

# INDIVIDUAL DIFFERENCES AND INTAKE OF NOVEL WORDS IN L2 WRITTEN INPUT

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## *Abstract*

The study aims to analyse the effects of the individual differences of L2 educational background, working memory capacity, vocabulary size, and attitude both in the L1 and the L2 on the incidental learning of receptive and productive knowledge of the following word's aspects: association, grammatical functions, and orthographic forms. The participants were 17 students learning English as a foreign language in San Jose, Costa Rica. They completed a battery of pre-tests for individual differences before the main exposure task, and they undertook six post-tests to determine their receptive and productive knowledge of the words' aspects mentioned above. Results showed that, overall, participants scored higher in all the receptive tasks than the productive ones; that association scores were significantly higher than those of grammatical functions; that scores on the productive orthography task were significantly higher than both the association and the grammatical tasks; that L1 reading for pleasure has an effect in receptive knowledge of orthographic forms and productive knowledge of grammatical functions, that phonetic memory has an effect on the receptive and productive knowledge of grammatical functions, and that the intake of nouns was higher than that of verbs and adjectives.

## *1. Introduction*

It goes without saying that individual differences (ID) in factors such as age, motivation, cognitive capacity, and aptitude affect the process of second language acquisition (SLA) (Dörnyei and Ryan, 2015). Scholars have highlighted the importance of studying IDs in SLA by noting that “studying individual differences in second language learning can contribute to a better understanding of one of the key issues in current cognitive science, which is how general cognitive skills and domain-specific skills jointly determine behavior” (Roberts and Meyer: 2012, p.3). In SLA, learners' individual differences have been investigated in areas such as sentence processing (Roberts 2012), learning environment (Dörnyei 2009), language aptitude (Skehan 2015), working memory (Juff & Harrinton, 2011), anxiety (MacIntyre 2002), prior knowledge (Bilikozen and Ayse, 2014), among others; however, the area of individual differences and incidental vocabulary learning, which refers to that learning that takes place without any conscious intention to learn (Ellis 2008) has been understudied. Research on L2 vocabulary learning has investigated the number of encounters with new words that are required for intake and retention. It has been found that more than 10 encounters with new words are needed to enhance vocabulary learning (Webb, 2007), that number of encounters and to control for the type of vocabulary in the written input are needed to facilitate incidental learning (Nation & Wang Ming-Tzu, 1999), that in order to have a 50% chance of recognizing a word form, after three months of first meeting in the input, the word needs to be encountered at least eight times (Warring and Takaki, 2003), and that in terms of recall and recognition tests there is no difference if the word is met 2 or 7 times in a text (Laufer and Rozovski-Roitblat, 2011). In terms of the quality of encounters, it has been found that involvement load and task type have an effect on vocabulary learning (Laufer and Hulstijn,

2001) and that frequency of encounters contributes more to vocabulary learning than contextual richness (Joe: 2010, p.117). Nevertheless, there is scarce literature on the effects of individual differences and their influence on incidental vocabulary learning since scholars have studied them separately. For this reason, more research that sheds light on this topic is needed.

## *2. The Present Study*

Due to the fact that reading is one of the main sources of vocabulary learning and that it “provides comprehensible input, which is the key to language acquisition, first and second, grammar and vocabulary.” (Laufer: 2011, p.392), the present study makes use of L2 written pieces of input. It aims to investigate whether individual differences in language aptitude, which refer to the “strengths individual learners have—relative to their population—in the cognitive abilities information processing draws on during L2 learning and performance in various contexts and at different stages” (Robinson: 2005, p.46), L2 educational background, whether the L2 was learned at a public or private institution, working memory capacity, digit and word span task, vocabulary size, and attitude to reading in both the L1 and the L2, have an effect on the incidental vocabulary intake of novel words ( nouns, verbs, and adjectives) in L2 written input. The main research question of the study was: What are the effects of the individual differences of L2 educational background, working memory, vocabulary size, and attitude both in the L1 and the L2 on the incidental learning of receptive and productive knowledge of nonwords in L2 written input?

## *3. Methodology*

### *3.1 Participants*

The participants in this study were 17 students learning English as a foreign language in San Jose, Costa Rica. The participants were selected from the third and fourth years of the English Teaching Major to ensure an advanced English level. Descriptive statistics revealed that their vocabulary size mean score was of 8624. According to Nation (2006) a vocabulary size of 8000 word families is necessary to cover 98% of the words in a newspaper article; therefore, their vocabulary size was appropriate for adequate unassisted comprehension of the texts (Hu & Nation, 2000).

### *3.2 Materials*

#### *3.2.1 Target Words and Contexts*

Seven target nonwords were selected for this study (see Table 1). They were created with a nonwords database generator which selected only orthographically existing onsets such as “kn,” only legal bigrams like “th,” and no morphologically ambiguous syllables to ensure “English-like” nonwords. Table 1 shows the nonwords and the words they replaced in specifically chosen contexts (newspaper articles) and only one sense of the target word’s meaning was found in the contexts (see Appendix 1). All words were piloted with a native speaker to determine their English-like phonetics.

<b>Nonwords</b>	<b>Type</b>	<b>Meaning</b>
<b>Chuth</b>	Adjective	Iconic
<b>Knush</b>	Noun	Deflation
<b>Boaf</b>	Noun	Liquidity
<b>Rird</b>	Verb	Mastermind
<b>Thafe</b>	Adjective	Fragile
<b>Pib</b>	Noun	Investor
<b>Reun</b>	Noun	Asset

Table 1: Nonwords' types and meanings

Participants undertook six post-tests to determine their receptive and productive knowledge of the following words' aspects: association, grammatical functions, and orthographic forms. More details are provided on the procedures in the next section.

### 3.2.2. Vocabulary Knowledge Tasks

It is relevant to highlight that participants had twelve encounters of each target word spread among the written input. According to Webb (2007) “[i]f learners meet unknown words ten times in context, sizeable learning gains may occur. However, to develop full knowledge of a word more than ten repetitions may be needed” (p.64). Therefore, the number of encounters in the study was of twelve repetitions. Immediately after the exposure task, the post-tests were administered. First, participants undertook the receptive tests and then the productive ones. The receptive test of orthographic forms examined if participants were able to recognise the correct spelling of the target words, while the productive test aimed to find out if participants were able to write the correct spelling after listening to the target words three times. The receptive test of grammatical functions determined whether or not participants could identify sentences containing the target word in a correct grammatical way, while the productive test measured participants' ability to write correct grammatical sentences using the target words. The receptive test of association analysed if participants could identify an associate for each of the target words and the productive test of association examined if participants could come up with an associate for the target words. Table 2 illustrates the post-tests in the different word's aspects.

### 3.2.3 Tests of Individual Differences

The individual differences tests comprised:

- Vocabulary size (Nation 2012): a test of decontextualized receptive knowledge of written input

- Working Memory: a digit and word span task in which participants had to immediately respond to the stimulus in order to avoid strategic processing (Juffs & Harrington 2011)
- Language Aptitude Tests-LLAMA (Meara 2005): LLAMA B-Vocabulary Learning Task is “a simple vocabulary learning task, which measures your ability to learn relatively large amounts of vocabulary in a relatively short space of time. The program is loosely based on the original vocabulary learning subtask of Carroll and Sapon (1959)” (Meara, 2005, p.5)
- LLAMA D-Phonetic Memory test that has its theoretical basis in Service (1992), Service and Kohonen (1995), and Speciale et al (2004). It is designed to recognise short stretches of spoken language that participants were exposed to a short while previously (Meara 2005). The test LLAMA D is about recognition of phonological patterns and variations in endings, which contributes to the recognition of grammatical features (Meara 2005)
- LLAMA E- Sound-Symbol Correspondence that “presents a set of 22 recorded syllables, along with a transliteration of these syllables in an unfamiliar alphabet. Your task is to work out the relationship between the sounds you hear and the writing system” (Meara, 2005, p.11)

<b>WORD ASPECT</b>	<b>TEST</b>
Productive Knowledge of Orthographic Forms	Spelling
Receptive Knowledge of Orthographic Form	Multiple- Choice
Productive Knowledge of Grammatical Functions	Sentence Construction
Receptive Knowledge of Grammatical Functions	Multiple Choice
Productive Knowledge of Association	Write an Associate
Receptive Knowledge of Association	Multiple-Choice

Table 2: Post-tests in word's aspects.

#### 4. Procedure

Each participant was seen for approximately 100 minutes. Each session began with the battery of ID tasks, in the following order: vocabulary size, working memory, and LLAMA tests. After the ID tests, participants were exposed to the main task with no time constraints, which lasted 25 minutes in average. The session ended with an L2 language background questionnaire that asked participants if they learned the L2 in a public or private institution and if they read for pleasure in their L1 and L2.

#### 5. Results

The data was analysed in two sections: vocabulary intake and individual differences. The descriptive statistics of vocabulary learning are shown in Table 3.

### 5.1 Vocabulary Learning

To determine if there was a difference on the scores for the receptive and productive tests on each word aspect a one way analysis of variance (ANOVA) was performed with the factors of receptive and productive intake of orthographic forms, association, and grammatical functions.

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
RORTHOFORMS	17	0.43	1.00	0.8988	0.16628
PORTHOFORMS	17	0.14	1.00	0.6212	0.27088
RASSOC	17	0.86	1.00	0.9506	0.6896
PASSOC	17	0	0.71	0.3029	0.22458
RGRAMMAR	17	0.33	1.00	0.6771	0.18113
PGRAMMAR	17	0	1.00	0.3529	0.2676
Valid N (listwise)	17				

Table 3. Descriptive Statistics for Vocabulary Learning

The analysis showed a significant result for the receptive scores ( $F(2, 48) = 16.511$ ;  $p < 0.001$ ). A post-hoc Bonferroni test was performed to locate particular differences amongst the receptive scores and it found that for the receptive tasks, the association scores were significantly higher than those for the grammar test (95% vs. 68%;  $p < .001$ ), but there was no difference between the orthography (90%) and association scores (95%).

For the scores on productive knowledge, the results of a one-way ANOVA were significant ( $F(2, 48) = 7.643$ ;  $p < 0.01$ ). A post-hoc Bonferroni test was performed to locate particular differences amongst the productive scores and it found that the scores on the productive orthography task (62%) were significantly higher than both the association (30%;  $p < 0.01$ ) and the grammar scores (35%;  $p < 0.05$ ).

To determine if there was a difference in the intake of nouns, adjectives, and verbs a one way analysis of variance (ANOVA) was performed. The results were significant for the receptive intake ( $F(2, 48) = 29.748$ ;  $p < 0.00$ ), and for the productive intake ( $F(2, 48) = 9.221$ ;  $p < 0.00$ ). Overall, the intake of nouns (62%) was significantly higher than those of adjectives (30%) and verbs (50, 5%). For the receptive knowledge, it was found that the intake of nouns (78%) was significantly higher than adjectives (42%), and verbs (42%). For the productive knowledge, it was found that the intake of nouns (46%) was higher than adjectives (18%), and verbs (23%).

To determine whether or not there were differences in task, type paired-sample T-tests were run. Overall, participants achieved higher scores in receptive versus productive tasks and all three comparisons were significant: orthographic test, receptive task (90%) vs. productive task result (62%):  $t(16) = 4.037$ ;  $p < .01$ , grammatical function test, receptive task (67%) vs. productive task (35%):  $t(16) = 5.390$ ;  $p < .00$ ., association test, receptive task (95%) vs. productive task (30%):  $t(16) = 5.390$ ;  $p < .00$ .

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
ReceptiveAdjec	17	25	50	42.1569	8.05288
ProductiveAdje	17	0	50	18.6275	14.29155
ReceptiveNouns	17	50	91.67	77.9412	11.38849
ProductiveNouns	17	8.33	91.67	46.5686	19.10743
ReceptiveVerbs	17	33.33	100	78.4314	23.39627
ProductiveVerbs	17	0	66.67	23.5294	25.72479
Valid N (listwise)	17				

Table 4. Descriptive Statistics for Intake of Nouns, Adjectives, and Verbs

The analysis just shown reveals that, overall, participants achieved higher scores in receptive versus productive tasks. For the receptive scores those of association were significantly higher than those of the grammatical functions, and for the productive scores, the ones for the productive orthography task were significantly higher than both the association and the grammatical function. In terms of word type, the intake of nouns was higher, both receptively and productively, than adjectives and verbs.

### 5.2 Individual Differences

To determine if there were effects of the individual differences on the receptive and productive knowledge of each word aspect a Pearson Correlation test was run. Table 5 shows the descriptive statistics for the individual differences' aspects.

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
L2 Reading	17	0.00	1.00	0.5882	0.5073
L1 Reading	17	0.00	1.00	0.6471	0.49259
WMC	17	8.00	18.00	13.1765	2.45549
LLAMAB	17	5.00	95.00	48.8235	23.01694
LLAMAC	17	5.00	100.00	45.5882	27.94427
LLAMAD	17	0.00	100.00	53.8235	33.84382
VocabSize	17	6100.00	10200.00	8694.12	945.488
Valid N (listwise)	1				

Table 5. Mean scores and Standard Deviations for the Individual Differences

The analysis showed positive correlations between receptive knowledge of orthographic forms and L1 reading [ $r = .521$ ,  $n = 17$ ,  $p = 0.002$ ], productive knowledge of grammatical

functions and L1 reading [ $r=.530$ ,  $n=17$ ,  $p=0.029$ ], receptive knowledge of grammatical functions and LLAMA D (Phonetic Memory) [ $r=.642$ ,  $n=17$ ,  $p=0.005$ .], productive knowledge of grammatical functions & LLAMA D [ $r=.498$ ,  $n=17$ ,  $p=0.042$ .], and productive knowledge of orthographic forms and productive knowledge of grammatical functions [ $r=.617$ ,  $n=17$ ,  $p=0.008$ ].

The analysis just shown reveals that L1 aptitude has an effect on receptive knowledge of orthographic forms as well as in productive knowledge of grammatical functions, and that LLAMA D (test of phonetic memory) has an effect on the receptive and productive knowledge of grammatical functions.

## 6. Discussion and conclusions

The study investigated if the individual differences of language aptitude, L2 educational background, working memory, vocabulary size, and reading for pleasure in L1 and L2 had an effect on incidental vocabulary learning. In addition, it looked at the incidental receptive and productive learning of a number of different word's aspects and the intake of nouns, verbs, and adjectives. The results showed that individual differences in language aptitude and reading for pleasure in the L1 have an effect on the incidental vocabulary learning of receptive knowledge of orthographic forms and productive knowledge of grammatical functions, and that there were higher results in all the receptive tasks. Moreover, it has found that the intake of nouns was higher than both adjectives and verbs.

The results of the present study confirm that advanced L2 adult learners can learn vocabulary incidentally from reading, although the success with which they do so depends on modality, given that their receptive scores were higher than their scores on the productive tasks. This supports the findings of previous research (Webb, 2008; Fan, 2000; Laufer, 1998; Laufer & Paribakht, 1998; Waring, 1997). For the receptive scores, the association scores were significantly higher than those of grammatical functions (95% vs. 68%;  $p < .001$ ), which reveals that L2 adult learners scored higher when identifying associates for the target words than when identifying sentences containing the target word in a correct grammatical way, and this also support previous investigations (Webb, 2007). On the productive scores, the scores on the productive orthography task (62%) were significantly higher than both the association (30%;  $p < 0.01$ ) and the grammar tasks (35%;  $p < 0.05$ ) and this also supports previous findings (Webb, 2007).

The intake of nouns was significantly higher than those of adjectives and higher than verbs. In the study, the target words included four nouns, two adjectives, and one verb, which means that participants had 48 encounters of words functioning as nouns (12x4), 24 encounters of words functioning as adjectives (12x2), and only 12 encounters of words functioning as verbs (12x1). Thus, the number of encounters of nouns was double in comparison to those of adjectives and triple in comparison with verbs, which may explain the results shown above. In light of the just mentioned, it is not surprising that the intake of nouns was higher. These results confirm what Webb (2007) and Nation (2015) have mentioned regarding the number of encounters and word learning. For instance, Nation (2015) highlights that vocabulary learning in extensive reading “depends on the number of meetings with each word and the quality of attention at each meeting (see Table 1). The more meetings, the more likely learning is to occur. The deeper the quality of the meetings, the more likely learning is to occur” (p.136). Thus, the findings support that the higher the number of encounters, the more likely learning is to occur. It is relevant to mention that nouns and verbs are the most

common parts of speech found in natural text (Webb 2007), thus, participants may have been used to identify nouns and verbs more easily than adjectives. In addition, nouns are easier to learn than verbs (e.g. Bornstein, 2005; Bornstein *et al.*: 2004; Gentner, 1982; Maguire, Hirsh- Pasek & Golinkoff, 2006; cited by Colleen *et al.*, 2011), and that can also explain the higher intake of nouns in the study. This finding supports previous research on L2 nouns' acquisition (Darryl, 2012) in that the noun/verb distinction also exists in the L2 and that nouns are easier than verbs to learn.

In regards to the positive correlation between L1 reading and receptive knowledge of orthographic forms (ability to recognise the correct spelling of the target words), it reveals that the more adult learners read for pleasure in their L1, the higher their receptive knowledge of orthographic forms. The typological difference between English and Spanish is not far since both languages have similar alphabets and this may explain the correlation found. In addition, lexical information from both languages is active during the parsing of either so if the typologies are similar it may contribute to the receptive knowledge of orthographic forms. In addition, in both beginners and advanced learners, lexical information from both languages is active during the processing of either Schmitt (2010); therefore, if the typologies are similar it may contribute to the receptive knowledge of orthographic forms. It has been mentioned that learning L2 word forms is strongly affected by the orthographic nature of the learners' L1 (Hamada and Koda, 2008, as cited in Nation, 2013, p.45), and since English (L2) and Spanish (L1) have similar alphabetic systems this could have enhanced the positive correlation between the L1 reading and receptive knowledge of orthographic forms; therefore, the participants' L1 orthographic background could have facilitated their L2 orthographic learning.

The positive correlation between L1 reading and productive knowledge of grammatical functions (ability to write correct grammatical sentences using the target words) shows that the more adult learners read for pleasure in their L1, the higher their productive knowledge of grammatical functions. Research on L2 grammatical processing has found that L2 adult learners present no difficulties when using lexical, semantic, and pragmatic information (Clahsen & Felser 2006), that grammatical processing differs between bilinguals and monolinguals (Roberts 2013), that shallow processing is not unique to L2 learners (Clahsen & Felser 2006), amongst many others. However, research is still needed to account for the individual differences that may have an effect on L2 grammatical learning and processes. Hence, in depth research on reading for pleasure in the L1 and on-line grammatical processes may shed light on their possible correlations.

In order to analyse the positive correlation between LLAMA D (Phonetic Memory) and receptive and productive knowledge of grammatical functions it is necessary to highlight that a key skill in language ability is to recognise patterns and particularly in spoken language (Speciale et al 2004); thus, if repeated patterns are recognised, it is more likely that learners will recognise words when they are heard for the second time, which contributes to vocabulary learning. In light of the findings and the theoretical basis for the LLAMA D test, it is concluded that higher recognitions of phonological patterns can produce higher recognition of grammatical patterns and that a higher recognition of phonological patterns can predict a high intake of receptive and productive knowledge of grammatical functions. This supports previous studies (Speciale et al 2004) in that phonological sequence learning contributes to productive vocabulary learning.

It is relevant to mention that regarding vocabulary size and lexical coverage, the mean score of the vocabulary size  $M=8694.12$  goes hand in hand with Nation's (2006) assertion that



6,000 to 7,000 word-families are needed to get 98% coverage of a written text, and with Laufer & Ravenhorst-Kalovski's (2010) findings of 8,000 word-families for a 98% text coverage including proper nouns.

This study revealed that L2 adults can incidentally learn different words' aspects such as those related to meaning (association), form (orthographic), and use (grammatical functions); however, their receptive learning is higher than their productive learning. The study also confirmed that frequency of encounters contributes to vocabulary learning in that the more exposures of a target word enhance its intake, and that in L2 nouns may be easier to learn than adjectives and verbs. In terms of the effects of individual differences, the study showed that there is a relationship between L1 reading and the intake of grammatical functions, and the recognition of orthographic forms (receptive knowledge), and that a typological influence may have contributed to those results. It was also found that phonological memory correlates to the recognition and recall of grammatical functions. The results of this study have relevant implications for the SLA field. For instance, that L1 reading for pleasure contributes to the intake of L2 grammatical functions and to the recognition of L2 orthographic forms gives a new role to L1 reading in the intake process of L2 novel words, and this has not been widely explored. In addition, the finding that in L2 nouns may be easier to learn than verbs can have implications in recognition and lexical processing. Future research on this topic should address the role of L1 reading in L2 grammatical processing and the recognition of L2 orthographic forms. It is also necessary to research on the L2 noun-verb dichotomy using on-line methodologies such as eye-tracking and self-paced reading.

### *7. Limitations*

One of the limitations of the study is the unbalanced number of nouns, verbs, and adjectives in the nonwords. Certainly, more encounters of words functioning as nouns can influence performance at post-tests on word learning; however, even in natural contexts, the number of nouns is higher to adjectives and verbs.

Another limitation is the number of participants that took place in the study. In order to improve the ecological validity, a higher number of participants is needed. However, the study is still relevant and sheds light on major SLA topics.

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## Appendix

### *Newspaper article with the target words*

Low inflation, bond yields and interest rates around the world will push the boundaries of economic and political stability to breaking point if they continue on their downward trajectory, the Bank for International Settlements has warned.

The chuth Swiss-based "bank of central banks" said the "sinking trend" of global rates would push countries further into uncharted territory.

It highlighted that \$2.4 trillion (£1.6 trillion) of long-term global sovereign debt was now trading at negative yields, with an increasing number of pibs willing to pay governments for the privilege of lending to them.

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