

LANGUAGE PROFICIENCY AND CUMULATIVE LEARNING EXPERIENCE AS CORRELATES OF COLLOCATIONAL PROCESSING: EXPERIMENTAL DATA ON LEARNERS OF ENGLISH AS AN L2

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ABSTRACT

In this paper, we analyse the relationship between two measures of language processing, namely accuracy and reaction time, and measures of L2 proficiency and language exposure. The language processing data were collected using a phrasal decision task, L2 proficiency was measured using a short English language proficiency test, while the measures of language exposure were collected using a sociodemographic questionnaire. The participants (N = 96) in the study were L2 speakers of English whose first languages were Croatian or Slovenian. The results show a statistically significant correlation between general L2 proficiency and both measures of processing. A more in-depth analysis of the correlations between accuracy and subcomponents of the proficiency test (vocabulary, grammar, spelling, reading) yielded mixed results, while reaction times were significantly correlated with all four components of the proficiency test in Experiment 1 and three out of four components in Experiment 2. The number of years spent learning English as an L2 was found to be reliably correlated with measures of processing (reaction times, specifically) and L2 proficiency in both experiments. The findings of the study indicate that both global and componential aspects of L2 proficiency, as well as cumulative learning experience, play critical roles in the ability of L2 speakers to process adjective–noun collocations.

KEYWORDS:

adjective–noun collocations, English as an L2, L2 proficiency, multiword expressions, non-native processing

INTRODUCTION

Collocations are often recognized as a central component of linguistic competence, both in first and second language use, which is in part due to their compositional nature, which brings together lexical choices and syntactic structures (cf. Sinclair, 1991). In other words, the borderline nature of the phenomenon requires of the speaker to command both of these domains simultaneously, for it is often the case that in order for something to be meaningful, it must achieve not only semantic coherence but also syntactic well-formedness. It is precisely the interdependence of lexis and grammar in collocational patterning that makes collocations challenging in the context of L2 learning (Nesselhauf, 2005). In that sense, the combinatorial potential of lexical items is constrained by the syntactic framework in which it operates, making collocational knowledge dependent on more than word meaning alone; i.e. to use collocations fluently, learners must also recognize how words can be conventionally realized within broader linguistic contexts.

Given this complexity, an important question arises as to how collocational processing relates to overall L2 proficiency and its individual components. Since collocations integrate grammatical and lexical knowledge, their successful processing might correlate not only with general proficiency but also with specific linguistic subskills such as vocabulary size, grammatical accuracy, or reading ability. Furthermore, as learners differ in their exposure to and engagement with the target language, factors such as years of study or amount of input may also influence how efficiently collocations are processed. The present study, therefore, examines whether the processing of adjective–noun collocations in English as a second language is associated with general and subcomponent measures of proficiency, as well as with selected language-related sociodemographic variables.

MULTIWORD EXPRESSIONS AND COLLOCATIONS

Collocations occupy a distinct space within the broader category of multiword expressions (MWEs), which also includes idioms, phrasal verbs, fixed formulae, and lexical bundles. In particular, Gries (2008, p. 6) defines collocations as co-occurring items of various kinds “which function as a semantic unit in a clause or a sentence and whose frequency of occurrence is larger than expected on the basis of chance.” This emphasis on frequency and semantic cohesion distinguish-

es collocations from mere co-occurrences of words in text, highlighting their entrenched status in the lexicon. Unlike idioms, which are often opaque in meaning and fixed in form, collocations typically retain a significantly higher degree of semantic transparency but are conventionalized in their co-occurrence patterns. Compared to lexical bundles, which are often more extended lexical sequences than collocations, collocations are less motivated by semantic and syntactic association, and even more so by high-frequency occurrence (Biber & Conrad, 1999). In this sense, collocations represent a class of multiword units that combine regularity of form, statistical salience, and functional value in communication. Finally, one of the most important refinements in defining what exactly constitutes collocations is the measure of exclusivity, meaning that collocations are not just frequent word combinations, but those that exhibit statistically significant association strength, i.e. the tendency of two words to co-occur more often than would be expected given their individual frequencies. This distinction excludes frequent but non-exclusive sequences such as *he is* or *she works* (and the like), and instead highlights statistically significant associations that form meaningful lexical units (see Gries, 2008; Evert, 2008).

Non-native processing of multiword expressions

The research on collocations in second language learners is a growing field of investigation, raising numerous questions about how this phenomenon is used, whether and how collocational knowledge can be reliably assessed, to what extent it is acquired through processing media input or large amounts of written text, and how corpus research can contribute to the investigation of language phenomena in general (particularly in contact and learner corpus settings) (Barfield & Gyllstad, 2009). By now, it is obvious that the explanation for collocational competence goes beyond a unifactorial approach to the phenomenon but rather depends on the interplay of factors such as various corpus- and frequency-derived information, salience, congruency, and semantic transparency (Barfield & Gyllstad, 2009; Wolter & Gyllstad, 2013; Men, 2017; Gablasova et al., 2017; Jiang, 2022; Lou, 2024, among others). Additionally, in learning L2 collocations (and consequently processing them), there is a significant difference between the stages at which these mechanisms take place, i.e. unlike native speakers, post-childhood L2 learners often decompose collocations into individual lexical units when first encountered, which can later lead to difficulties in recombining them appropriately (see

Wray, 2002: 209–212). Having a precise insight into this persistent challenge in lexical decision-making that arises during collocational development is crucial to understanding how learners progressively develop their L2 collocational competence over time, including the lexical and sociocultural implications for effective collocation learning in general (cf. Barfield, 2009).

The role of frequency, as an integral aspect of defining collocational phenomena, has been widely examined in relation to second language competency and acquisition by different researchers (Durrant, 2008; Siyanova & Schmitt, 2008; Wolter & Gyllstad, 2013; Szudarski & Conklin, 2014; Yi, 2018; Pellicer-Sánchez et al., 2022, among others). As early as 2008, Durrant concluded that not all frequent collocations are necessarily equivalently represented, though high-frequency occurrence still plays a role with respect to the mental lexicon of the learner; in particular, collocational learning from input is possible, particularly with repeated exposure, but the usual scarcity and unevenness of input limit the emergence of native-like collocational competence. In other words, frequency information is helpful, but it is not sufficient on its own, and one must additionally account for salience, discourse relevance, L1 and L2 interaction, etc. Wolter & Gyllstad (2013) showed that both native (L1) speakers and advanced L2 speakers show faster processing (i.e. lower reaction times) for high-frequency collocations compared to low-frequency ones. More importantly, the results indicated that when collocations are highly frequent, the effect of individual word frequency (especially that of the noun in the collocation) becomes weaker for both L1 and L2 participants, meaning that, as a collocation becomes more entrenched, processing depends more on the whole phrase than its individual parts (*ibid.*).

The second major aspect, apart from frequency, is the effect of congruency; that is, the question is whether or not collocations that have an equivalent pattern or construction in the learner's first language (L1) are more easily processed. Again, the data are more or less similar on these issues, with a number of studies indeed clearly showing that L2 participants process congruent collocations more easily (i.e. faster) than incongruent ones, indicating significant transfer from L1 (Wolter & Gyllstad, 2013; Fang & Zhang, 2021; Jiang, 2022; Chen, 2024; Lou, 2024, among others). Additionally, congruency does not seem to operate in isolation, with proficiency also playing a significant role in shaping how learners handle collocations. The congruency effect tends to be stronger for lower- and intermediate-proficiency learners, who rely more heavily on L1-based processing strategies. At higher levels of proficiency, the advantage of congruency dimin-

ishes as learners become more sensitive to L2-specific frequency distributions and develop greater independence from L1 transfer (Lou, 2024). In other words, while congruency facilitates processing at earlier stages, continued exposure and increasing proficiency enable learners to gradually overcome L1 influence and approximate native-like patterns of collocational knowledge and use.

In this sense, language competence (or proficiency in the L2 context) needs to be singled out on its own as probably the most well-researched, if not the most impactful, factor in language processing. In fact, due to the obvious and well-documented link between L2 proficiency and L2 processing, proficiency is often treated as a mediating factor in studies of second-language comprehension and production. It is frequently included as a covariate or controlled variable in order to isolate other influences on processing performance and to better understand what else, aside from general proficiency, may affect non-native language processing (Clahsen & Felser, 2006; Hopp, 2015; Cunnings, 2017). A considerable body of research shows that more proficient L2 users process linguistic input more efficiently and more “natively”, demonstrating more automatic parsing of multiword sequences and sentence structures (Osterhout et al., 2000; Kotz & Elston-Güttler, 2004; Liu, 2009; Gao & Sun, 2025, etc.), although there can be a point at which the difference in L2 competence passes the point at which grammatical sensitivity can be detected and where ceiling effects come into play (Tokowicz & MacWhinney, 2005; Gao & Sun, 2025). Additionally, the sole measure of reaction time is not necessarily a clear indicator of processing ability because deep syntactic or morphological decomposition relies on more thoughtful structural analysis by the learners; i.e. some research also clearly indicates that highly proficient L2 learners engage in manifest rule-based decomposition, as opposed to less proficient L2 learners who rely more on lexical storage (Liang & Chen, 2014). Nevertheless, the findings collectively support the notion that proficiency shapes the depth and automaticity of syntactic and lexical processing, with lower-proficiency learners relying more heavily on lexical-semantic cues and surface information rather than fully detailed syntactic representations.

When it comes to experimental data, a number of indications exist that priming bears less of an effect with decreasing target language proficiency, or no effect at all (see Zeng et al., 2019; Cai et al., 2021; Kim & Hwang, 2025; Hopp et al., 2025), especially when it comes to morphological priming (Liang & Chen, 2014; Viviani & Crepaldi, 2022; Wanner-Kawahara et al., 2022; Wanner-Kawahara et al., 2025). In particular, a meta-study by Fernandes et al. (2023) which evaluat-

ed morphological priming effects by looking at masked priming lexical decision studies, found that there is a downward trajectory across proficiency levels, where only native speakers remain morphologically aware, whereas higher-proficiency learners are more likely to show morphological priming, though with an overall tendency of L2 learners to rely more on the orthographic overlap in general regardless of proficiency. In the context of experimental research, we already know that reaction times (RTs) are influenced by multiple factors, such as proficiency and dependency distance (DD). Interestingly, Gao and Sun (2025) found that as DD increases, advanced learners' word-level processing times increase at a slower rate than those of intermediate learners, thus suggesting that advanced learners can manage longer dependencies more efficiently, likely because their greater linguistic knowledge allows them to allocate cognitive resources more effectively and to integrate information into a more comprehensive understanding of the expression. One of the possibilities that is not necessarily discussed at length, but remains nonetheless worthy of consideration, is that L2 proficiency can be an indicator itself of other cognitive skills, if not the overall general intelligence factor (which again translates to other cognitive subdomains). For example, in their priming experiment dealing with whether cross-domain effects (in their case, mathematical expressions and relative clauses), Lei & Wang (2025) found that more advanced learners are better able to leverage structural similarities between mathematical expressions and linguistic relative clauses to facilitate comprehension. In other words, cross-domain structural priming appears to be moderated by L2 proficiency, with higher-proficiency learners showing significantly stronger priming effects in terms of sentence comprehension, thus suggesting that they maintain more abstract representations that support structural transfer from arithmetic to language.

Furthermore, there remains a notable gap in research directly linking specific subdomains of L2 proficiency (such as vocabulary breadth, grammatical knowledge, and morphosyntactic sensitivity) to processing speed in online comprehension and production, particularly in the domain of collocational or multiword processing. Some studies focusing on the lexical dimension (e.g., Daidone & Darcy, 2021; van Zeeland & Schmitt, 2013; Pellicer-Sánchez et al., 2024) are indicative of the fact that larger vocabulary size and richer lexical representations predict faster and more accurate lexical access, which should, in turn, facilitate smoother sentence-level processing. Similarly, research on grammatical competence (Hopp, 2013; Sagarra & Herschensohn, 2010) suggests that sensitivity to morphosyntac-

tic regularities increases with proficiency, allowing learners to integrate syntactic and semantic information more efficiently in real time. However, empirical work connecting these subcomponents of proficiency to collocational processing (how L2 learners recognize and produce multiword units) is still limited, leaving open questions about how specific dimensions of proficiency jointly shape the processing of formulaic or phrasal patterns in a non-native context.

RESEARCH QUESTIONS AND HYPOTHESES

The experiments conducted in this study were a part of a larger project on processing multiword expressions, specifically compounds and adjective–noun collocations in English as an L2. Nominal compounds and adjective–noun collocations represent an interesting phenomenon for both applied and theoretical linguistics due to their ubiquity and the fact that they represent an area of overlap in the so-called lexicon–syntax divide (cf. Giegerich 2005). The *-er* nouns used in this study were selected to allow a more direct formal comparison of the two constructions, as both standalone *-er* nouns (e.g. *player*) and *-er* compounds (e.g. *babysitter*) are highly frequent and productive in English.

The analysis presented here aimed to test whether and to what extent processing of adjective–noun collocations is affected by L2 proficiency and other inter-participant variables. Taking into consideration that L2 proficiency is a multifaceted construct encompassing grammatical, lexical, and orthographic knowledge, the present study seeks to determine whether the processing of adjective–noun collocations in English as a second language is more strongly associated with specific subcomponents of proficiency (namely, grammar, vocabulary, reading, or spelling ability) and, if so, which domains exert the strongest influence on processing efficiency.

In addition, we look into language-related sociodemographic variables, such as the number of years spent studying English, so as to explore how accumulated exposure and learning experience contribute to variability in collocational processing. The picture which emerges from the results of studies presented in the previous section is that L2 proficiency, operationalized either as the score on a test or the amount of time spent studying a particular language or spent in an L2-immersion context, is evidently a significant factor in L2 processing of multiword expressions. The aim of this study is to extend this analysis to South

Slavic languages (namely, Croatian and Slovenian) and check whether this correlation holds for native speakers of these languages. This language group has been relatively neglected in the studies of this type, which highlights the necessity for conducting studies like this with native speakers of these languages.¹ With the study presented in this paper, we want to answer the following research questions:

1. Is the processing of adjective–noun collocations in English as an L2 correlated with L2 proficiency?
2. Is processing of adjective–noun collocations in English as L2 more strongly correlated with any of the subcomponents of L2 proficiency (grammar, vocabulary, reading, spelling) and, if so, which ones?
3. Are measures of processing of adjective–noun collocations or L2 proficiency correlated with any of the language-related sociodemographic variables (e.g. number of years spent studying English)?

We hypothesize that the general score on the English proficiency test will be strongly correlated with both measures of processing (accuracy and reaction time), and we expect that this link will be particularly strong for the vocabulary and reading parts of the test, as these components are most directly involved in tasks such as those used in the experiment. With regards to RQ3, our hypothesis is that L2 proficiency is positively correlated with the number of years spent studying English, while the correlation between measures of processing and number of years spent studying English is mediated by L2 proficiency, i.e. that they are not independently correlated.

¹ An anonymous reviewer has pointed out that the two groups of speakers (Croatian and Slovene) in the study differed from each other in multiple aspects, such as age, level of education, and modality in which the study was conducted. While all of this is true, the main idea behind the study was not to directly compare the two groups of speakers, but to see whether the same correlations emerge with these two groups of non-native speakers, i.e. whether the measures of processing will be correlated with the same or similar variables in two different groups of speakers.

METHODOLOGY

Participants

The participants took part in the experiment both in live and online conditions. Croatian native speakers were recruited for live participation at the University of Zadar, Croatia, and the Juraj Dobrila University of Pula, Croatia. Slovenian native speakers were recruited for online participation via the Prolific platform. A total of 66 Croatian native speakers (M = 3, F = 60, other = 3) and a total of 30 Slovenian native speakers (M = 11, F = 22, other = 1) took part in the study. The mean age was 20.73 for Croatian native speakers (range: 16–18) and 24.94 for Slovenian native speakers (range: 22–30). Croatian native speakers were enrolled in the BA (87.9%) and MA level of studies (12.1%), while Slovenian native speakers were enrolled at the BA level (33.33%), MA level (63.3%) and PhD level (3.3%). All Slovenian speakers were residents of Slovenia at the time of study.²

The participants received academic or financial compensation for participation in the experiment. The participants were informed about their rights (anonymity/confidentiality, voluntary participation), the nature of the study and its general aim in writing in the form of a consent form (live sessions) or study description (online sessions), and orally by the researcher at the beginning of every live session.

Stimuli

The stimuli for the experiments were collected using the UkWac corpus (Baroni et al., 2009), available via the NoSketch Engine interface. The collocations were retrieved by selecting the appropriate *-er* nouns³, which served as nodes, and conducting the filtering procedure to select only the adjectives located in the 2L window (i.e. occurring one or two words before the noun) and measuring their association strength using the in-built tools in the NoSketch Engine interface,

² An anonymous reviewer has pointed out that a more detailed profile of English language exposure would be beneficial. This question was unfortunately not the main point of interest of this paper, which is why these data were not collected from the participants.

³ The study presented in this paper was conducted as a part of a larger project which focuses on factors which influence processing of English *-er* nominals, which is why all nouns in the study contained the suffix in question. The methods presented in this section could just as easily be used for analyzing other types of nouns or word-class combinations.

specifically the logDice value.⁴ For every *-er* noun, we used one adjective with a moderate-to-high logDice value (6 or above) and one adjective with a low value (below 0)⁵, as shown in Table 1. This gave us a sample of 54 pairs of adjective–noun phrases, i.e. 108 phrases in total.

TABLE 1. Examples of adjective–noun collocations with strong and weak association

Adjective	Noun	logDice
absolute	beginner	8.7571
quick	beginner	-0.07178
compulsive	shopper	6.52508
primary	shopper	-0.14831

For each adjective–noun phrase, we created three types of primes according to which the collocations were assigned to different conditions in the experiment – Morphological, Orthographic, and Unrelated. In the Morphological condition, the prime was the verb that the deverbal head noun is derived from (WRITE – WRITER); in the Orthographic condition, the prime was a word which was orthographically similar to the verb that the head noun is derived from but is completely unrelated to it (LONE – LOVER); and in the Unrelated condition the prime was a word completely unrelated to the head noun (IMAGE – ROBBER). The final list of 108 adjective–noun phrases collected (see Appendix A) was balanced across six lists so that every head noun occurred in a condition only once, either with an adjective with a strong association (e.g. *prolific writer*) or with an adjective with a weak level of association (e.g. *objective writer*), as shown in Table 2. The mean length of all adjective–noun phrases was 15.8 characters (SD = 2.75).⁶

⁴ For a detailed analysis of differences between different measures of association between words, see Gablasova et al. (2017).

⁵ According to Rychlý, the maximum value of logDice is 14, but the value is usually less than 10. Words with a logDice value of 7 and above are considered strong associates, while words with association values below 0 are not significantly associated.

⁶ The experiments from which the data in this study were used were conducted as a part of a research project on processing of multiword expressions. The conditions presented here were used in the experiments to test the effects of morphological relatedness, but they were not directly relevant for the study in this paper and are reported here only for the sake of clarity.

TABLE 2. Example of prime–target pairs across different experimental lists

Prime	Target	Association strength	Condition
WRITE	PROLIFIC WRITER	Strong	Morphological
WRITE	OBJECTIVE WRITER	Weak	Morphological
WRIST	PROLIFIC WRITER	Strong	Ortho
WRIST	OBJECTIVE WRITER	Weak	Ortho
REAL	PROLIFIC WRITER	Strong	Unrelated
REAL	OBJECTIVE WRITER	Weak	Unrelated

In addition to the 54 experimental items, a list of 64 filler items was created using the Unipseudo generator (New et al., 2024), a tool that uses the existing phrases and corpus-collected words as models for the algorithm for generating prime and target phrases. The length of all filler items was equal to the average length of experimental items.

English language proficiency test

The proficiency test used in the study was designed to allow for relatively quick and highly reliable collection of data on L2 proficiency.⁷ The test was used in conjunction with a questionnaire, which was used to collect the basic sociodemographic information and data on learning experience from the participants. The questionnaire contained seven questions about the participants' gender, age, native language, level of studies, and number of years spent learning English, while the proficiency test contained 40 multiple-choice questions aimed to gauge four different aspects of L2 proficiency – vocabulary, spelling, reading comprehension, and grammar. In order to make the results more valid for the context of language processing experiments, the participants had a finite amount of time to go through the entire experiment (12 minutes in total). To confirm the validity of the test, the results collected from it were compared to the results obtained by the Oxford Placement Test and they showed a moderate to strong correlation between the results of the two tests.⁸ Every participant in the study completed the profi-

⁷ For more details about the validity and the internal consistency of the proficiency test used in this study, see Gugić et al. (in review).

⁸ An anonymous reviewer has asked why an established proficiency test (such as the Oxford Quick Placement Test) was not utilized to measure proficiency instead of a self-developed test. While this is a fair point, the explanation of our methodological choice lies in practicality and potential participant fatigue – our aim was to use a test that can be easily used in the online environment and would not be

ciency test after finishing the experiment. An example of tasks for each section of the proficiency test is shown in Table 3.

TABLE 3. Tasks with instructions divided by test sections.

Section	Task instruction	Example of tasks
Vocabulary	<i>Choose the most suitable word.</i>	Sam was _____ tired that he couldn't keep his eyes open. very too so extremely
Spelling	<i>Chose the word which is correctly spelled.</i>	The show has _____ mostly positive reviews. received recieved receved
Reading comprehension	<i>For each sentence choose an explanation below.</i>	I couldn't help but notice your beauty. It happened, although I didn't want to. I wanted people to notice it, but I couldn't help them. It can't be noticed.
Grammar	<i>Choose the most appropriate words.</i>	We are looking forward to _____ you soon. a. see b. seeing c. have seen d. be seeing

Procedure

The experiments were conducted using the PCIBex farm tool (Zehr & Schwartz, 2018). The local experiments were all conducted in a large, well-lit room equipped with personal desktop computers with no external visual or auditory distractions. The number of participants per live session was six or fewer. The procedure for the experiment and the description of trials were provided at the beginning of every session, followed by several practice tasks and a break before the session with the experimental conditions. The participants in the online experiments completed the experiment in individual sessions in their personal space with no audi-

too demanding in terms of time. Our estimate was that integrating a test like the one suggested by the reviewer in a digital format may ultimately prove to be more time-consuming. However, the question of whether that particular test would provide more reliable data is worth investigating further.

tory or visual external distractions.⁹

To test the speed and accuracy of collocation processing, we used a phrasal decision task with masked priming, which entails exposure of participants to prime stimuli at speeds which do not allow conscious processing, typically 42 to 60 ms. The prime is preceded by an intervening forward mask and is immediately followed by the target stimulus (Kinoshita & Lupker, 2010; Forster & Azuma, 2000). Every trial started with a fixation cross, followed by the forward mask '#####' in the duration of 500 ms, a masked prime in the duration of 60 ms, and the target phrase for which the participants were supposed to press the corresponding keys on the keyboard as quickly as possible. The participants were instructed to answer whether they thought the sequence of letters shown on the screen was a valid phrase in English. After the non-native participants completed the experiment, they were directed to the demographic questionnaire and the English proficiency test (§4.2). The whole procedure took about 30 minutes from the beginning to the end.

RESULTS

The experimental data and the results of the L2 proficiency test were collected from the PCIBex farm and Microsoft Forms websites and were imported into R (R Core Team, 2015) for data wrangling and data analysis using the *tidyverse* package (Wickham et al., 2019). The data collected from the proficiency test included the total number and percentage of correct answers for each section and the whole test, and the duration for each section and the whole test. The data from the experiment included accuracy and reaction times for every observation and overall accuracy for every participant, which was calculated as the percentage of all items (including filler items) for which a correct answer was recorded.

Experiment 1 (Croatian)

In the first experiment, conducted with Croatian speakers, we looked at the correlations between two indicators of processing – accuracy and reaction times. The collected data had to be filtered out using different procedures based on the

⁹ The participants were instructed to provide a space in which they can guarantee no disturbances, but the assurance of implementation of these conditions was left to their discretion.

type of correlation that was analysed. Specifically, for correlation between accuracy and other variables, we filtered out the data to remove those participants whose total accuracy was below 60%, as these participants could not be regarded as reliable (1785 observations, 15 participants). The remaining observations were aggregated per participant and condition so that each participant provided four observations. In terms of accuracy, we looked at the correlations between total accuracy (all items, including fillers)¹⁰ and the results on the proficiency tests and its subcomponents (vocabulary, spelling, reading, grammar), the number of years the participant had spent learning English, the age of the participants, and the total amount of time it took the participant to complete the proficiency test. The summary of values filtered out this way is shown in Table 4.

TABLE 4. Mean scores and standard deviations for analysed variables in Experiment 1

	Mean	SD	Min.	Max.
Total Accuracy (%)	83.51	10.51	59.66	98.32
Total Proficiency (%)	72.84	13.14	42.5	95
Vocabulary (%)	82.94	18.40	30	100
Spelling (%)	69.41	17.76	30	100
Reading (%)	78.82	21.48	20	100
Grammar (%)	60.20	17.43	10	90
Years Learning English	14.04	2.41	8	20
Age	20.73	1.73	18	25

Accuracy was significantly correlated¹¹ with the results of the entire proficiency test ($p < .001$), the vocabulary ($p < .001$) and grammar ($p < .01$) subsections of the test, with the number of years spent learning English ($p < .001$) and participants' age ($p < .001$), and as can be seen in Figure 1, the correlation is strong for

¹⁰ Anonymous reviewers have pointed out that the inclusion of observations from fillers in the analysis of accuracy and their exclusion from RT analysis creates an asymmetry between the two dependent measures. While we agree that this double-sided approach seems arbitrary at first glance, we find it conceptually justified as the overarching goal of the experiments used in this study (not reported in this paper) is the analysis of factors which influence the processing of multiword expressions (cf. §4.2). In that respect, it makes sense to analyze the reaction times by condition and to exclude fillers from the analysis as they are not multiword expressions (cf. Appendix C). On the other hand, it makes sense that the overall accuracy, which is the measure used in our study, encompasses both fillers and experimental items as it is indicative of their general precision in distinguishing valid from invalid expressions.

¹¹ Correlation was tested using Pearson's correlation coefficient in the Hmisc package (Harrell 2026) in R.

all mentioned variables.¹² Accuracy was found to be negatively correlated with total duration of the proficiency test ($p < .05$), while there was a strong positive correlation between total proficiency and number of years spent learning English ($p < .001$) and age of participants ($p < .001$), as well as an almost perfect negative correlation between total duration and results on the proficiency test ($p < .001$).

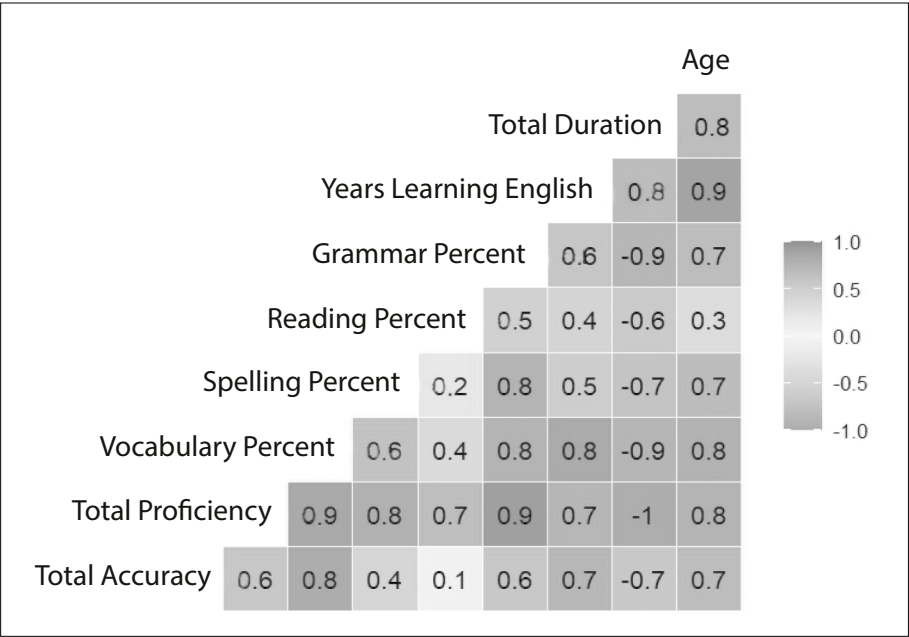


FIGURE 1. Matrix with correlation strength for accuracy in Experiment 1 (Croatian)

To test the potential correlation between the mentioned variables and reaction times in the experiment, several additional filtration steps were conducted. In addition to removing all participants whose overall accuracy was below 60%, we also removed all observations for which an incorrect response was given (1001 observations) and all observations that were not within the 50–2000 ms range (720 observations), as well as all filler items, which resulted in a total dataset

¹² The matrix in Figure 1 (and the remaining figures throughout the paper) shows the strength of correlation, but not its statistical significance. While the two are closely interrelated, there are variables for which a relatively strong correlation effect is obtained without it being statistically significant (e.g. the correlation between total accuracy and spelling has a moderate correlation coefficient of 0.4 but is not statistically significant).

of 1914 observations. The visual inspection of histograms of the remaining RT values showed that the data were close to normal. Even though the Shapiro–Wilk test showed significant deviation from normality of the dataset, any potential data transformations (square-root values, log-transformed values, inversely-transformed values) yielded the same result, which is why we used the untransformed values in subsequent analyses. The values were aggregated across each condition and participant, so that each participant provided three observations. These observations were included in the correlation analysis with the results of the proficiency test, its subcomponents and the demographic variables. Reaction times were found to be in significant negative correlation with the results of the entire proficiency test ($p < .001$) and all of its subsections – vocabulary ($p < .05$), spelling ($p < .001$), reading ($p < .001$) and grammar ($p < .001$) subsections of the test, and with the number of years spent learning English ($p < .05$) and participants’ age ($p < .05$). Similarly to accuracy, a statistically significant positive correlation was noted with the amount of time spent on the proficiency test, meaning that participants who took longer to complete the test were also slower in their responses in the experiment. The results of the proficiency test were significantly correlated with the number of years spent learning English ($p < .001$) and the age of participants ($p < .001$).

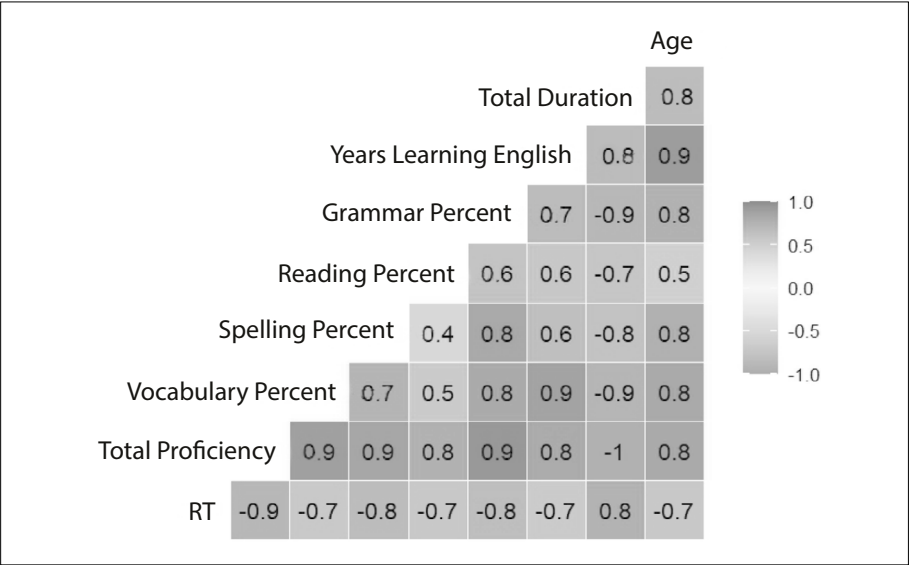


FIGURE 2. Matrix with correlation strength for reaction times in Experiment 1 (Croatian)

Experiment 2 (Slovenian)

The data collection and data pruning procedure were the same for Experiment 2, which was conducted online with Slovene participants. As with Experiment 1, we first looked at the correlation between accuracy and the results of the proficiency test and the demographic variables. Since all participants had a total accuracy higher than 60%, no observations were removed during this step. If we compare the summary statistics in Table 5, with those for Experiment 1, we can see that the participants in this experiment were on average older (24.93 vs. 20.73), had spent more time learning English (15.35 vs. 14.04), achieved higher scores on the proficiency test (82.21 vs. 72.84), and had higher accuracy in the experiment (91.99 vs. 83.51).

Table 5. Mean scores and standard deviations for analysed variables in Experiment 2

	Mean	SD	Min.	Max.
Total Accuracy (%)	91.99	6.15	66.39	99.16
Total Proficiency (%)	82.21	9.01	57.5	100
Vocabulary (%)	92.94	9.56	60	100
Spelling (%)	73.53	21.27	30	100
Reading (%)	91.47	8.45	30	100
Grammar (%)	70.88	16.87	70	100
Years Learning English	15.35	4.41	20	100
Age	24.94	2.10	9	25

We used the same aggregation procedure as in Experiment 1, so that each participant provided one observation per variable. While the accuracy scores in Experiment 2 were significantly correlated with the results of the proficiency test ($p < .05$), accuracy was not correlated with any of the remaining variables used in the analysis, except for the spelling subsection of the proficiency test ($p < .001$). We also found a statistically significant positive correlation between the results of the proficiency test and the number of years spent learning English ($p < .05$).

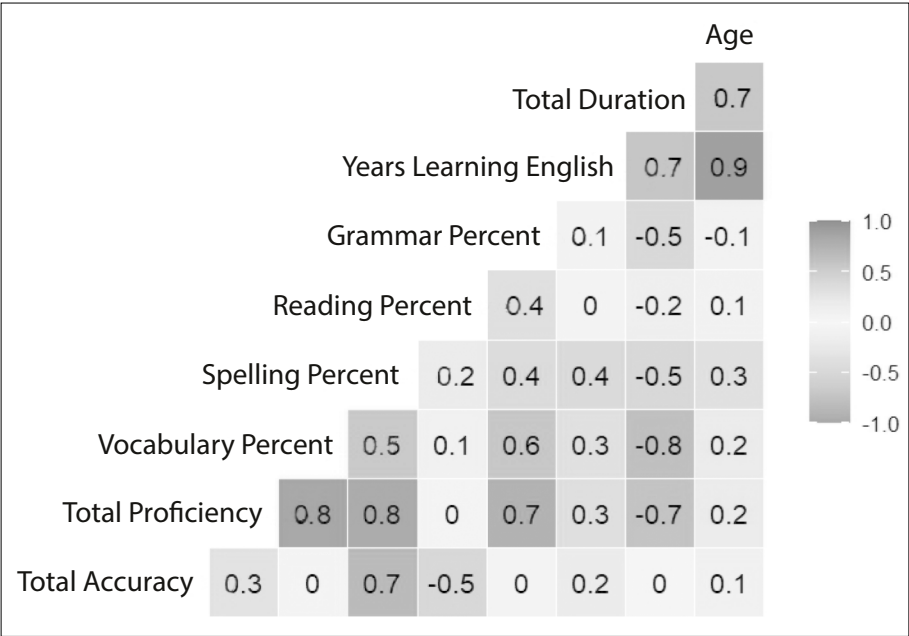


FIGURE 3. Matrix with correlation strength for accuracy in Experiment 2 (Slovenian)

As with the data in Experiment 1, in order to test the correlation with RT values, we further pruned the dataset to remove all observations for which an incorrect response was given (249 observations) and all observations that were not within the 50–2000 ms range (233 observations), as well as all filler items, which resulted in the total dataset of 1134 observations. The remaining RT values were aggregated across each condition and participant so that each participant provided three observations. The reaction time was significantly correlated with the results of the proficiency test and three out of four of its subcomponents – vocabulary ($p < .01$), spelling ($p < .001$), and grammar ($p < .001$), as well as with the number of years spent learning English ($p < .05$), but not with the age of participants. As with Experiment 1, the amount of time spent solving the proficiency test had a strong positive correlation with RT values ($p < .001$) and a strong negative correlation with the results on the proficiency test ($p < .01$). The L2 proficiency values were significantly correlated with the number of years spent learning English ($p < .05$) but not with age.

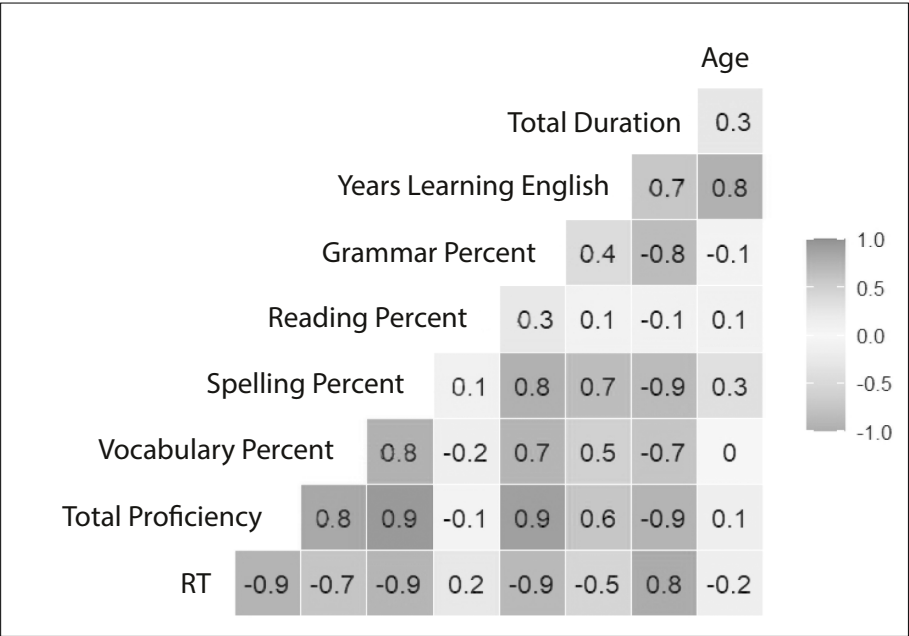


FIGURE 4. Matrix with correlation strength for reaction times in Experiment 2 (Slovenian)

DISCUSSION

The study in this paper set out to assess a potentially meaningful connection between the processing of adjective–noun collocations in English as L2 and the results of a proficiency test and its subcomponents and/or sociodemographic factors such as age and the number of years spent studying English. We also examined whether these sociodemographic variables are correlated with the results on the proficiency test.

With regards to RQ1 (cf. §3), we see a statistically significant correlation between both measures of processing and L2 proficiency. Specifically, we observed a positive correlation with accuracy and a negative correlation with reaction times, meaning that participants who got a higher score on the proficiency test were, on average, more accurate and faster in their responses. While the negative link between accuracy and RT was shown to be strong in both experiments, the strength of correlation with accuracy was visibly lower in Experiment 2 than in Experiment 1, and we attribute this difference to the difference in the dispersion

of proficiency scores. The difference in the two datasets can be seen in Table 4 and Table 5, but also from the scatterplots in Figure 5, which clearly show that the two datasets are distributed differently. Both sets of values from Experiment 1 are more evenly dispersed across the whole continuum of values, with the majority of them following the linear trend indicated by the confidence interval (lime green area). On the other hand, the majority of values for Experiment 2 are clustered tightly together around the upper right corner (i.e. intersection of 90% accuracy and 80–90% L2 proficiency) with a small number of outliers towards the lower left corner of the scatterplot, which increase the confidence interval and reduce the strength of correlation.

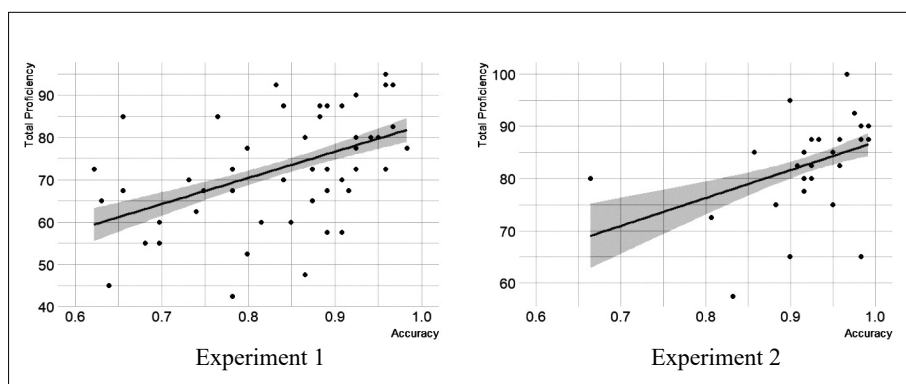


FIGURE 5. Scatterplots of L2 proficiency and accuracy in both experiments

An even bigger discrepancy between the two groups of participants comes from the data pertinent to our RQ2 – while accuracy was correlated with the vocabulary and grammar sections of the proficiency test in Experiment 1, it was correlated only with spelling in Experiment 2. On the other hand, the data on the correlation of RT and L2 proficiency scores show a higher level of agreement between the two groups, as all sections of the proficiency test were strongly correlated with RT in Experiment 1, while this was also true for three out of four sections in the Experiment 2 dataset. While there is no definite answer for the discrepancy in terms of accuracy, this may be attributed to a combination of ceiling effects and a relatively lower number of data points in Experiment 2, as can be seen from Figure 6. The results reinforce the well-established relationship between L2 proficiency and processing efficiency in general, confirming that learners with higher proficiency demonstrate faster collocational recognition. The significant correlations

between vocabulary and grammar scores and both accuracy and reaction times (especially in Experiment 1) indicate that these proficiency subdomains contribute to more automatized access and integration of linguistic information. This pattern is consistent with earlier studies showing that richer lexical representations (Daidone & Darcy, 2021; van Zeeland & Schmitt, 2013; Pellicer-Sánchez et al., 2024) and greater grammatical sensitivity (Hopp, 2013; Sagarra & Herschensohn, 2010) facilitate smoother real-time comprehension. The fact that higher proficiency levels can generally yield more native-like, automatic processing is not necessarily surprising and aligns well with previous research (see Osterhout et al., 2000; Kotz & Elston-Güttler, 2004; Liu, 2009; Gao & Sun, 2025).¹³ On the other hand, the possibility of ceiling effects must also be acknowledged when it comes to the observed disproportion in correlation effects between the two experiments, as beyond a certain threshold, differences in grammatical sensitivity may become less detectable (cf. Tokowicz & MacWhinney, 2005).

¹³ As one reviewer suggests, the inclusion of a native-speaker control group would significantly strengthen the theoretical contribution and provide a clearer frame of reference for interpreting the results. Such an addition would allow for a stronger argument regarding facsimile processing patterns shared by high-proficiency learners and native speakers. In other words, the question remains whether the impact of the observed effects reflects more general cognitive differences rather than language-specific mechanisms. Further follow-up studies would benefit from incorporating such a control group, should they aim to enhance the explanatory scope and robustness of their conclusions.

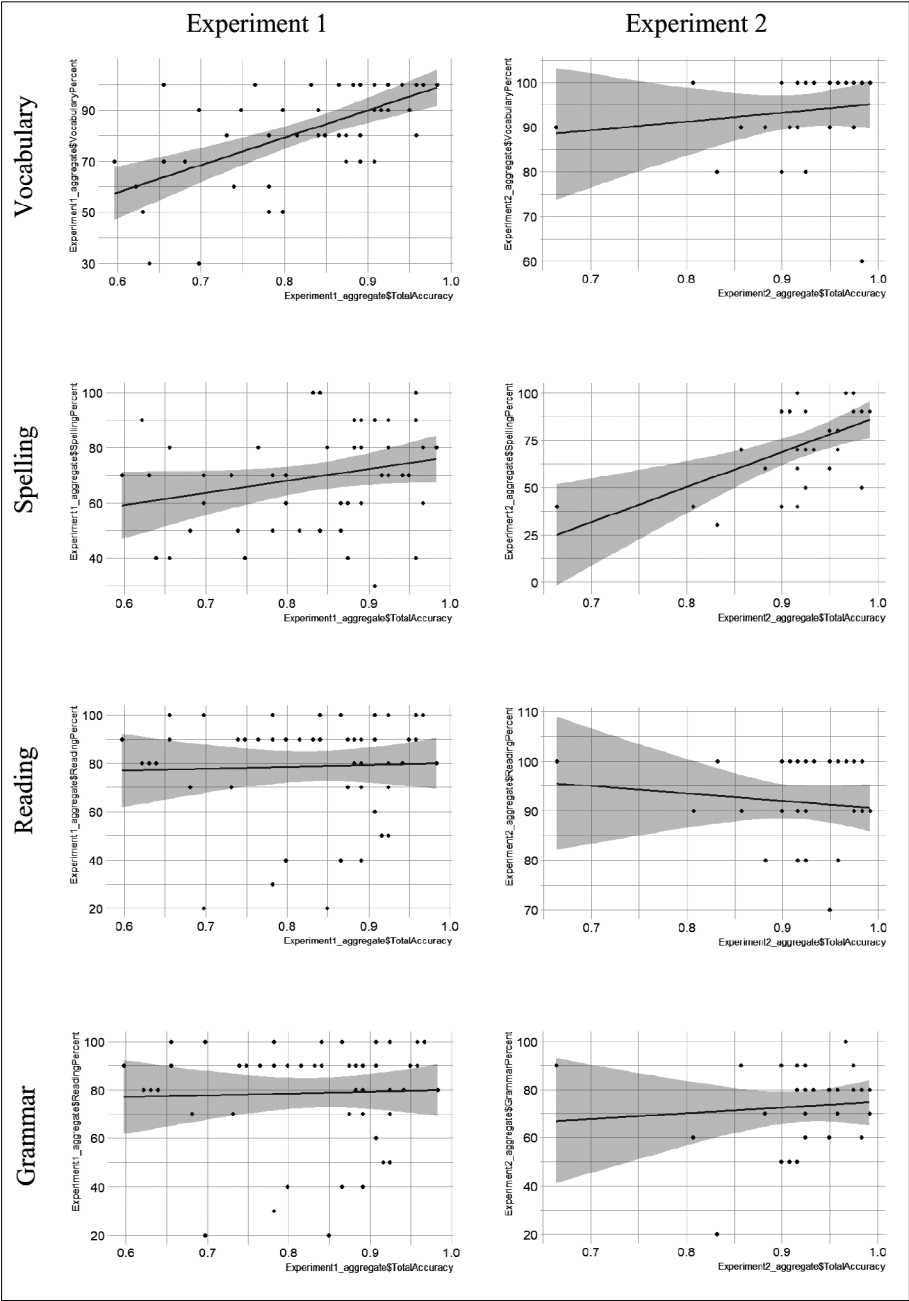


FIGURE 6. Scatterplots of the components of the L2 proficiency test and accuracy in both experiments

However, a more important finding is that reaction time turns out to be a far more reliable indicator of L2 proficiency, as it is strongly correlated with all (Experiment 1) or most of the L2 proficiency components (Experiment 2), in addition to the proficiency test as a whole. It is also quite telling that the time taken to complete the proficiency test was very strongly correlated with reaction times in both experiments ($p < .001$ in both), and this value had an almost perfect negative correlation with the proficiency score in both experiments. In other words, the more advanced learners of English as an L2 were faster in both the experimental tasks and the tasks on the L2 proficiency test, which would indicate that increasing the knowledge of English as L2 automatically increases the speed at which we process the linguistic input. Again, the finding that slower reaction times correlated with longer proficiency test durations is relevant in relation to accuracy results and the potential mediating role that proficiency plays in understanding how L2 users engage with formulaic collocational language in real time. In other words, while faster processing often signals automatization, deliberate structural analysis can also characterize advanced processing strategies. In comparison to Liang and Chen (2014), the results obtained in our study do not reflect the idea that highly proficient learners engage in more analytical, rule-based decomposition rather than relying solely on stored lexical knowledge. If anything, they might suggest that the strategy for achieving the best results accuracy-wise is one that is more intuitive rather than analytical.

With regards to the third research question, there seems to be a strong general finding – the number of years spent learning English as L2 is more reliably correlated with measures of processing (RT specifically) and L2 proficiency than age, and this is particularly visible in Experiment 2. With data from Experiment 1, both measures of processing and the overall L2 proficiency score are significantly correlated with the sociodemographic variables. On the other hand, the only correlation between measures of processing and sociodemographic variables in Experiment 2 is that between reaction times and time spent learning English ($p < .05$), while L2 proficiency is also correlated with time spent learning English ($p < .001$) and age ($p < .05$). This is a somewhat expected result, but still a positive one from the perspective of formal systems of language learning as it provides a reliable confirmation of the importance of the educational system for reaching higher levels of language proficiency.

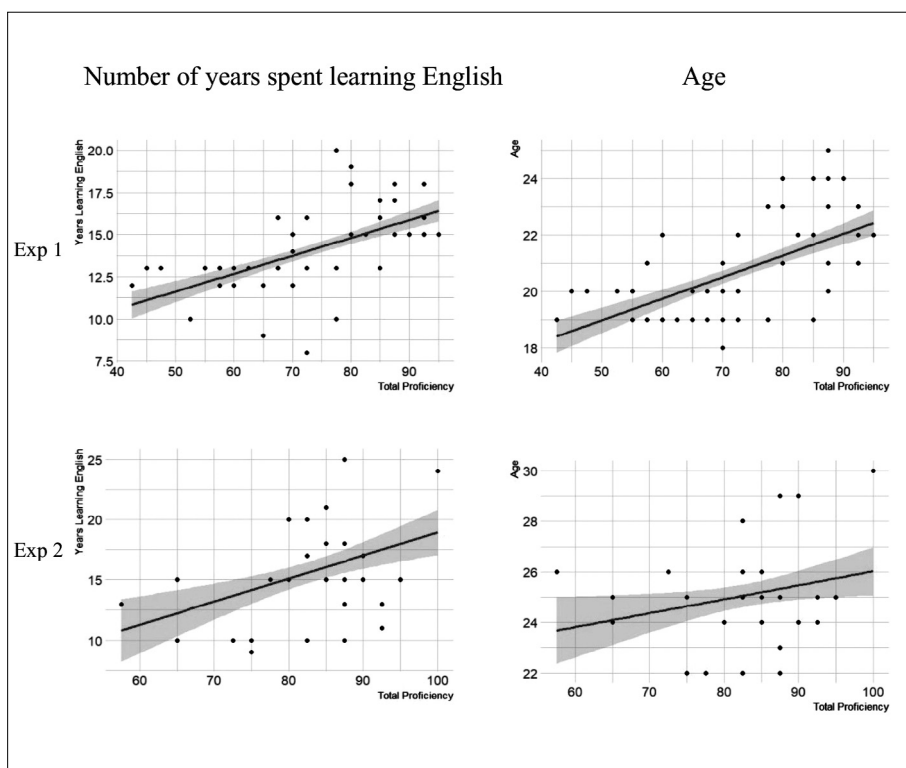


FIGURE 7. Scatterplots of sociodemographic variables and L2 proficiency in both experiments

In line with previous studies, the results underscore the importance of viewing proficiency not merely as a background variable but as a central mediating factor in L2 processing studies (cf. Clahsen & Felser, 2006; Hopp, 2015; Cummings, 2017). Additionally, the correlations with years of learning English and age suggest that extended exposure and cumulative linguistic experience consolidate these processing advantages over time, thus supporting the notion that proficiency mediates both the accuracy and fluency of multiword processing in L2 learners. To conclude, follow-up studies ought to disentangle linguistic competence from general processing efficiency more directly, perhaps by employing alternative proficiency measures that are not necessarily timed. This might situate componential proficiency effects more explicitly within specific models of L2 processing and collocational representation and extend the present findings in a more explanatory direction.

CONCLUSION

In summary, our study demonstrated that the processing of adjective–noun collocations in English as a second language is significantly associated with overall L2 proficiency, confirming that higher proficiency tends to predict both greater accuracy (Experiment 1) and faster response times (Experiments 1 and 2). Regarding specific subcomponents of proficiency, accuracy was most consistently related to vocabulary and grammar knowledge in Experiment 1, whereas spelling emerged as the strongest predictor in Experiment 2. This is consistent with earlier studies showing that greater vocabulary competence and grammatical sensitivity facilitate smoother real-time processing and understanding. More importantly, our research extends this line of evidence to the domain of collocational processing, suggesting that vocabulary breadth and morphosyntactic awareness play a joint role in the efficient retrieval of multiword expressions.

Reaction times, however, exhibited significant correlations across nearly all proficiency subdomains, suggesting that the speed of collocational processing reflects a broad proficiency effect rather than dependence on any single linguistic skill. Finally, among the language-related sociodemographic variables, the number of years spent learning English proved to be the most reliable predictor of processing efficiency, particularly in Experiment 2, while age showed a comparatively weaker link. Together, our findings highlight that both global and componential aspects of L2 proficiency, as well as cumulative learning experience, play critical roles in shaping how learners comprehend collocations in real time.

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APPENDIX A

List of stimuli (List 1)

ABSOLUTE BEGINNER	BEGIN	Morpho	12.21381	8.7571
ABSOLUTE BEGINNER	BENIGN	Ortho	12.21381	8.7571
ABSOLUTE BEGINNER	ACCEPT	Unrelated	12.21381	8.7571
ACTIVE EXAMINER	EXAMINE	Morpho	2.8773	-0.43906
ACTIVE EXAMINER	EXIT	Ortho	2.8773	-0.43906
ACTIVE EXAMINER	BELOW	Unrelated	2.8773	-0.43906
ADDICTED SMOKER	SMOKE	Morpho	13.41289	7.27106
ADDICTED SMOKER	SMOOTH	Ortho	13.41289	7.27106
ADDICTED SMOKER	SEARCH	Unrelated	13.41289	7.27106
AGGRESSIVE PLAYER	PLAY	Morpho	8.89026	7.27488
AGGRESSIVE PLAYER	PLAN	Ortho	8.89026	7.27488
AGGRESSIVE PLAYER	HEAR	Unrelated	8.89026	7.27488
ALIEN INVADER	INVADE	Morpho	12.15317	7.10856
ALIEN INVADER	INVITE	Ortho	12.15317	7.10856
ALIEN INVADER	FOCUS	Unrelated	12.15317	7.10856
ALTERNATIVE SINGER	SING	Morpho	1.28961	-0.68447
ALTERNATIVE SINGER	SINK	Ortho	1.28961	-0.68447
ALTERNATIVE SINGER	REAL	Unrelated	1.28961	-0.68447
ANONYMOUS REVIEWER	REVIEW	Morpho	11.31555	7.2193
ANONYMOUS REVIEWER	REVISE	Ortho	11.31555	7.2193
ANONYMOUS REVIEWER	METHOD	Unrelated	11.31555	7.2193
APPROPRIATE CALLER	CALL	Morpho	3.13617	-1.01047
APPROPRIATE CALLER	CULL	Ortho	3.13617	-1.01047
APPROPRIATE CALLER	IMAGE	Unrelated	3.13617	-1.01047
ARDENT LOVER	LOVE	Morpho	11.89372	7.12502
ARDENT LOVER	LONE	Ortho	11.89372	7.12502
ARDENT LOVER	ENOUGH	Unrelated	11.89372	7.12502
AVID GOLFER	GOLF	Morpho	13.27799	8.0646
AVID GOLFER	GOLD	Ortho	13.27799	8.0646
AVID GOLFER	STORY	Unrelated	13.27799	8.0646
BEAUTIFUL TEACHER	TEACH	Morpho	-0.04	-0.42
BEAUTIFUL TEACHER	TEASE	Ortho	-0.04	-0.42

BEAUTIFUL TEACHER	ENOUGH	Unrelated	-0.04	-0.42
CASUAL OBSERVER	OBSERVE	Morpho	12.4795	9.18526
CASUAL OBSERVER	OBSCURE	Ortho	12.4795	9.18526
CASUAL OBSERVER	ENOUGH	Unrelated	12.4795	9.18526
COMPULSIVE SHOPPER	SHOP	Morpho	11.67948	6.52508
COMPULSIVE SHOPPER	SHOT	Ortho	11.67948	6.52508
COMPULSIVE SHOPPER	UPON	Unrelated	11.67948	6.52508
CRAZED STALKER	STALK	Morpho	14.60122	7.17557
CRAZED STALKER	STALL	Ortho	14.60122	7.17557
CRAZED STALKER	METHOD	Unrelated	14.60122	7.17557
CURRENT COMPOSER	COMPOSE	Morpho	1.56243	-0.97184
CURRENT COMPOSER	COMPILE	Ortho	1.56243	-0.97184
CURRENT COMPOSER	ZEAL	Unrelated	1.56243	-0.97184
DEVOUT WORSHIPPER	WORSHIP	Morpho	13.52369	7.06972
DEVOUT WORSHIPPER	WARSHIP	Ortho	13.52369	7.06972
DEVOUT WORSHIPPER	FOCUS	Unrelated	13.52369	7.06972
DRY CLEANER	CLEAN	Morpho	10.93546	6.68589
DRY CLEANER	CLEAR	Ortho	10.93546	6.68589
DRY CLEANER	SEARCH	Unrelated	10.93546	6.68589
EXCELLENT DIVER	DIVE	Morpho	2.67167	-0.46026
EXCELLENT DIVER	DINE	Ortho	2.67167	-0.46026
EXCELLENT DIVER	FIELD	Unrelated	2.67167	-0.46026
FREQUENT WORKER	WORK	Morpho	0.46	-0.4
FREQUENT WORKER	WORD	Ortho	0.46	-0.4
FREQUENT WORKER	MONEY	Unrelated	0.46	-0.4
FUTURE MURDERER	MURDER	Morpho	3.89006	-1.31767
FUTURE MURDERER	MUDDY	Ortho	3.89006	-1.31767
FUTURE MURDERER	STORY	Unrelated	3.89006	-1.31767
GLOBAL EXPLORER	EXPLORE	Morpho	3.65657	-0.44556
GLOBAL EXPLORER	EXPLODE	Ortho	3.65657	-0.44556
GLOBAL EXPLORER	MAJOR	Unrelated	3.65657	-0.44556
GRAPHIC DESIGNER	DESIGN	Morpho	12.84514	10.44192
GRAPHIC DESIGNER	DECIDE	Ortho	12.84514	10.44192
GRAPHIC DESIGNER	FIELD	Unrelated	12.84514	10.44192

GREAT WANDERER	WANDER	Morpho	4.25748	-2.75087
GREAT WANDERER	WANT	Ortho	4.25748	-2.75087
GREAT WANDERER	UPON	Unrelated	4.25748	-2.75087
HARDENED DRINKER	DRINK	Morpho	13.0299	7.61822
HARDENED DRINKER	DRILL	Ortho	13.0299	7.61822
HARDENED DRINKER	MAJOR	Unrelated	13.0299	7.61822
HEAVY READER	READ	Morpho	0.88	-0.28
HEAVY READER	REAL	Ortho	0.88	-0.28
HEAVY READER	ZEAL	Unrelated	0.88	-0.28
INDEPENDENT CLIMBER	CLIMB	Morpho	3.47246	-0.59719
INDEPENDENT CLIMBER	CLING	Ortho	3.47246	-0.59719
INDEPENDENT CLIMBER	TEXT	Unrelated	3.47246	-0.59719
INFLUENTIAL THINKER	THINK	Morpho	10.65135	7.14944
INFLUENTIAL THINKER	THANK	Ortho	10.65135	7.14944
INFLUENTIAL THINKER	HEAR	Unrelated	10.65135	7.14944
INTERNAL RESEARCHER	RESEARCH	Morpho	1.33335	-0.21616
INTERNAL RESEARCHER	RESEND	Ortho	1.33335	-0.21616
INTERNAL RESEARCHER	MAJOR	Unrelated	1.33335	-0.21616
INTERNATIONAL PAINTER	PAINT	Morpho	2.64827	-0.69505
INTERNATIONAL PAINTER	PAIN	Ortho	2.64827	-0.69505
INTERNATIONAL PAINTER	MONEY	Unrelated	2.64827	-0.69505
KEEN GARDENER	GARDEN	Morpho	11.87749	7.86999
KEEN GARDENER	GARBAGE	Ortho	11.87749	7.86999
KEEN GARDENER	BELOW	Unrelated	11.87749	7.86999
LEGENDARY DRUMMER	DRUM	Morpho	10.30738	6.01155
LEGENDARY DRUMMER	DRUNK	Ortho	10.30738	6.01155
LEGENDARY DRUMMER	DRUG	Ortho	10.30738	6.01155
LOCAL ROBBER	ROB	Morpho	4.22174	-1.58762
LOCAL ROBBER	ROD	Ortho	4.22174	-1.58762
LOCAL ROBBER	IMAGE	Unrelated	4.22174	-1.58762
LONG-TIME ADMIRER	ADMIRE	Morpho	13.16976	7.47905
LONG-TIME ADMIRER	ADMIT	Ortho	13.16976	7.47905
LONG-TIME ADMIRER	BELOW	Unrelated	13.16976	7.47905
ORIGINAL BIDDER	BID	Morpho	3.43638	-0.35647

ORIGINAL BIDDER	BIT	Ortho	3.43638	-0.35647
ORIGINAL BIDDER	IDEA	Unrelated	3.43638	-0.35647
PATIENT DRIVER	DRIVE	Morpho	-0.28	-0.93
PATIENT DRIVER	DRAW	Ortho	-0.28	-0.93
PATIENT DRIVER	ALMOST	Unrelated	-0.28	-0.93
POPULAR GROWER	GROW	Morpho	3.98622	-0.32068
POPULAR GROWER	GRIND	Ortho	3.98622	-0.32068
POPULAR GROWER	MONEY	Unrelated	3.98622	-0.32068
PREVIOUS REPAIRER	REPAIR	Morpho	6.3422	-1.04764
PREVIOUS REPAIRER	REPAINT	Ortho	6.3422	-1.04764
PREVIOUS REPAIRER	TEXT	Unrelated	6.3422	-1.04764
PRIVATE HACKER	HACK	Morpho	3.76663	-1.23572
PRIVATE HACKER	HASH	Ortho	3.76663	-1.23572
PRIVATE HACKER	IDEA	Unrelated	3.76663	-1.23572
PROLIFIC WRITER	WRITE	Morpho	11.95539	8.85472
PROLIFIC WRITER	WRIST	Ortho	11.95539	8.85472
PROLIFIC WRITER	REAL	Unrelated	11.95539	8.85472
PROSPECTIVE DEVELOPER	DEVELOP	Morpho	9.81514	7.05006
PROSPECTIVE DEVELOPER	ZEAL	Unrelated	9.81514	7.05006
PROSPECTIVE DEVELOPER	STORY	Unrelated	9.81514	7.05006
RELIGIOUS LEADER	LEAD	Morpho	7.68359	8.02187
RELIGIOUS LEADER	LEAP	Ortho	7.68359	8.02187
RELIGIOUS LEADER	HEAR	Unrelated	7.68359	8.02187
REPUTABLE BUILDER	BUILD	Morpho	11.9907	7.80282
REPUTABLE BUILDER	BUTTON	Ortho	11.9907	7.80282
REPUTABLE BUILDER	ACCEPT	Unrelated	11.9907	7.80282
SEASONED WATCHER	WATCH	Morpho	13.85149	7.38657
SEASONED WATCHER	WASH	Ortho	13.85149	7.38657
SEASONED WATCHER	ACCEPT	Unrelated	13.85149	7.38657
SERIOUS LEARNER	LEARN	Morpho	1.38672	-0.65328
SERIOUS LEARNER	LEAN	Ortho	1.38672	-0.65328
SERIOUS LEARNER	ALMOST	Unrelated	1.38672	-0.65328
SOLO PERFORMER	PERFORM	Morpho	9.83242	7.2664
SOLO PERFORMER	PERFECT	Ortho	9.83242	7.2664

SOLO PERFORMER	METHOD	Unrelated	9.83242	7.2664
SPECIAL DANCER	DANCE	Morpho	2.04982	-0.74979
SPECIAL DANCER	DARE	Ortho	2.04982	-0.74979
SPECIAL DANCER	IDEA	Unrelated	2.04982	-0.74979
STANDARD INTRUDER	INTRUDE	Morpho	4.41329	-1.59126
STANDARD INTRUDER	INVEST	Ortho	4.41329	-1.59126
STANDARD INTRUDER	IMAGE	Unrelated	4.41329	-1.59126
STRANGE USER	USE	Morpho	-0.05	-0.52
STRANGE USER	USUAL	Ortho	-0.05	-0.52
STRANGE USER	TEXT	Unrelated	-0.05	-0.52
SUCCESSFUL KILLER	KILL	Morpho	2.00729	-1.06485
SUCCESSFUL KILLER	KID	Ortho	2.00729	-1.06485
SUCCESSFUL KILLER	UPON	Unrelated	2.00729	-1.06485
UNDERCOVER REPORTER	REPORT	Morpho	13.77517	8.99202
UNDERCOVER REPORTER	RESORT	Ortho	13.77517	8.99202
UNDERCOVER REPORTER	FOCUS	Unrelated	13.77517	8.99202
UNREPENTANT SINNER	SIN	Morpho	14.7671	7.87416
UNREPENTANT SINNER	SING	Ortho	14.7671	7.87416
UNREPENTANT SINNER	SEARCH	Unrelated	14.7671	7.87416
URBAN DWELLER	DWELL	Morpho	12.50166	6.84248
URBAN DWELLER	DWARF	Ortho	12.50166	6.84248
URBAN DWELLER	ALMOST	Unrelated	12.50166	6.84248
USEFUL BUYER	BUY	Morpho	1.80618	-0.20457
USEFUL BUYER	BUSY	Ortho	1.80618	-0.20457
USEFUL BUYER	REAL	Unrelated	1.80618	-0.20457
YOUNG ATTACKER	ATTACK	Morpho	5.1453	-0.20959
YOUNG ATTACKER	ATTRACT	Ortho	5.1453	-0.20959
YOUNG ATTACKER	FIELD	Unrelated	5.1453	-0.20959

APPENDIX B

List of stimuli (List 2)

Target	Prime	Condition	MI	logDice
ACCOMPLISHED PAINTER	PAINT	Morpho	11.35945	7.04
ACCOMPLISHED PAINTER	PAIN	Ortho	11.35945	7.04
ACCOMPLISHED PAINTER	FOCUS	Unrelated	11.35945	7.04
AIMLESS WANDERER	WANDER	Morpho	14.72466	7.04872
AIMLESS WANDERER	WANT	Ortho	14.72466	7.04872
AIMLESS WANDERER	ENOUGH	Unrelated	14.72466	7.04872
ALPINE CLIMBER	CLIMB	Morpho	10.43766	5.78585
ALPINE CLIMBER	CLING	Ortho	10.43766	5.78585
ALPINE CLIMBER	STORY	Unrelated	10.43766	5.78585
ANONYMOUS CALLER	CALL	Morpho	10.6551	6.32737
ANONYMOUS CALLER	CULL	Ortho	10.6551	6.32737
ANONYMOUS CALLER	UPON	Unrelated	10.6551	6.32737
ARMED ROBBER	ROB	Morpho	14.20983	8.34407
ARMED ROBBER	ROD	Ortho	14.20983	8.34407
ARMED ROBBER	FIELD	Unrelated	14.20983	8.34407
BAD GARDENER	GARDEN	Morpho	3.52884	-0.42628
BAD GARDENER	GARBAGE	Ortho	3.52884	-0.42628
BAD GARDENER	UPON	Unrelated	3.52884	-0.42628
CAREFUL PLAYER	PLAY	Morpho	0.08	-0.52
CAREFUL PLAYER	PLAN	Ortho	0.08	-0.52
CAREFUL PLAYER	STORY	Unrelated	0.08	-0.52
CLASSICAL COMPOSER	COMPOSE	Morpho	10.37023	7.57374
CLASSICAL COMPOSER	COMPILE	Ortho	10.37023	7.57374
CLASSICAL COMPOSER	TEXT	Unrelated	10.37023	7.57374
COMMON DESIGNER	DESIGN	Morpho	1.37967	-0.27498
COMMON DESIGNER	DECIDE	Ortho	1.37967	-0.27498
COMMON DESIGNER	HEAR	Unrelated	1.37967	-0.27498
DEAR READER	READ	Morpho	10.18112	8.46828
DEAR READER	REAL	Ortho	10.18112	8.46828
DEAR READER	METHOD	Unrelated	10.18112	8.46828
DRUNK DRIVER	DRIVE	Morpho	9.57732	7.22071

Target	Prime	Condition	MI	logDice
DRUNK DRIVER	DRAW	Ortho	9.57732	7.22071
DRUNK DRIVER	BELOW	Unrelated	9.57732	7.22071
EXOTIC DANCER	DANCE	Morpho	10.56642	7.23958
EXOTIC DANCER	DARE	Ortho	10.56642	7.23958
EXOTIC DANCER	SEARCH	Unrelated	10.56642	7.23958
EXPERIENCED RESEARCHER	RESEARCH	Morpho	9.38136	7.62429
EXPERIENCED RESEARCHER	RESEND	Ortho	9.38136	7.62429
EXPERIENCED RESEARCHER	ALMOST	Unrelated	9.38136	7.62429
EXTERNAL EXAMINER	EXAMINE	Morpho	13.25866	9.92636
EXTERNAL EXAMINER	EXIT	Ortho	13.25866	9.92636
EXTERNAL EXAMINER	HEAR	Unrelated	13.25866	9.92636
FINE STALKER	STALK	Morpho	5.95432	-0.99844
FINE STALKER	STALL	Ortho	5.95432	-0.99844
FINE STALKER	SEARCH	Unrelated	5.95432	-0.99844
GOOD OBSERVER	OBSERVE	Morpho	2.29394	-0.41319
GOOD OBSERVER	OBSCURE	Ortho	2.29394	-0.41319
GOOD OBSERVER	ZEAL	Unrelated	2.29394	-0.41319
HAPPY BUILDER	BUILD	Morpho	2.6077	-0.72371
HAPPY BUILDER	BUTTON	Ortho	2.6077	-0.72371
HAPPY BUILDER	IMAGE	Unrelated	2.6077	-0.72371
HARD SINNER	SIN	Morpho	3.33156	-1.59426
HARD SINNER	SING	Ortho	3.33156	-1.59426
HARD SINNER	FIELD	Unrelated	3.33156	-1.59426
HUMAN INVADER	INVADE	Morpho	4.02743	-0.92494
HUMAN INVADER	INVITE	Ortho	4.02743	-0.92494
HUMAN INVADER	ACCEPT	Unrelated	4.02743	-0.92494
IMPORTANT SMOKER	SMOKE	Morpho	3.21185	-0.58866
IMPORTANT SMOKER	SMOOTH	Ortho	3.21185	-0.58866
IMPORTANT SMOKER	STORY	Unrelated	3.21185	-0.58866
INDIVIDUAL WORSHIPPER	WORSHIP	Morpho	3.86507	-2.23819
INDIVIDUAL WORSHIPPER	WARSHIP	Ortho	3.86507	-2.23819
INDIVIDUAL WORSHIPPER	MONEY	Unrelated	3.86507	-2.23819
LIFELONG LEARNER	LEARN	Morpho	11.57014	8.60043

Target	Prime	Condition	MI	logDice
LIFELONG LEARNER	LEAN	Ortho	11.57014	8.60043
LIFELONG LEARNER	IMAGE	Unrelated	11.57014	8.60043
MALICIOUS HACKER	HACK	Morpho	13.66344	8.36065
MALICIOUS HACKER	HASH	Ortho	13.66344	8.36065
MALICIOUS HACKER	MAJOR	Unrelated	13.66344	8.36065
MASKED INTRUDER	INTRUDE	Morpho	13.87429	7.34716
MASKED INTRUDER	INTAKE	Ortho	13.87429	7.34716
MASKED INTRUDER	MONEY	Unrelated	13.87429	7.34716
MEAN GOLFER	GOLF	Morpho	2.48185	-1.97555
MEAN GOLFER	GOLD	Ortho	2.48185	-1.97555
MEAN GOLFER	METHOD	Unrelated	2.48185	-1.97555
MODERN DRUMMER	DRUM	Morpho	3.55237	-0.52966
MODERN DRUMMER	DRUNK	Ortho	3.55237	-0.52966
MODERN DRUMMER	ACCEPT	Unrelated	3.55237	-0.52966
NATURAL DRINKER	DRINK	Morpho	3.75644	-0.83531
NATURAL DRINKER	DRILL	Ortho	3.75644	-0.83531
NATURAL DRINKER	UPON	Unrelated	3.75644	-0.83531
OBJECTIVE WRITER	WRITE	Morpho	0.62	-0.18
OBJECTIVE WRITER	WRIST	Ortho	0.62	-0.18
OBJECTIVE WRITER	MAJOR	Unrelated	0.62	-0.18
OFFICIAL REPAIRER	REPAIR	Morpho	15.08709	7.56259
OFFICIAL REPAIRER	REPAINT	Ortho	15.08709	7.56259
OFFICIAL REPAIRER	ENOUGH	Unrelated	15.08709	7.56259
ONCOMING ATTACKER	ATTACK	Morpho	13.42047	7.22906
ONCOMING ATTACKER	ATTRACT	Ortho	13.42047	7.22906
ONCOMING ATTACKER	IDEA	Unrelated	13.42047	7.22906
ORGANIC GROWER	GROW	Morpho	11.23785	6.88277
ORGANIC GROWER	GLOW	Ortho	11.23785	6.88277
ORGANIC GROWER	TEXT	Unrelated	11.23785	6.88277
POLAR EXPLORER	EXPLORE	Morpho	12.76942	8.2078
POLAR EXPLORER	EXPLODE	Ortho	12.76942	8.2078
POLAR EXPLORER	REAL	Unrelated	12.76942	8.2078
POLITICAL PERFORMER	PERFORM	Morpho	1.37783	-0.862

Target	Prime	Condition	MI	logDice
POLITICAL PERFORMER	PERFECT	Ortho	1.37783	-0.862
POLITICAL PERFORMER	ENOUGH	Unrelated	1.37783	-0.862
POTENTIAL BUYER	BUY	Morpho	9.60046	7.59744
POTENTIAL BUYER	BUSY	Ortho	9.60046	7.59744
POTENTIAL BUYER	IMAGE	Unrelated	9.60046	7.59744
PRIMARY SHOPPER	SHOP	Morpho	4.13927	-0.14831
PRIMARY SHOPPER	SHOT	Ortho	4.13927	-0.14831
PRIMARY SHOPPER	ALMOST	Unrelated	4.13927	-0.14831
PROFESSIONAL WATCHER	WATCH	Morpho	5.7021	-0.55226
PROFESSIONAL WATCHER	WASH	Ortho	5.7021	-0.55226
PROFESSIONAL WATCHER	REAL	Unrelated	5.7021	-0.55226
PSYCHOPATHIC MURDERER	MURDER	Morpho	14.5646	7.6218
PSYCHOPATHIC MURDERER	MUDDY	Ortho	14.5646	7.6218
PSYCHOPATHIC MURDERER	FIELD	Unrelated	14.5646	7.6218
QUALIFIED TEACHER	TEACH	Morpho	10.88819	9.36584
QUALIFIED TEACHER	TEASE	Ortho	10.88819	9.36584
QUALIFIED TEACHER	BELOW	Unrelated	10.88819	9.36584
QUICK BEGINNER	BEGIN	Morpho	3.28913	-0.07178
QUICK BEGINNER	BENIGN	Ortho	3.28913	-0.07178
QUICK BEGINNER	METHOD	Unrelated	3.28913	-0.07178
RECENT ADMIRER	ADMIRE	Morpho	3.66595	-1.32907
RECENT ADMIRER	ADMIT	Ortho	3.66595	-1.32907
RECENT ADMIRER	TEXT	Unrelated	3.66595	-1.32907
RECREATIONAL DIVER	DIVE	Morpho	11.69686	8.07844
RECREATIONAL DIVER	DINE	Ortho	11.69686	8.07844
RECREATIONAL DIVER	ZEAL	Unrelated	11.69686	8.07844
REGISTERED USER	USE	Morpho	10.34253	9.43686
REGISTERED USER	USUAL	Ortho	10.34253	9.43686
REGISTERED USER	IDEA	Unrelated	10.34253	9.43686
REGULAR LOVER	LOVE	Morpho	2.70637	-0.32001
REGULAR LOVER	LONE	Ortho	2.70637	-0.32001
REGULAR LOVER	MAJOR	Unrelated	2.70637	-0.32001
RELEVANT REVIEWER	REVIEW	Morpho	3.25344	-0.63315

Target	Prime	Condition	MI	logDice
RELEVANT REVIEWER	REVISE	Ortho	3.25344	-0.63315
RELEVANT REVIEWER	HEAR	Unrelated	3.25344	-0.63315
RESPONSIBLE THINKER	THINK	Morpho	2.80184	-0.386
RESPONSIBLE THINKER	THANK	Ortho	2.80184	-0.386
RESPONSIBLE THINKER	ZEAL	Unrelated	2.80184	-0.386
SECURE DEVELOPER	DEVELOP	Morpho	1.73048	-0.6196
SECURE DEVELOPER	DEVISE	Ortho	1.73048	-0.6196
SECURE DEVELOPER	FOCUS	Unrelated	1.73048	-0.6196
SERIAL KILLER	KILL	Morpho	14.18046	10.79947
SERIAL KILLER	KID	Ortho	14.18046	10.79947
SERIAL KILLER	IDEA	Unrelated	14.18046	10.79947
SKILLED WORKER	WORK	Morpho	10.48771	8.95782
SKILLED WORKER	WORD	Ortho	10.48771	8.95782
SKILLED WORKER	REAL	Unrelated	10.48771	8.95782
STRONG CLEANER	CLEAN	Morpho	3.8321	-0.39498
STRONG CLEANER	CLEAR	Ortho	3.8321	-0.39498
STRONG CLEANER	SEARCH	Unrelated	3.8321	-0.39498
TALENTED SINGER	SING	Morpho	10.37861	7.84167
TALENTED SINGER	SINK	Ortho	10.37861	7.84167
TALENTED SINGER	FOCUS	Unrelated	10.37861	7.84167
TRADITIONAL DWELLER	DWELL	Morpho	5.41756	-0.2285
TRADITIONAL DWELLER	DWARF	Ortho	5.41756	-0.2285
TRADITIONAL DWELLER	MONEY	Unrelated	5.41756	-0.2285
UNIQUE REPORTER	REPORT	Morpho	3.1756	-0.55503
UNIQUE REPORTER	RESORT	Ortho	3.1756	-0.55503
UNIQUE REPORTER	ACCEPT	Unrelated	3.1756	-0.55503
UNSUCCESSFUL LEADER	LEAD	Morpho	1.93	-0.42
UNSUCCESSFUL LEADER	LEAP	Ortho	1.93	-0.42
UNSUCCESSFUL LEADER	BELOW	Unrelated	1.93	-0.42
WINNING BIDDER	BID	Morpho	11.49916	7.46821
WINNING BIDDER	BIT	Ortho	11.49916	7.46821
WINNING BIDDER	ALMOST	Unrelated	11.49916	7.46821

APPENDIX C

Fillers (Both lists)

Target	Prime
OTHER DRAYER	DRAY
NEW SISHER	SISH
MORE FARNER	FARN
FIRST TRASER	TRAS
SUCH FORDER	FORD
MANY RUNTER	RUNT
AVAILABLE BROWER	BROW
OWN ROLDER	ROLD
LAST BORKER	BORK
HIGH BARMER	BARM
SAME PORMER	PORM
DIFFERENT LUTLER	LUTL
LARGE HARKER	HARK
SMALL WRIVER	WRIV
OLD PRADER	PRAD
FULL FORTER	FORT
NEXT DRITER	DRIT
PUBLIC SILLER	SILL
POSSIBLE BANCER	BANC
FURTHER WARBER	WARB
LONG MURNER	MURN
EARLY MANCER	MANC
ABLE PARMER	PARM
FREE FOLLER	FOLL
SOCIAL WALMER	WALM
LATE CENDER	CEND
LITTLE LITLER	LITL
MAIN TRAYER	TRAY
TOP SENTER	SENT
SECOND TURDER	TURD
PARTICULAR GROKER	GROK

Target	Prime
BIG FEEPER	FEEP
SEVERAL CARKER	CARK
LEAST BORNER	BORN
LOW LUTTER	LUTT
MAJOR BARPER	BARP
REAL HARNER	HARN
NATIONAL SERGER	SERG
ONLY SEEPER	SEEP
CLEAR WARTER	WART
GENERAL KEEKER	KEEK
ONLINE CARNER	CARN
PERSONAL BUNGER	BUNG
EASY FISTER	FIST
SHORT CALTER	CALT
WIDE FOWDER	FOWD
SINGLE HUNNER	HUNN
OPEN PARBER	PARB
WHOLE FRAYER	FRAY
VARIOUS BUTHER	BUTH
SIMILAR FINTER	FINT
ECONOMIC PALLER	PALL
LIKELY MOTTER	MOTT
NECESSARY DANNER	DANN
RIGHT POWLER	POWL
CERTAIN PALKER	PALK
SPECIFIC KEEDER	KEED
TRUE MILVER	MILV
DIFFICULT FARKER	FARK
POOR HAREER	HARE
MILITARY WARPER	WARP
SURE BAREER	BARE

Target	Prime
PRESENT MERVER	MERV
FINAL RUNGER	RUNG
LESS MARTER	MART

JEZIČNA KOMPETENCIJA I KUMULATIVNO ISKUSTVO UČENJA KAO KORELATI PROCESIRANJA KOLOKACIJA: REZULTATI EKSPERIMENTA S UČENICIMA ENGLESKOG KAO DRUGOG JEZIKA

SAŽETAK

U ovom se radu analizira odnos između dvaju mjera jezičnog procesiranja – točnosti i vremena reakcije – te mjera jezične kompetencije u engleskom kao prvom stranom jeziku (L2) i izloženosti jeziku. Podaci o jezičnom procesiranju prikupljeni su pomoću zadatka frazne odluke, mjere jezične kompetencije procijenjene su kratkim testom poznavanja engleskog jezika, dok su podaci o izloženosti jeziku prikupljeni sociodemografskim upitnikom. Sudionici istraživanja (N = 96) bili su govornici engleskoga kao prvog stranog jezika, čiji je materinski jezik bio hrvatski ili slovenski. Rezultati pokazuju statistički značajnu korelaciju između opće jezične kompetencije u L2 i obaju pokazatelja jezičnog procesiranja. Detaljnijom analizom korelacija između točnosti i potkomponenti testa jezične kompetencije (rječnik, gramatika, pravopis, čitanje) dobiveni su mješoviti rezultati, dok je vrijeme reakcije u statistički značajnoj korelaciji sa sve četiri komponente testa u Eksperimentu 1 i s tri od četiri komponente u Eksperimentu 2. Broj godina provedenih u učenju engleskoga kao L2 pokazao se pouzdano povezanim s mjerama obrade (posebice vremenom reakcije) i jezičnom kompetencijom u L2 u oba eksperimenta. Rezultati ovog istraživanja upućuju na to da i cjelokupni i parcijalni aspekti jezične kompetencije u L2 te ukupno iskustvo učenja imaju ključnu ulogu u sposobnosti govornika L2 da obrađuju imensko-pridjevske kolokacije.

KLJUČNE RIJEČI:

pridjevsko-imeničke kolokacije, Engleski kao prvi strani jezik, jezična kompetencija u L2, višerječni izrazi, procesiranje kod neizvornih govornika