficult to define the exact type of responses that would belong to these categories, which causes them to be open to different interpretations. Additionally, there are always responses that may be placed in more than one category. Secondly, she has pointed out that the three categories do not account for all the possible types of responses. This issue had been previously addressed and had led to the inclusion of the "other" category in certain studies (cf. Söderman 1992, Wolter 2001, etc.). Lastly, according to Fitzpatrick (2006: 12), the most important constraint in using the conventional categorization of responses is that the categories are rather broad. She has argued that it is necessary to further divide them into precise subcategories in order to get a more detailed picture of the differences in types of associations produced by various groups of respondents.

For the reasons set out above, Fitzpatrick (2006: 18) proposed a different set of categories and subcategories based on the advantages and disadvantages of previous categorization systems, as well as types of responses gathered in past studies. The three main categories of associations proposed were: meaning-based associations (roughly corresponds to the paradigmatic category), position-based associations (roughly corresponds to the syntagmatic category) and form-based associations (roughly corresponds to the clang category, but it includes both orthographic and phonological associations). In addition, a category of "erratic associations" was included for responses based on false cognates and indecipherably linked association pairs. In the 2006 study, the meaning-based category was further divided into 6 subcategories (defining synonym, specific synonym, hierarchical/lexical set, quality, context, conceptual), the position-based category into 5 subcategories (consecutive xy, consecutive yx, phrasal xy, phrasal yx, different word-class collocation), the form-based category into 4 subcategories (derivational, inflectional, similar in form only, similar form association) and the erratic category was divided into 2 subcategories (false cognate and no link).

Fitzpatrick continued to modify and refine this categorization system in each following published study (cf. Fitzpatrick 2007, Fitzpatrick & Izura 2011, Fitzpatrick et al. 2015, etc.). The modifications were based on the issues encountered in previous studies, such as problematic, obsolete or missing categories/subcategories.

2.5 The effect of semantic variables on word association

Not many studies that used word association tests to explore the mental lexicon have included the influence of semantic variables on the results. However, those that investigated the effect of concreteness and/or imageability of cue words (cf. DeGroot 1989, Bøyum 2016) have shown that the two variables are likely to have significant influence on word associations (Thwaites, 2018: 77).

Although concreteness and imageability are often interchanged, contemporary semantics clearly differentiates between the two variables. Concreteness refers to the extent to which the concept denoted by the word can be perceived through the senses (Fitzpatrick & Thwaites, 2020: 34), while imageability defines how easy it is to produce a sensory mental image of the concept denoted by a certain word (Bird, 2001: 1). The results of certain psycholinguistic studies have shown that a word can simultaneously be highly abstract and relatively highly imageable, especially if it is used to express, for example, emotional states (Tušek & Peti-Stantić, 2018: 317).

De Groot (1989: 837) was able to find evidence that more imageable words motivate more homogenous and faster responses, as well as fewer "blank" responses. The effect of the two variables on response type preference has only been explored in one study – Bøyum (2016) investigated the effect of imageability on response type preference, using a categorization model proposed by Fitzpatrick. The results of Bøyum's study showed no significant effect of imageability on the responses, with the exception of the "dual-link" category (Bøyum, 2016: 95). However, she did find a correlation between imageability ratings and the number of "blank" responses, i.e. the results of her study supported the notion that fewer "blank" responses are produced with highly imageable cue words (Bøyum, 2016: 83).

This paper will attempt to explore the influence of the two semantic variables on the types of association links that are activated among native and non-native speakers of English, and compare the effects produced in each group.

3 The study

3.1 Aims

There are 3 aims to this study. The first one is to compare the association behaviour of native and non-native speakers of English, and thus observe the similarities and differences between the L1 and L2 mental lexicon. The second aim is to compare the association behaviour of lower-

and higher-English-proficiency non-native speakers in order to investigate the correlation of language proficiency level with the similarities and differences between the L1 and L2 mental lexicon. The third goal is to observe the effect of semantic variables (imageability and concreteness) on association behaviour in L1 and L2.

3.2 Participants

The participants were divided into two groups. The first group consisted of thirteen native speakers of English (see Table 1).

Table 1: Native speakers (13)

Gender	
Female	8
Male	5
Age group	
18–30	5
31–50	2
>50	6
Home country	
USA	12
Great Britain	1

The second group of participants consisted of twenty non-native speakers of English whose first language was Croatian (see Table 2). Before taking the WAT, all respondents of this group were asked to self-assess their proficiency in English and were given four options: basic, good, very good and excellent. Based on the given answer, they have been divided into two groups: lower-English-proficiency learners, which represent non-native speakers that described their English proficiency as 'basic' or 'good' and higher-English-proficiency learners, or those that opted for 'very good' or 'excellent'. Furthermore, based on the information that the respondents provided about their formal education in the English language, on average, lower-proficiency learners had studied English for 6.5 years, ranging from 3 to 12 years, while higher-proficiency learners had studied English for 11,7 years, ranging from 8 to 17 years.

Table 2: Non-native speakers (20)

Gender	
Female	15
Male	5
Age group	
18–30	15

31–50	3
>50	2
English proficiency	
Lower	7
Higher	13

3.3 Cue words

The cue words used in this study have been selected from the list proposed by Grace Helen Kent and A. J. Rosanoff (1910: 5-6), which is considered to be "one of the most well-known and frequently used standard word association tests" (Söderman, 1992: 158). The complete Kent-Rosanoff list consists of one hundred cue words and was originally used to determine variations in word associations in patients with various forms of mental disorder in comparison with the responses given by healthy participants (Kent & Rosanoff, 1910: 6). It has since been used by numerous researchers as a tool for psychiatric diagnosis, based on the notion that certain cue-response pairings could be considered normal, frequent or predictable. The Kent-Rosanoff list was also adopted by linguists and used in numerous studies which attempted to explore the mental lexicon using WATs.

In order to minimise issues with word recognition among respondents of all levels of language proficiency, fairly common words have been selected from the Kent-Rosanoff list: *chair, sweet, hand, wish, soft, hammer, baby, afraid, eating, beautiful, bread, spider, cold, doctor, moon, loud, thief, anger, stomach, blue*.

Furthermore, to explore the effect of semantic variables on association links in L1 and L2, the selected words have different values of concreteness and imageability[1]. The values of each of the two semantic variables range from 100 to 700, with 100 indicating that the concept denoted by the word is either highly abstract or highly unimageable, and 700 indicating that the concept is either highly concrete or highly imageable. The values of concreteness and imageability for each word used in the WAT are shown in Appendix 1.

3.4 Procedure

The study was conducted via an online survey tool. In the first part of the survey, the participants were asked to answer several general questions about themselves. The second part of the survey

[1] The values have been determined using the MRC Psycholinguistic Database. The database contains 150837 words with up to 26 linguistic and psycholinguistic attributes for each word (e.g. number of letters, part of speech, age of acquisition, verbal frequency, etc.).

was a word association test. The WAT consisted of twenty cue words, which appeared on the screen one at a time. The participants were instructed to type the first word they thought of when they read each of the given words, and to use only a single word for each response. Non-native speakers were additionally instructed that the responses should be in English.

In order to try and avoid overthinking and changing the answer, this part of the survey was timed. More specifically, the participants were given ten seconds per response, of which they were warned in the WAT instructions. Given that a timed online survey is not a typical WAT procedure, the participants were given two additional cue words at the beginning of the WAT, *lion* and *black*, to grasp the procedure without it affecting the results. They were not told that the two additional words would not be included in the analysis.

3.5 Categorization of responses

The categorization system used in this study is shown in Table 3.

Table 3: The response categorization system[2]

MEANING-BASED		
Synonym	Cue and response are synonymous in some situations	*afraid → scared* *baby → infant*
Lexical set	Cue and response share a hyponym, or one word in the pair is an example of the other; includes antonyms and meronyms	*chair → table* *chair → furniture* *hard → soft* *hand → body*
Other conceptual	Cue and response are related in meaning, but are not synonyms or in the same lexical set	*hammer → strong* *anger → tiger* *spider → dusty*
POSITION-BASED		
Cue-response collocation	Cue is followed by the response in common usage; includes compound nouns	*stomach → ache* *blue → moon* *doctor → who*
Response-cue collocation	Cue is preceded by the response in common usage; includes compound nouns	*hammer → MC* *moon → full*
Cue–response and response–cue collocation	Cue could precede or follow the response in a common phrase(s)	*hand → shake*

[2] The majority of association pairs listed as examples in the table have been taken from this study. Those marked by an asterisk (*) have been taken from Fitzpatrick and Izura's study (2011: 384).

FORM-BASED		
Affix manipulation	Cue is the response with the addition, deletion or changing of an affix	*anger → angry*
Similar in form only	Cue and response are similar in orthography and/or phonology but do not share meaning	*wish → fish*
DUAL-LINK		
Form and meaning	Response and cue are related in both their form and general meaning	*newsagent → newspaper**
Meaning and collocation	Response and cue are related in both their general meaning and in their tendency to co-occur in language	*hammer → nail* *loud → sound* *blue → sky*
OTHER		
Two-step association	Cue and response appear linked only through another word	*bread (breed) → dog*
Erratic	The link between cue and response seems illogical. Includes repetition of the cue	*hammer → paper*
Blank	No response	

The categorization shown above is a replication of the one used by Fitzpatrick et al. (2015: 40-41) in a study which focused on investigating the reliability of word association data for investigating individual and group differences. It was comprised on the basis of the categorization systems used by Fitzpatrick in her previous studies and revised by rationalizing the number of subcategories and allowing for responses to be coded as a combination of more than one link (Fitzpatrick et al., 2015: 39) While the main categories are equal to those in the 2015 study, a few modifications have been made to the subcategories used in this study:

1 Informed by some of Fitzpatrick's earlier studies (e.g. Fitzpatrick, 2006), the "lexical set" subcategory of meaning-based associations has been modified to include meronyms (e.g. *hand → finger)*.
2 In the original study (Fitzpatrick et al., 2015), dual-link associations include 4 subcategories: lexical set *and* cue–response collocation, lexical set *and* response–cue collocation, synonym *and* cue–response collocation, and synonym *and* response–cue collocation. Informed by the categorization system used by Fitzpatrick & Izura (2011: 384), the "dual-link" category in this study features 2 main subcategories: form *and* meaning (e.g. *hairdresser → hairdryer)* and meaning *and* collocation (e.g. *pearl → necklace)*. This

modification allows for all possible combinations of form-based and meaning-based subcategories which could appear.

3 The "two-step association" and the "erratic" subcategory have been placed in the "other" category, as opposed to "form-based", as was suggested in the original study. The reasoning behind the original placement was that in two-step associations, one step is nearly always based on word form (e.g. *weak (week) → Monday*), and the "erratic" category "encompasses potential spelling mistakes" (e.g. *bean → stalk (stork))* (Fitzpatrick et al., 2015: 45). While this might be true, placing these response types in the "other" category allows for the inclusion of other possible forms of erratic and two-step associations, which are not necessarily based on word form.

4 Based on previous studies (e.g. Wolter, 2001), a "blank" subcategory has been included in the "other" category for cases in which there was no response to the cue word.

3.6 Results

3.6.1 Responses

The participants were asked not to concern themselves with correct spelling in order to attempt to avoid changing the answer to one that was easier for them to write. The spelling mistakes have been corrected.

All responses given by native and non-native speakers (separately), as well as the number of response occurrences in each group, can be found in Appendices 2 and 3.

3.6.2 The comparison of association behaviour in L1 and L2

The responses given by native and non-native speakers are first analysed and compared in terms of the 5 main categories, followed by a more detailed analysis of the distribution of responses among the subcategories of each main category. The results are used to assess the similarities and differences of the L1 and L2 mental lexicon.

3.6.2.1 Main categories

The overall number of each response type occurrence in L1 and L2 is shown in Table 4.

Table 4: Response occurrences

Response category	Total (660 responses)	L1 (260 responses)	L2 (400 responses)
Meaning-based	430	181	250
Position-based	105	47	58
Form-based	3	0	3
Dual-link	86	21	65
Other	33	11	22

A statistical analysis of response type occurrences in L1 and L2 is shown in Figure 1.

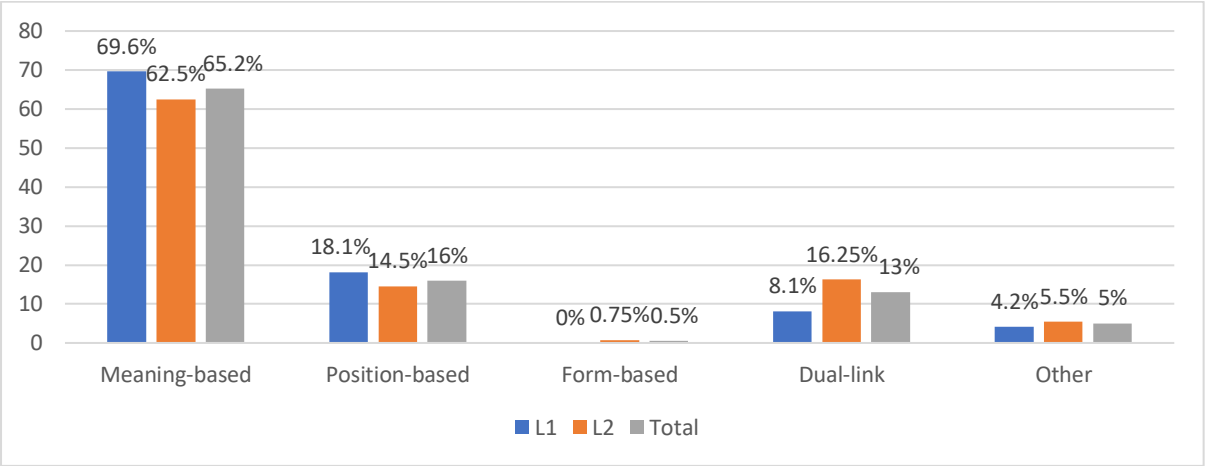

Figure 1: Distribution of L1 and L2 responses among the main categories

Overall, most responses fell into the meaning-based category. Native speakers produced a larger proportion (69.6%) of this response type than non-native speakers (62.5%). Position-based responses were the second most frequent response type overall and in the L1 group (18.1%), while third in the L2 group (14.5%). On the other hand, non-native speakers produced twice as many dual-link associations (16.25%) in comparison with native speakers (8.1%), and this was the second most frequent response type in the L2 group. Furthermore, form-based responses did not appear in the L1 group and were not frequent in the L2 group (0.75%). The responses which could not be placed into any of the 4 previous categories were placed in the "other" category. This response type was not frequent overall, but was slightly more present among non-native speakers (5.5%) than among native speakers (4.2%).

3.6.2.1.1 Discussion

Given that past studies have shown that the mental lexicon of an adult native speaker often gives preference to meaning-based association links (Wolter, 2001: 56), it is not surprising that this response type was more present in the group that uses English as L1. However, contrary to

certain past studies that argued that non-native speakers have a "syntagmatically dominated mental lexicon" (Wolter, 2001: 61), and consistent with Fitzpatrick's study (2006), meaning-based associations still constituted the largest proportion of L2 responses. This shows that both the L1 and L2 mental lexicon have a greater tendency to produce meaning-based than any other type of association, which is suggestive of structural similarity between them.

Furthermore, consistent with Fitzpatrick's study (2006), native speakers demonstrated a greater tendency to produce position-based responses in comparison with non-native speakers. However, the results of this type of study do not reveal whether this was motivated by response type preference or a restricted knowledge of collocations in L2. Fitzpatrick (2006: 31) goes on to explain that the reason for this might be that the L1 lexicon by default stores language in chunks, which are subsequently analysed, while non-native speakers "construct formulaic strings from single words and only then store them", and thus have fewer "ready-made collocations available for activation".

Furthermore, although there were few form-based responses overall, they expectedly appeared in L2. Previous studies have shown that language learners tend to produce more associations based on word form than native speakers (cf. Fitzpatrick 2006, Fitzpatrick & Barfield 2009). Fitzpatrick and Izura (2011: 390) have argued that "this suggests that L2 associative activations have stronger phonological-orthographical lexical reliance than L1 words". The results of this study are consistent with this theory.

Certain studies have shown that dual-link associations are activated strongly and more quickly than any other type of associations, in both native and non-native speakers. However, even though they are most readily accessed, this type of links is not very common, which is why they are not frequently produced. Past studies have shown no significant difference between L1 and L2 in this category (cf. Fitzpatrick & Izura, 2011: 389-391). However, in this study, the dual-link category revealed the largest difference between L1 and L2, as dual-link responses were twice as frequent among non-native speakers than among native speakers. More specifically, the second most frequent type of association links in L2 were dual-link associations, while in L1, this place was occupied by positioned-based associations. This suggests that L2 associative activations might give preference to associations with more than one link more often than this happens in L1.

Even though there were few responses placed in the "other" category, they were expectedly produced by non-native speakers. The responses placed in this category were mostly based on misunderstanding of the cue word, incorrect translation from L1 or failure to provide a response

in the limited time frame. This type of association behaviour is not surprising for second-language users.

3.6.2.2 Subcategories

The following figures are a statistical representation of L1 and L2 response distribution among the subcategories of each individual main category.

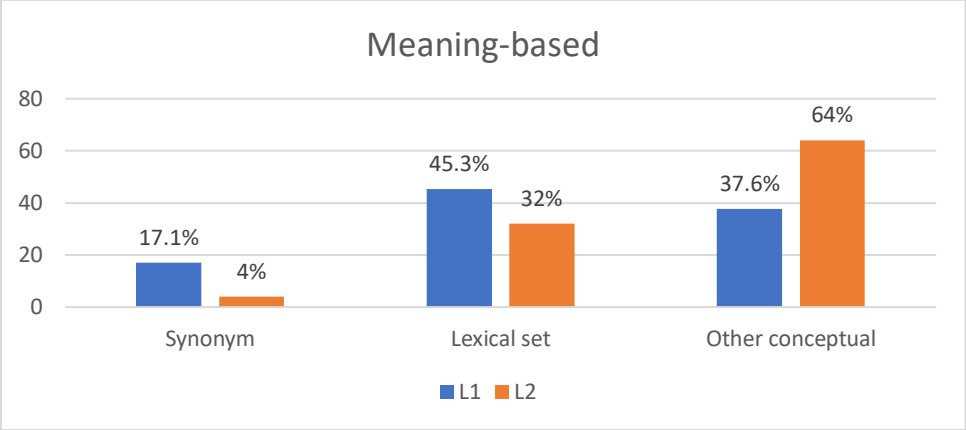

Figure 2: Distribution of L1 and L2 responses among the subcategories of the "meaning-based" category

Although synonyms of cue words were the least frequent meaning-based response in both groups of respondents, an evidently greater number of synonyms was produced among native speakers (17.1%) than among non-native speakers (4%). Furthermore, native speakers also produced more responses that belong to the same lexical set as the cue word (45.3%) in comparison with non-native speakers (32%). While the greatest proportion of meaning-based responses in L1 fell into the "lexical set" subcategory, L2 users demonstrated a tendency towards "other conceptual" associations. More specifically, it comprised 64% of all meaning-based responses produced by L2 users, which is twice as much than in the L1 group (37.6%).

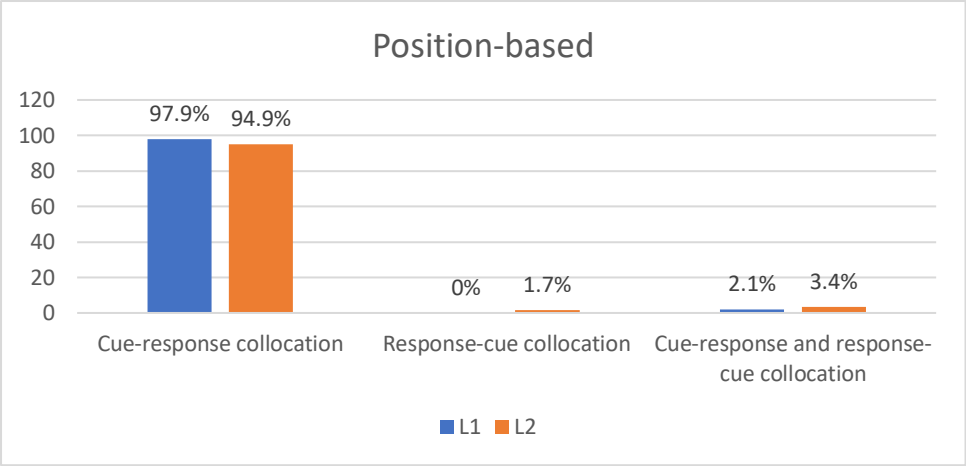

Figure 3: Distribution of L1 and L2 responses among the subcategories of the "position-based" category

Even though native speakers produced a greater number of position-based responses in comparison with non-native speakers, the two groups did not demonstrate a significant difference in the distribution of these responses among the three subcategories. Both in L1 and L2, the most frequent position-based association was a "cue-response collocation" (L1 – 97.9%, L2 – 94.9%). Much less popular position-based response type in both groups of respondents was a bi-directional collocation, i.e. the cue-response and response-cue collocation (L1 – 2.1%, L2 – 3.4%). The "response-cue collocation" did not appear in the L1 group and was not very frequent among L2 users (1.7%).

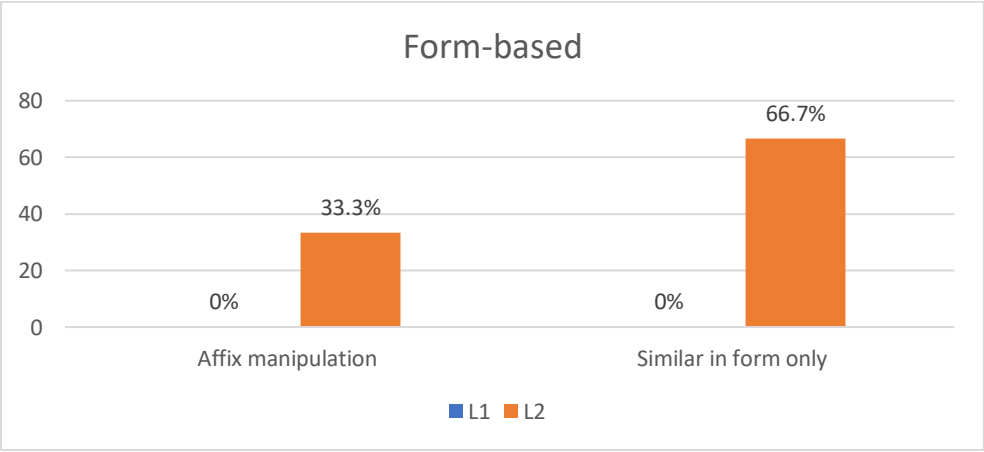

Figure 4: Distribution of L1 and L2 responses among the subcategories of the "form-based" category

In this study, native speakers did not produce any form-based associations. Non-native speakers produced few form-based responses, but the "similar in form only" subcategory proved slightly more popular (66.7%) than the "affix manipulation" subcategory (33.3%).

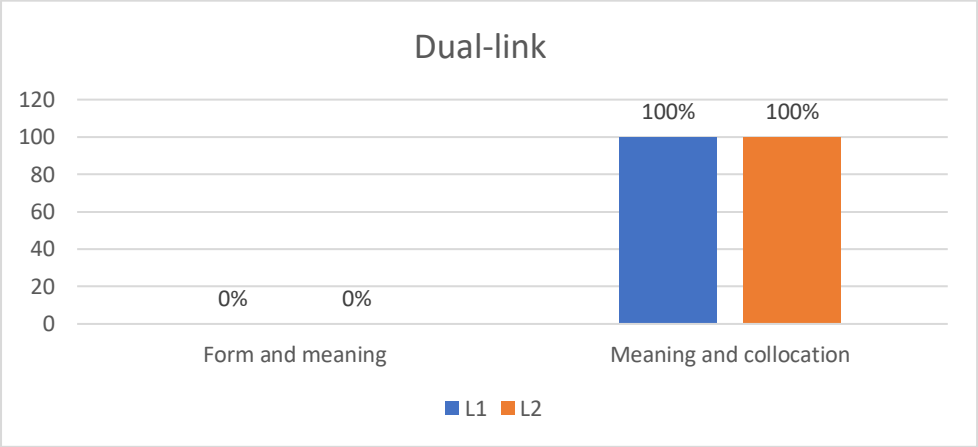

Figure 5: Distribution of L1 and L2 responses among the subcategories of the "dual-link" category

Even though non-native speakers demonstrated a greater tendency towards dual-link associations, there is no difference in the preference for a particular subcategory, as both groups produced only the responses linked to the cue word by meaning and collocation. A "form and meaning" response type did not appear in this study.

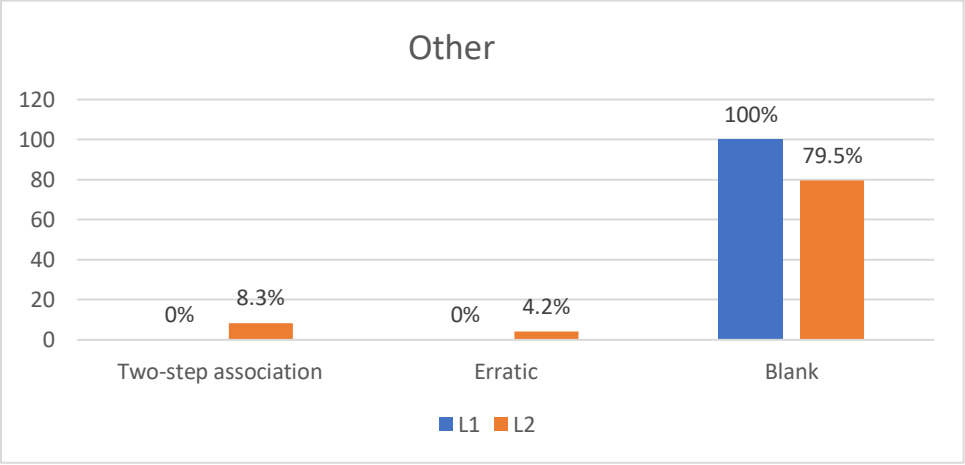

Figure 6: Distribution of L1 and L2 responses among the subcategories of the "other" category

Although there were few responses in the "other" category overall, most cases were the result of a failure to provide a response in the 10-second time frame. More specifically, all L1 responses in this category fell into the "blank" subcategory, while this was the case for 79.5%

of L2 responses. Furthermore, the remaining two response types did not appear among L1 users, while 8.3% of L2 responses in this category represented a two-step association and 4.2% an erratic association.

3.6.2.2.1 Discussion

The response distribution in the meaning-based category is consistent with Fitzpatrick's previous research (cf. Fitzpatrick, 2006). In other words, native speakers were expected to produce more responses related to the cue word by synonymy or the same lexical set, while non-native speakers were expected to produce more "other conceptual" associations. She attempts to explain the results by saying that this might be due to a restricted L2 vocabulary, which causes non-native speakers to resort to responses that are more loosely related to the cue word, but quickly challenges this idea by stating that it is not possible to prove this (Fitzpatrick, 2006: 33).

The position-based category of responses did not reveal significant differences in the subcategory preference of the two groups. Both L1 and L2 users showed a strong tendency towards producing cue-response collocations, which is also consistent with the results of some previous studies (cf. Fitzpatrick et al., 2015). Given that this is the order in which the two words are usually used, it is not surprising that this association link is generally stronger (both in L1 and L2) in comparison with the remaining two types in this category.

Unlike in certain past studies (cf. Fitzpatrick 2006, Roux 2013), native speakers did not produce any form-based associations. The results support Meara's claim that it is very uncharacteristic of native speakers that their semantic links are overridden by phonological (or in this case orthographical) similarities (Meara, 2009: 22). Moreover, the tendency towards "similar in form only" responses in L2 is consistent with Fitzpatrick's research.

Although they were more frequent among non-native speakers, the only type of dual-link associations produced in both groups was based on meaning and collocation. As past studies generally did not include dual-link associations, there is not much information about the subcategory preference in L1 and L2. Fitzpatrick and Izura's study (2011: 391) resulted in few dual-link associations in both subcategories and the authors attributed this to the fact that this type of links rarely exists. The results of this study do not fully support that theory. This might be explained by a possible influence of cue word selection, as some words are more likely to elicit this type of associations than others (e.g. *hammer* → *nail* vs. *afraid* → *scared*). The absence of "form and meaning" associations in this study could also be explained in such

manner. However, gathering data to support this idea would require a thorough analysis of the cue words used in both studies and/or a repetition of the same WATs on different participants. Finally, the "other" category revealed a small difference between native and non-native speakers. While all L1 responses fell into the "blank" subcategory, L2 users produced a small number of two-step and erratic associations. As previously explained, these were mostly the result of a misunderstanding of the cue word (e.g. *bread* (*breed*) → *dog*), and incorrect translation from L1 (*spider* → *net* (*mreža*[3]). Errors of this type are not uncommon in L2.

3.6.3 The effect of language proficiency on association behaviour in L2

The responses given by lower- and higher-English-proficiency non-native speakers are first compared in terms of the five main categories, followed by a more detailed analysis of the distribution of these responses among the subcategories of each main category. The results are used to assess whether the L2 association behaviour changes with language proficiency and moves towards that of an L1 user.

3.6.3.1 Main categories

A statistical analysis of the response types produced by lower- and higher-proficiency learners of English is shown in Figure 6.

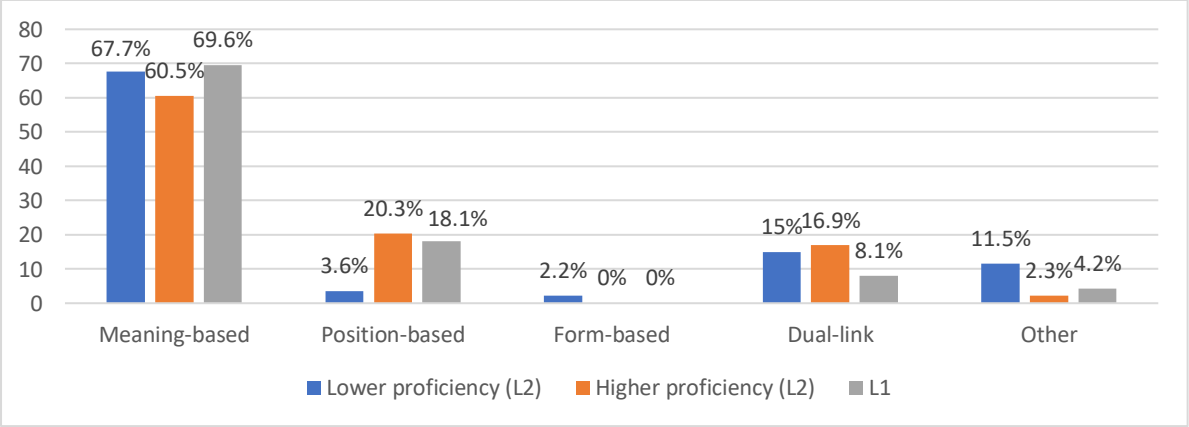

Figure 7: Distribution of the responses produced by lower- and higher-proficiency learners among the main categories

As shown in the figure, meaning-based responses were the most frequent response type in both groups of non-native speakers. More specifically, 67.7% of responses produced by the lower-

[33] The Croatian word "*mreža*" can be translated as both "net" and "web", depending on the context.

proficiency group were meaning-based, while this was the case for a slightly smaller percentage of responses (60.5%) given by the higher-proficiency group. The position-based responses were not equally popular in both groups, as lower-proficiency learners opted for this response type in only 3.6% of cases, while this was the second most frequent response type (20.3%) in the higher-proficiency group. Form-based responses did not appear in the higher-proficiency group, while 2.2% of the responses that occurred in the lower-proficiency group were based on word from. Dual-link associations showed no significant difference between the two groups, as they comprised 15% of responses in the lower-proficiency group and 16.9% in the higher-proficiency group. Lastly, a significantly larger proportion of the responses (11.5%) produced by lower-English-proficiency respondents fell into the "other" category, while only 2.3% of the responses that occurred in the higher-proficiency group were placed in this category.

3.6.3.1.1 Discussion

The most evident difference between lower- and higher-English-proficiency respondents appeared in the position-based category. Higher-proficiency learners produced significantly more position-based responses in comparison with lower-proficiency learners. The results of Fitzpatrick's study (2006: 34) also indicated a greater tendency towards position-based responses in the higher-proficiency group, but the number of occurrences was too small to make the finding reliable. However, in this study, out of 58 position-based responses produced by non-native speakers, 55 occurred in the higher-proficiency group, which strongly supports her findings. It also supports the idea of a positive correlation of language proficiency with "native-likeness" of the L2 mental lexicon. Moreover, the results show a decrease in the activation of form-based and "other" associations with increased proficiency, which further corroborates the afore-mentioned idea. However, although the results seen in the "meaning-based" and "dual-link" category reveal differences between the two groups, they do not demonstrate a movement towards association behaviour that is more typical of an L1 user.

3.6.3.2 Subcategories

The following figures are a statistical representation of the distribution of responses produced by lower- and higher-proficiency learners of English among the subcategories of each individual main category.

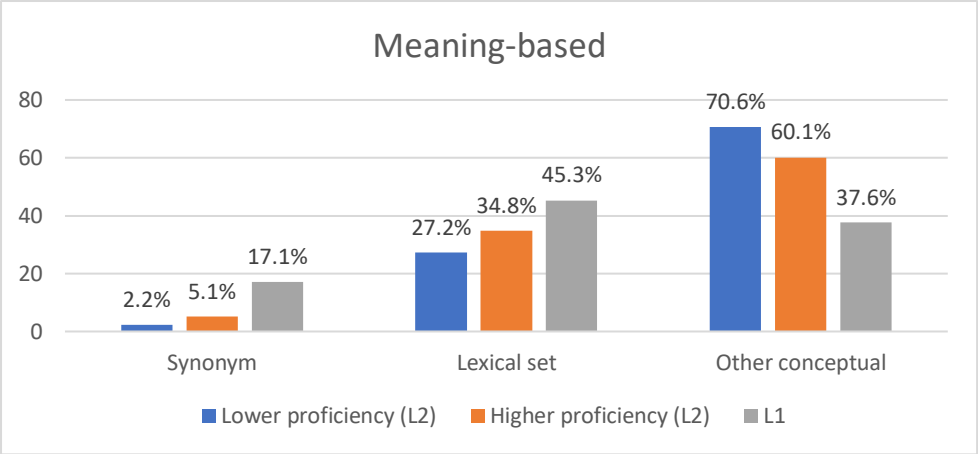

Figure 8: Distribution of the responses produced by lower- and higher-proficiency learners among the subcategories of the "meaning-based" category

Most meaning-based responses in both groups were categorized as "other conceptual" associations. However, lower-proficiency learners showed a greater tendency (70.6%) towards this response type than this was the case for higher-proficiency learners (60.1%). The "lexical set" category also revealed a difference between the two groups, as the higher-proficiency group produced more responses (34.8%) of this type than the lower-proficiency group (27.2%). Furthermore, synonyms did not frequently appear among non-native speakers, but they appeared more frequently in the higher-proficiency group (5.1%) in comparison with the lower-proficiency group (2.2%).

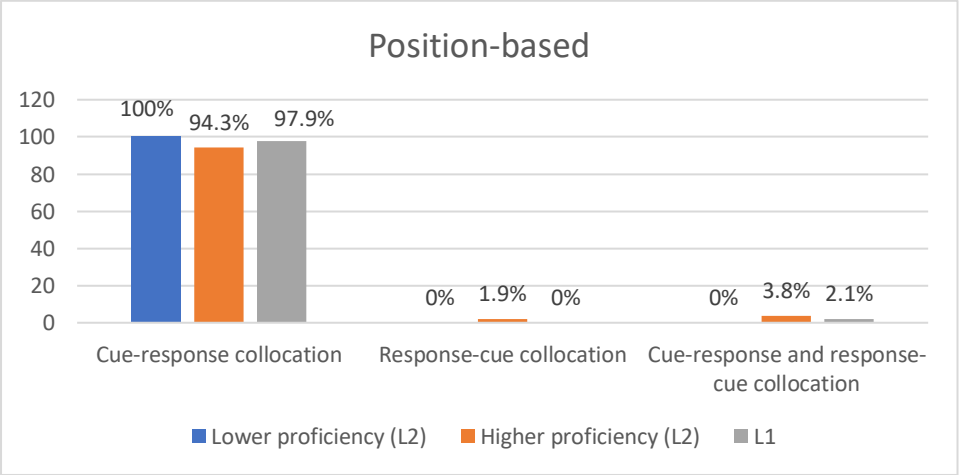

Figure 9: Distribution of the responses produced by lower- and higher-proficiency learners among the subcategories of the "position-based" category

Although higher-proficiency learners produced a significantly larger number of position-based responses than lower-proficiency learners, both groups showed a preference for cue-response

collocations. This was especially evident in the lower-proficiency group where all position-based responses fell into this subcategory, while this was the case for 94.3% of the responses that occurred in the higher-proficiency group. Moreover, a small number of the responses produced by higher-proficiency learners were categorized as a "response-cue collocation" (1.9%) or "cue-response and response-cue collocation" (3.8%).

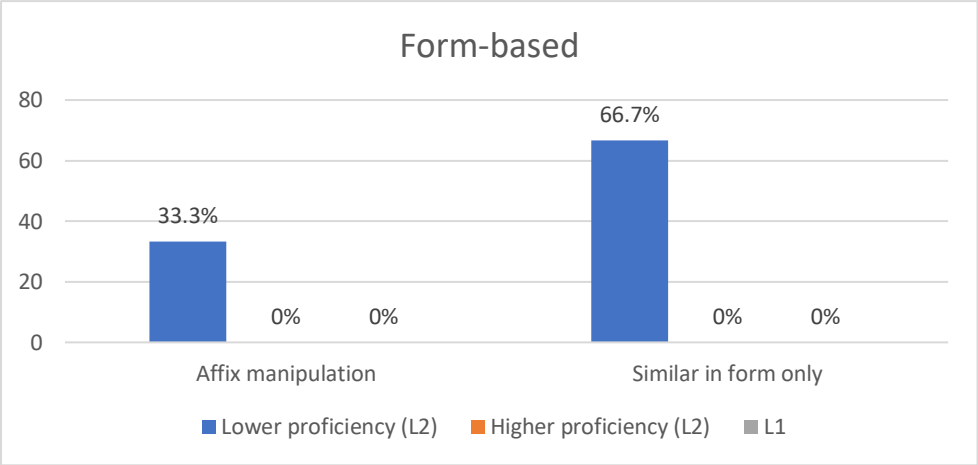

Figure 10: Distribution of the responses produced by lower- and higher-proficiency learners among the subcategories of the "form-based" category

Form-based responses did not appear in the higher-proficiency group, which is why it is not possible to compare how the responses were distributed among the subcategories in the two groups. In the lower-proficiency group, 66.7% of form-based responses were categorized as "similar in form only" and 33.3% as an "affix manipulation.

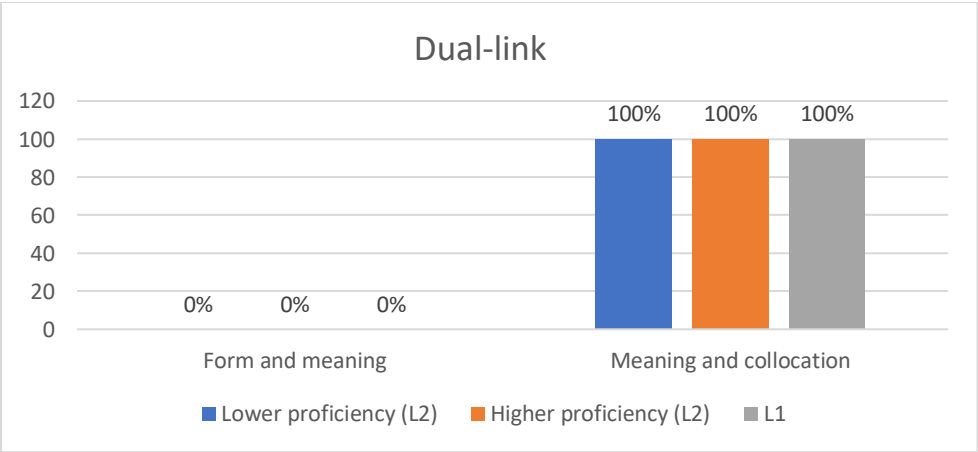

Figure 11: Distribution of the responses produced by lower- and higher-proficiency learners among the subcategories of the "dual-link" category

Dual-link associations revealed no difference in the response type subcategory preference between the two groups, as both lower- and higher-proficiency learners only produced responses that are linked with the cue word by meaning and collocation.

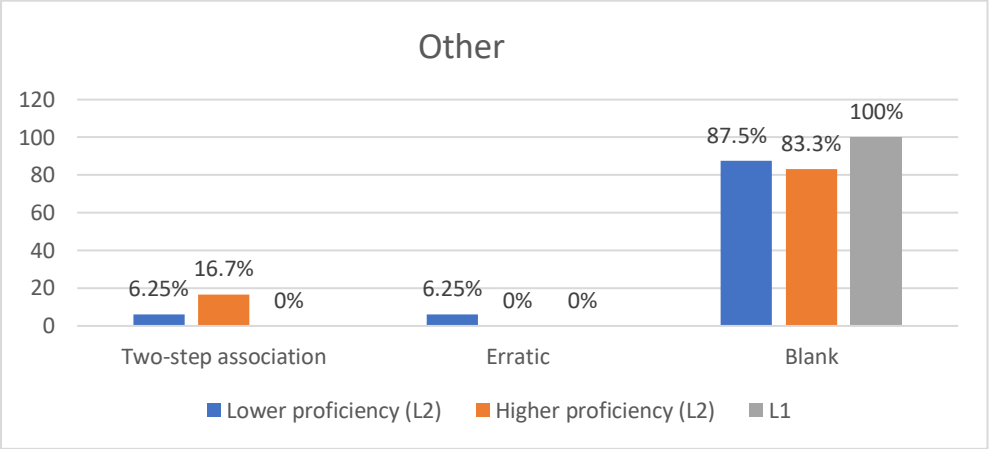

Figure 12: Distribution of the responses produced by lower- and higher-proficiency learners among the subcategories of the "other" category

In both groups, a significantly greater proportion of responses fell into the "blank" subcategory. However, lower-proficiency learners failed to respond in a slightly greater number of cases (87.5%) in comparison with the higher-proficiency group (83.3%). Furthermore, while lower-proficiency learners produced an equal number of two-step and erratic associations (6.25%), the former response type appeared in 16.7% of the responses given by higher-proficiency learners and the latter did not appear.

3.6.3.2.1 Discussion

As evident in Figure 7, the most significant indication of correlation between language proficiency and "native-likeness" of the L2 mental lexicon appeared in the meaning-based category. The results show a visible change in the L2 association behaviour. A higher number of responses related to the cue word by synonymy or lexical set in the higher-proficiency group, as opposed to a higher number of "other conceptual" responses in the lower-proficiency group, appears to corroborate the idea that the L1 and L2 similarities increase with proficiency, as proposed in previous studies (Meara, 2009: 112). However, no evidence of this was found in the distribution of responses among the subcategories of the remaining 4 categories.

3.6.4 The effect of concreteness and imageability on association behaviour in L1 and L2

This analysis did not include all the cue words from the WAT, but only those with the largest differences in the level of concreteness and imageability. More specifically, it included 3 words of the highest level of concreteness (*bread*, *stomach* and *spider*) and 3 of the lowest level of concreteness (*wish*, *anger* and *afraid*). The effect of imageability was investigated separately, and it included 3 words of the highest level of imageability (*bread*, *hammer* and *chair*) and 3 of the lowest level of imageability (*wish*, *loud* and *afraid*). The exact ratings of concreteness and imageability of the selected words can be found in Appendix 1.

A statistical analysis of how concreteness and imageability of the selected cue words influenced the response type preference among native and non-native speakers in this study is represented in the following figures.

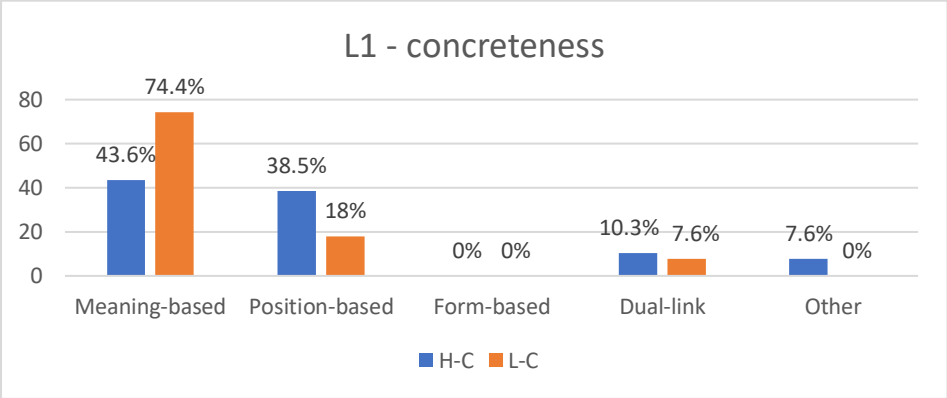

Figure 13: The effect of concreteness on association behaviour in L1

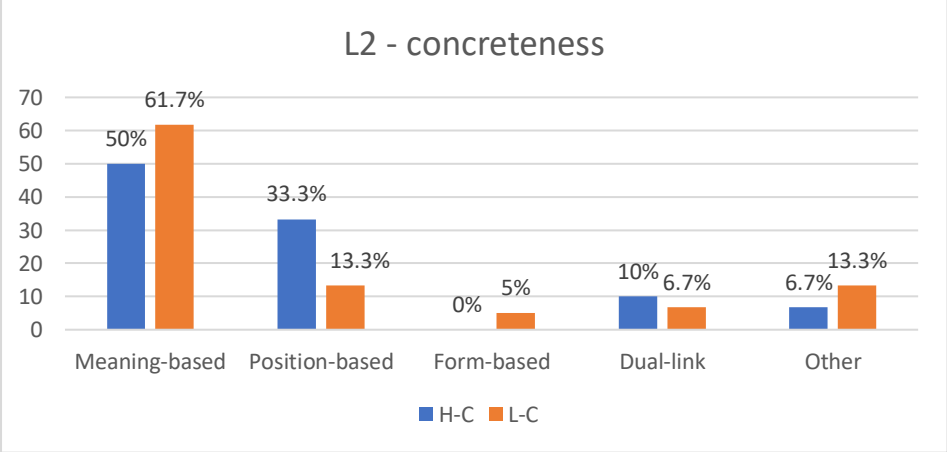

Figure 14: The effect of concreteness on association behaviour in L2

Cue words of a lower concreteness level motivated a larger proportion of meaning-based responses both in L1 and L2 in comparison with cue words of a higher level of concreteness.

On the other hand, in both groups of respondents, position-based responses were significantly more frequent when the cue word had a higher level of concreteness. Dual-link associations were fairly equally affected by concreteness of the cue word in both groups of respondents, i.e. H-C cue words motivated slightly more dual-link associations than L-C cue words. The most significant difference in the effect on L1 and L2 users appeared in the "other" category. In the L2 group, cue words with a lower level of concreteness caused twice as many responses that fell into this category than this was the case when the cue word was highly concrete. On the other hand, in the L1 group, L-C cue words did not elicit a single response that fell into the "other" category, while H-C cue words did. Lastly, form-based responses did not appear in the L1 group, while they did appear in the L2 group when the cue words were of a lower level of concreteness.

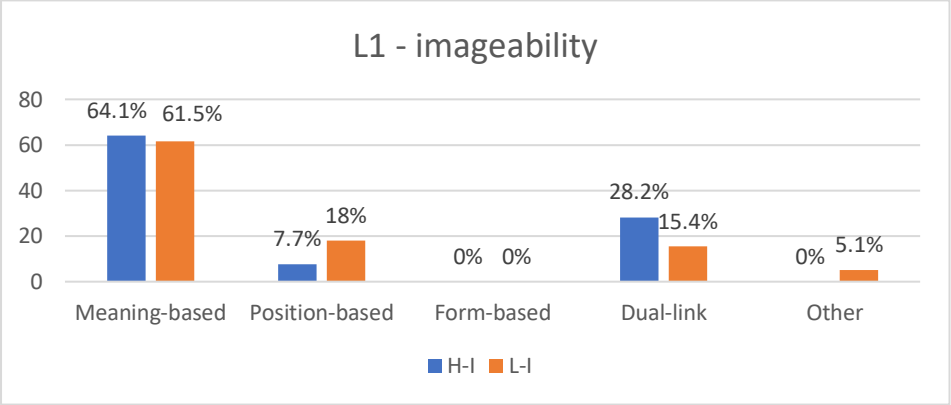

Figure 15: The effect of imageability on association behaviour in L1

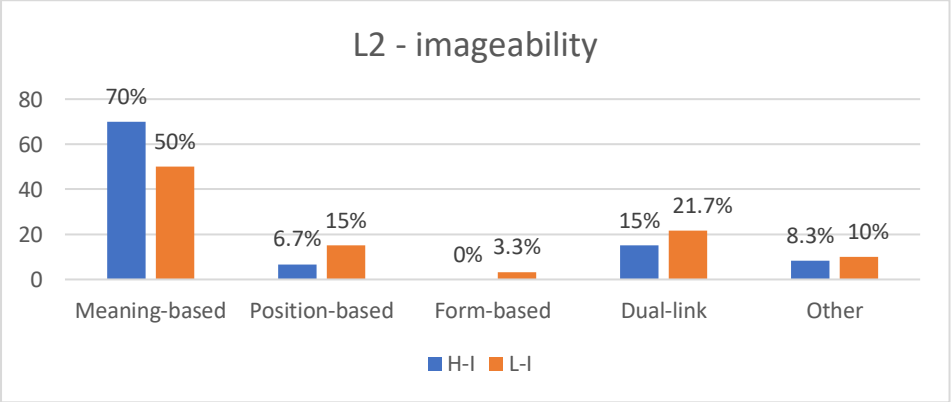

Figure 16: The effect of imageability on association behaviour in L2

While imageability of cue words did not cause a large difference in the meaning-based category of responses given by L1 users, L2 users produced a fairly larger proportion of meaning-based responses when the cue words where highly imageable. In the category of position-based

responses, cue words with a lower level of imageability motivated more position-based responses in both groups of respondents. Dual-link associations were differently affected by imageability of cue words in the two groups. While L1 users produced more dual-link associations when cue words were highly imageable, imageability caused an opposite effect in the L2 group. Furthermore, in both respondent groups, cue words with a lower level of imageability caused more responses that fell into the "other" category than those with a higher level of imageability. Finally, while form-based associations were not produced in the L1 group, they appeared among non-native speakers when the imageability level of cue words was lower.

3.6.4.1 Discussion

In most categories, the effects of the semantic variables are visible. However, even though concreteness and imageability are in most cases highly correlated variables, they did not have an equal effect on the responses. While the number of meaning-based responses increased with more imageable cue words both in L1 and L2, it decreased with highly concrete words. An opposite effect occurred in the position-based category, as the number of responses of this type increased when the cue words had a higher level of concreteness or a lower level of imageability. An equal effect of imageability and concreteness seen in the two afore-mentioned categories in L1 and L2 might be considered indicative of structural similarity between the two mental lexicons.

However, the two variables also revealed some differences in the effect that they had in L1 and L2. More specifically, imageability had a different effect on native and non-native speakers in the "dual-link" category, as highly imageable words caused more dual-link associations in L1 and less in L2.

Furthermore, as previously mentioned, past studies have shown that the number of "blank" responses decreases with higher imageability or concreteness of the cue word. The results of this study support previous findings. This was especially evident in L2, as non-native speakers produced more "blank" responses to both L-C and L-I cue words.

4 Conclusion

The aim of this study was to further explore association behaviour in L1 and L2 with the help of a word association test. Using a refined response categorization system, based on the ideas proposed in recent studies, primarily the one conducted by Fitzpatrick et al (2015), allowed for

a more thorough analysis of this behaviour. The results reveal that, despite certain discrepancies, the two mental lexicons do not systematically differ. Semantic associations (meaning-based, position-based and dual-link associations) largely dominate both mental lexicons. Both native and non-native speakers showed a greater tendency towards meaning-based responses, which contradicts the idea of a "syntagmatically dominated" L2 mental lexicon proposed in certain past studies. Native speakers produced more meaning- and position-based associations, while form-based, dual-link and "other" associations were more frequently activated in L2 than in L1. The dual-link category revealed the largest difference between the two groups of respondents, suggesting that associations with more than one link might more often override other links in the L2 lexicon than this is the case in the L1 mental lexicon. The subcategory analysis corroborated the results of the studies that used a similar categorization system (cf. Fitzpatrick 2006, Fitzpatrick & Izura 2011), revealing that more synonyms and words within the same lexical set will be produced in L1 in comparison with L2, where looser meaning-based connections will more likely be activated. Furthermore, the comparison of the responses produced by lower- and higher-English-proficiency L2 users showed a correlation of language proficiency with association behaviour. Contrary to the "syntagmatic-paradigmatic shift" theory, the results indicate that higher-proficiency learners are far more likely to activate position-based associations in comparison with lower-proficiency learners. This might suggest that as proficiency increases, the L2 association behaviour will move towards that of a native speaker. A subcategory analysis revealed further indication of this in the meaning-based category. However, no further evidence was found in the remaining categories. Finally, a correlation of semantic variables with response type preference was found both in L1 and L2. While cue words with a higher level of imageability elicited more meaning-based associations, those with a higher level of concreteness elicited more position-based associations in both respondent groups. Here the results also supported previous findings, demonstrating a decrease in the production of "blank" responses with higher levels of concreteness and imageability. This analysis additionally revealed similarities (in the "meaning-based" and "position-based" category) and differences (in the "other" and "dual-link" category) in the effect that the two variables had in L1 and L2. However, the findings of this study require support from further research in this area.

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Appendix 1: Levels of concreteness and imageability of cue words

CUE WORD	CONCRETENESS	IMAGEABILITY
chair	606	610
sweet	463	493
hand	604	598
wish	270	399
soft	414	476
hammer	605	618
baby	589	608
afraid	336	451
eating	485	536
beautiful	393	532
bread	622	619
spider	607	597
cold	457	531
doctor	575	600
moon	581	585
loud	413	448
thief	519	529
anger	315	488
stomach	617	551
blue	459	569

Appendix 2: All L1 responses

chair	table (5), furniture (2), seat (2), sit (2), faculty (1), wood (1)	
sweet	candy (4), sour (4), tooth (2), heart (1), sassy (1), sugar (1)	
hand	foot (5), body (2), arm (1), hold (1), nails (1), sanitizer (1), shake (1)	
wish	star (3), bone (1), desire (1), dreams (1), gift (1), granted (1), heart (1), love (1), luck (1), net (1), tree (1)	
soft	hard (4), blanket (1), caring (1), cuddly (1), fuzzy (1), sense (1), shell (1), paper (1), tissue (1), touch (1)	
hammer	nail (7), tool (2), dad (1), hard (1), head (1), strong (1)	
baby	infant (2), adult (1), blue (1), boy (1), cute (1), driver (1), girl (1), kid (1), mammal (1), pacifier (1), sweet (1),	no response (1)
afraid	scared (8), brave (1), cat (1), dark (1), fear (1), feeling (1)	
eating	food (6), disorder (2), American (1), drinking (1), full (1), need (1), starving (1)	
beautiful	pretty (6), ugly (2), attractive (1), butterfly (1), mind (1), perception (1), precious (1)	
bread	butter (2), food (2), carbs (1), crumbs (1), honey (1), loaf (1), pudding (1), sandwich (1), sourdough (1), staple (1), yeast (1)	
spider	Web (6), insect (2), arachnoid (1), black widow (1), bug (1),	no response (2)
cold	hot (4), winter (3), freezing (1), heart (1), snow (1), warm (1), water (1), wet (1),	
doctor	nurse (4), who (2), Covid (1), healer (1), medical (1), medicine (1), physician (1), sickness (1),	no response (1)
moon	sun (7), faraway (1), mistress (1), night (1), space (1)	no response (2)
loud	bang (2), quiet (2), forte (1), mom (1), music (1), noise (1), noisy (1), soft (1), sounds (1),	no response (2)
thief	steal (5), robber (2), honor (1), night (1), reformation (1), rob (1), wallet (1)	no response (1)
anger	mad (5), management (2), feeling (1), love (1), tiger (1), rage (1), patience (1), upset (1)	
stomach	ache (4), acid (1), anus (1), contents (1), cramps (1), duodenum (1), food (1), gastrointestinal (1), hungry (1)	no response (1)
blue	green (4), color (2), eyes (1), moon (1), sad (1), silver (1), teal (1), valentine (1)	no response (1)

Appendix 3: All L2 responses

chair	table (11), sit (2), sitting (2), comfortable (1), cushion (1), furniture (1), room (1), stool (1)	
sweet	candy (9), salty (2), bitter (1), bunny (1), chocolate (1), cookies (1), lullaby (1), scent (1), sour (1), sugar (1), tooth (1)	
hand	arm (2), body (2), finger (2), hug (2), sanitizer (2), wash (2), fingers (1), fist (1), glove (1), human (1), left (1), leg (1), shake (1), touch (1)	
wish	fish (2), list (2), star (2), away (1), birthday (1), Christmas (1), dream (1), good (1), miracle (1), money (1), nice (1), play (1), rich (1), well (1)	no response (3)
soft	hard (6), pillow (3), cushion (2), tissue (2), bed (1), gentle (1), kid (1), skin (1), sofa (1), sponge (1), warm (1)	
hammer	nail (5), work (3), build (1), crush (1), hard (1), iron (1), mc (1), nails (1), paper (1), Thor (1), tool (1), wood (1)	no response (2)
baby	mom (2), boy (2), boomer (2), little (2), love (2), adult (1), crying (1), diaper (1), lotion (1), mother (1), shark (1), smell (1), toys (1), women (1), young (1)	
afraid	fear (6), dark (3), scared (2), spider (2), brave (1), mountain (1), night (1), mouse (1), scary (1), strangers (1)	no response (1)
eating	pizza (4), disorder (3), food (3), breakfast (1), fat (1), fear (1), fine (1), full (1), hamburger (1), hungry (1), happiness (1), sleeping (1), table (1)	
beautiful	flower (3), world (2), baby (1), face (1), girl (1), horse (1), nice (1), lady (1), land (1), liar (1), princess (1), ugly (1), wedding (1), wife (1), women (1)	no response (2)
bread	crumbs (2), food (2), knife (2), always (1), butter (1), daily (1), dog (1), eat (1), loaf (1), Nutella (1), rye (1), sandwich (1), slice (1), sour (1), white (1), wholewheat (1)	no response (1)
spider	web (6), animal (5), fear (2), dusty (1), fly (1), kill (1), net (1), scared (1), scary (1), tiny (1)	
cold	winter (8), hot (6), ice (2), snow (2), fridge (1), warm (1)	
doctor	nurse (3), Dolittle (2), help (2), sick (2), white (2), disease (1), healing (1), health (1), hospital (1), mask (1), medicine (1), pain (1), sickness (1), who (1)	
moon	night (6), stars (6), full (2), grey (1), flash (1), river (1), romantic (1), sun (1)	no response (1)
loud	music (6), noise (2), speaker (2), annoyed (1), children (1), clear (1), motorhead (1), silent (1), sky (1), smile (1), voice (1), quiet (1)	no response (1)
thief	money (3), police (3), burglar (1), burglary (1), criminal (1), mask (1), house (1), prison (1), robber (1), robbery (1), robbing (1), safe (1), smooth (1), stealing (1), two (1)	no response (1)

anger	angry (1), explosion (1), fear (1), feeling (1), frustration (1), happy (1), injustice (1), mad (1), madness (1), management (1), peace (1), rage (1), sadness (1), saint (1), son (1), yelling (1),	no response (4)
stomach	ache (7), full (3), flu (2), food (2), pain (2), abdomen (1), fat (1), hungry (1)	no response (1)
blue	sky (10), sea (3), bird (1), colour (1), red (1), skies (1), white (1)	no response (2)