PROCESSING (IN)EFFICIENCY IN THE SECOND LANGUAGE: LINGUISTIC EXPERIENCE AND COGNITIVE EFFECTS ON MORPHOSYNTACTIC PREDICTIONS

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ABSTRACT OF THE DISSERTATION

Processing (in)efficiency in the second language: linguistic experience and cognitive effects on morphosyntactic predictions

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This dissertation aims to identify the locus of L2 processing inefficiency. Previous studies suggest that non-native processing is a specific result of an inefficient predictive mechanism that limits the ability of learners to generate linguistic expectations (Grüter, Rohde, & Schafer, 2014; 2016). Thus, this study employs two distinct online sentence processing tasks to disentangle processing mechanisms at the level of integration and prediction and to evaluate the effects of L2 linguistic knowledge and resource limitations on anticipatory processing of morphosyntax. Native Spanish-speakers (n = 32) and native English-speaking learners of Spanish at intermediate and advanced levels (n = 67) completed a picture-selection task and a self-paced reading task. The former isolates predictive mechanisms by testing the learners' ability to utilize number cues to anticipate upcoming constituents and the latter measures learners' sensitivity to number violations. Factors related to cognitive and language experience were also examined via tasks which measured working memory, lexical automaticity, verbal fluency, proficiency, vocabulary size, and metalinguistic awareness. The findings revealed that all learners are able to detect grammatical violations while reading, but only advanced learners are able to utilize number morphosyntax to anticipate correct picture selection in a native-like fashion,

suggesting that bottom-up processing is sufficient for the detection of violations in L2 reading. The results also showed that individual cognitive factors and language experience other than proficiency had minimal effects on performance. Taken together, these findings support the notion that L2 processing strategies are not inherently different from L1 strategies but are dependent on L2 experience.

Keywords: anticipatory processing, predictive processing, morphosyntax, second language acquisition

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Chapter I: Introduction to the Study

Input is fundamental for acquiring a language-specific grammar (Lidz & Gagliardi, 2015), but to comprehend spoken language in real time a listener must establish relationships among multiple sentential constituents, incrementally, and at a relatively fast speed. To meet this demand, processing strategies rely on both integrative mechanisms that assimilate incoming information with previously encountered information (e.g., Frazier, 1999; Kazanina, Lau, Lieberman, Yoshida, & Phillips, 2007; Phillips, 2006; Phillips, Wagers, & Lau, 2011; Phillips & Ehrenhofer, 2015; Traxler & Pickering, 1996) and anticipatory mechanisms that make predictions about upcoming material[1] or preactivate features which facilitate integration when the constituent becomes available (Borovsky, Elman, & Fernald, 2012; Elman, 1990; Misyak, Christiansen, & Tomblin, 2010; Rodriguez, Wiles, & Elman, 1999). Native speakers develop these abilities at a remarkably young age (e.g., Phillips & Ehrenhofer, 2015), yet, second language (L2) learners characteristically vary in their acquisition of these abilities and often fail to converge on native-like processing.

To understand the source of L2 learner difficulties, this thesis compares the language processing patterns of native English speakers learning Spanish in the United States to a control group of native speakers of Spanish in Argentina. By comparing such groups, the influence of the first language and the relationship between individual differences of L2 linguistic representation and of cognitive limitations on L2 Spanish performance can be evaluated. The aim of this thesis is to move beyond a holistic approach towards the L2 processor to undertake a more systematic analysis of the processor's subcomponents to

[1] In this thesis I will use the terms "prediction", "anticipation" and "expectation" interchangeably.

identify the mechanisms, which may be permeable to the effects of cognitive limitations and language experience.

This thesis advances a novel approach, which employs two distinct online sentence processing tasks to disentangle predictive processing mechanisms from integrative processing mechanisms as a way of identifying the loci of L2 divergence. Previous studies suggest that non-native processing is a specific result of an inefficient predictive mechanism, which limits the ability of learners to generate linguistic expectations (Grüter, Rohde, & Schafer, 2014; 2016). There is limited understanding of why learners can exploit some predictive information, but struggle in the case of other cues, in part because processing is often treated monolithically. Therefore, this thesis tests linguistic properties that vary in L1-L2 similarity as well as learner characteristics that are not solely linguistic in nature, such as domain-general cognitive capacities, in relation to integrative and predictive mechanisms to identify the possible cause of L2 processing inefficiency and to address the following questions:

1) Do L2 learners employ integrative and anticipatory processing strategies for sentence comprehension, and if so, under what conditions and/or contexts?

2) Can inefficient processing be attributed to cognitive limitations or language experience?

To date, L2 processing studies have focused mainly on comprehension tasks, such as self-paced reading, which do not allow for a direct measure of predictive processing. This type of methodology can indeed indicate whether or not second language learners are ultimately sensitive to number agreement violations, but it cannot tease apart the effects of predictive versus integrative processes, given that comprehension results from an

interplay of both. Furthermore, within these studies, it is generally accepted that cognitive constraints have variant effects on processing outcomes, however it remains controversial as to which cognitive constraints are the most influential and under which conditions. Therefore, to investigate the above questions, this study conducts a series of experiments designed to specifically test the predictions made by the hypothesis that L2 learners have a Reduced Ability to Generate Expectations, or "RAGE" (Grüter, Rohde, & Schafer, 2014, 2016). The experiments are designed to elicit data from adult English speakers who are intermediate and advanced learners of L2 Spanish (henceforth *L2 learners*) regarding their ability to integrate morphosyntactic number agreement and to use this morphosyntactic feature as a cue to generate predictions of upcoming constituents. Thus, by dissociating and understanding the complexity of both integrative and predictive mechanisms employed by L2 learners and by identifying and comparing language experience effects and cognitive constraints on each factor this study provides key data necessary for mapping the developmental arch of the learner.

1.1 Background

The key to achieving native-like processing in the L2 may lie in the learner's ability to develop specific and distinct strategies to overcome the cognitive demands at different levels of processing. Investigating how the learner does this, and the time-course thereof, is critical to understanding L2 development. A shortcoming to previous approaches is that they tend to treat processing holistically. However, we have evidence that the processor is quite complex and relies on numerous mechanisms and subcomponents, which are still ill-defined and controversial (see Hauk, 2016 for a review of the current debates). Consequently, the actual mechanisms of the processor must be considered

separately. Thus this dissertation aims to elucidate the differential effects the learner's proficiency and language experience (both in the L1 and L2) on two specific subcomponents of the processor.

Motivated by the breadth of related L1 research and the relative dearth of L2 research, the two processing subcomponents selected for investigation in this study are integration and anticipation. Integration is a bottom-up reactive mechanism that assimilates incoming information with previously encountered information in a serial fashion (e.g., Frazier, 1999; Kazanina et al., 2007; Phillips & Ehrenhofer, 2015; Traxler & Pickering, 1996). In contrast, anticipation is a top-down mechanism that proactively generates expectations about upcoming material based on previously encountered cues that facilitate integration of bottom-up input further down in the processing pipeline (Borovsky et al., 2012; Elman, 1990; Federmeier, 2007; Misyak et al., 2010; Rodriguez et al., 1999). Without doubt there are additional subcomponents that need to be examined, such as semantic organization, multimodal association, and multimodal discrimination (for a discussion see Simanova, Francken, de Lange, & Bekkering, 2016), but these processes are beyond the scope of the current study.

In previous L2 studies learners have been successful in achieving native-like abilities, for example, on comprehension tasks involving (ungrammatical) gender-mismatch between nouns and post-nominal adjectives, case marking, and verb semantics (e.g. Dowens, Vergara, Barber, & Carreiras, 2009; Keating, 2009; Hopp 2010). Nonetheless, preliminary evidence shows that even highly proficient L2 learners differ from native speakers on their ability to exploit morphosyntax to anticipate upcoming constituents. These limited studies have demonstrated that adult L2 learners show a consistent inability

to make use of gender-predictive determiners (Grüter, Lew-Williams, & Fernald, 2012; Lew-Williams & Fernald, 2010), phonologically-predictive determiners (Martin et al., 2013), extracted wh-phrases (Kaan, 2007), and case markings (Hopp, 2015a) to predict or facilitate integration of the upcoming constituent. However, outside of the domain of morphosyntax, it should be noted that there is some limited evidence that learners are capable of utilizing linguistic information, such as lexical-semantic information, in anticipatory processing (Hopp, 2015a). Additionally, the ability to generate expectations may be modulated by general processing abilities such as lexical automaticity (Hopp, 2014; Hopp, 2015a), the properties of the learner's L1 (Dussias et al., 2013), crosslinguistic lexical competition (Chambers & Cooke, 2009), the degree of lexical overlap across languages and semantic constraints (Foucart, Martin, Moreno, & Costa, 2014), vocabulary size (Borovsky et al., 2012), and L2 proficiency (Dussias et. al, 2013).

Within the L1 literature, anticipation is widely accepted as being fundamental to driving incremental processing in sentence comprehension (Altmann & Mirkovic, 2009; Federmeier, 2007; Gibson, 1998; Kamide, 2008; Levy, 2008; Pickering & Garrod, 2013. Therefore, if this mechanism is inefficient in the L2 it will have a negative impact on sentence comprehension. Taken together, the previous findings begin to paint a picture whereby L2 processing difficulties may be localizable, not in the bottom-up integration mechanisms, but rather in the inefficiency of the anticipatory mechanism to generate linguistic expectations based specifically on morphosyntactic features.

In sum, this study tests the assumptions and predictions of the RAGE hypothesis to identify a context in which native-like integrative and anticipatory processing is possible. If evidence can be found that the L2 learner is capable of native-like morphosyntactic

anticipation under any circumstances, then it will be most parsimonious to assume that the L2 processor is not inefficient or underdeveloped, but rather, influenced by interactions between cognitive abilities and language experience.

1.2. Research Design

This thesis tests Spanish natives (recruited in Argentina) and English learners of L2 Spanish (at a large public institution) on their ability to exploit linguistic cues to anticipate upcoming information. Results are discussed from a series of experiments that examine the effects of language experience and the role of individual factors, both cognitive and representational (lexical automaticity, working memory span, verbal fluency, vocabulary size, and proficiency levels) on the real-time processing of morphosyntactic cues.

A total of 100 participants were recruited to participate in this study:

Group 1: Spanish native speakers (32)

Group 2: Advanced English-Spanish learners (19)

Group 3: Intermediate English-Spanish learners (49)

1.2.1 Research Questions and Hypotheses

The ultimate goal of this project is to investigate the following research questions. The first two address the abilities of L2 learners to successfully integrate bottom-up information to derive meaning incrementally, whereas questions three and four evaluate the efficiency of employing anticipatory processes. The fifth question aims to identify a relationship between integrative and anticipatory mechanisms, and finally, the last question addresses the role of metalinguistic knowledge on the application of these parsing strategies in real time.

1. Are intermediate and advanced L2 learners of Spanish sensitive to number violations between demonstrative-noun and definite article-noun constructions during reading of L2 Spanish?
2. Which of the following representational and cognitive factors help L2 learners of Spanish detect number agreement errors between determiners and nouns: working memory, lexical automaticity, verbal fluency, vocabulary size, and proficiency?
3. Are intermediate and advanced L2 learners of Spanish able to use number information from the demonstrative and the definite article to anticipate an upcoming target object to improve accuracy and response time on a picture disambiguation task?
4. Which of the following representational and cognitive factors help L2 learners of Spanish use number information from the determiner to anticipate an upcoming target object: working memory, L1/L2 similarity, lexical automaticity, verbal fluency, vocabulary size, and proficiency?
5. Does the ability to utilize number information on determiners to anticipate upcoming input correlate with increased sensitivities to determiner-noun number violations in reading?
6. What is the relationship between L2 learners' metalinguistic knowledge of number agreement between determiners and nouns and their online sensitivities to this phenomenon for the detection of violations and the anticipation of target objects?

The starting point for this thesis is the RAGE hypothesis, which states that the underlying grammatical representations in late second language grammars are intact, but

as resources are exhausted first on integrative mechanisms, proactive processes such as prediction which are impaired or severely limited. This hypothesis follows previous proposals that non-native processing is not fundamentally different but that nonnative-like outcomes are the interaction of the integrative or anticipatory mechanisms with individual variation of language exposure and cognitive limitations.

Following the RAGE hypothesis, it is expected that L2 learners will show an inability to exploit number cues to anticipate upcoming information as available cognitive resources are limited and have already been expended on integrating bottom-up information, particularly evident when complexity is increased via L1-L2 dissimilarity or when linguistic knowledge is limited. Such findings would suggest that L1 processing routines are transferred and applied to the L2, but that full and efficient employment may be dependent on certain factors, such as language experience or cognitive ability. This would suggest that certain processes are recruited prior to others, because they offer a "good-enough" interpretation, which under certain demands is sufficient, although rarely exact, for the communicative goal.

1.2.2 The Findings

On the basis of the results of four online and two offline tasks, I argue that the findings support a weak interpretation of the RAGE hypothesis. All learners showed sensitivities to grammatical violations in the self-paced reading task, but only the advanced learners showed anticipation in the picture-selection task. These findings suggest that once the representation of number features is targeted - like at the representational level - and the integrative mechanism is fully operational, learning can exploit anticipatory processing. Cognitive factors and cross-linguistic similarity appeared to have minimal effects on

performance. These findings suggest a direct relationship between the individual's L2 linguistic knowledge and use and the ability to efficiently carry out bottom-up and top-down processing. Thus, I argue that L2 processing strategies are not inherently different from L1 strategies, but are dependent on L2 experience.

1.3 Broader Significance of the Study

This thesis attempts to disentangle predictive mechanisms from integrative mechanisms in L2 processing as a step towards understanding the scope and effects of cognitive constraints on the subcomponents of the L2 processor. This study sheds light on how L2 processing differs from native processing at different stages in L2 development and contributes to existing knowledge regarding L2 predictive mechanisms and the interaction of resource limitations and language experience on L2 acquisition. Additionally, this study offers theoretical implications for the fundamental differences debate. Lastly, by examining morphosyntactic representations and individual differences this research bridges the fields of SLA, linguistics, and cognitive science to provide a more detailed understanding of variation in L2 learner outcomes.

1.4 How the Dissertation is Organized

This dissertation is organized as follows: Chapter 2 provides a background review of processing models, predictive mechanisms, as well as a review of individual differences including L1/L2 differences, proficiency, vocabulary size, lexical automaticity, verbal fluency, and working memory. This is followed by a description of the linguistic constructions of number agreement in English and Spanish, and an overview of the acquisition of number agreement in the L2. Chapter 3 advances the research questions and hypotheses and presents the experiments on integration, anticipation, and individual

differences. Additionally, it provides a detailed description of the methods employed in the project. Chapter 4 provides a detailed account of the scoring, statistical analyses, and results of the study. Finally, Chapter 5 puts all findings into perspective and concludes with the implications for L2 processing research.

Chapter II: Background and Literature Review

2.1 Processing Models

The greatest challenge in comprehending real-time spoken language is that an utterance evolves and unfolds incrementally at a relatively fast pace. Sentential meaning can only be understood through the relations of its constituents and cannot generally be inferred at a single-word level. The efficiency of processing outcomes is reliant on how effectively an individual can employ parsing strategies that establish relationships among sentence constituents incrementally to create meaning.

Most language processing models posit a level of mental representation which contains the grammatical features and vocabulary knowledge of the L1 (and L2) in memory which interacts bidirectionally with the parsing routines of the processor resulting in ultimate comprehension outcomes. The influence between the language knowledge at the level of representation and the efficiency of the processor's performance is bidirectional. For example, the processor relies on the full representation of grammatical and morphological features as cues to guide both bottom-up and top-down processing. If these representations are not target-like the efficiency of the processor is compromised. Conversely, if the processor is not employing parsing strategies correctly the quality of the stored grammatical and morphological mental representations are negatively impacted. Thus, the two levels are intimately intertwined and evolve together with language experience. Furthermore, it is at the level of the processor that the model appears to be most susceptible to cognitive limitations of the individual, such as working memory and lexical automaticity (see Figure 1).

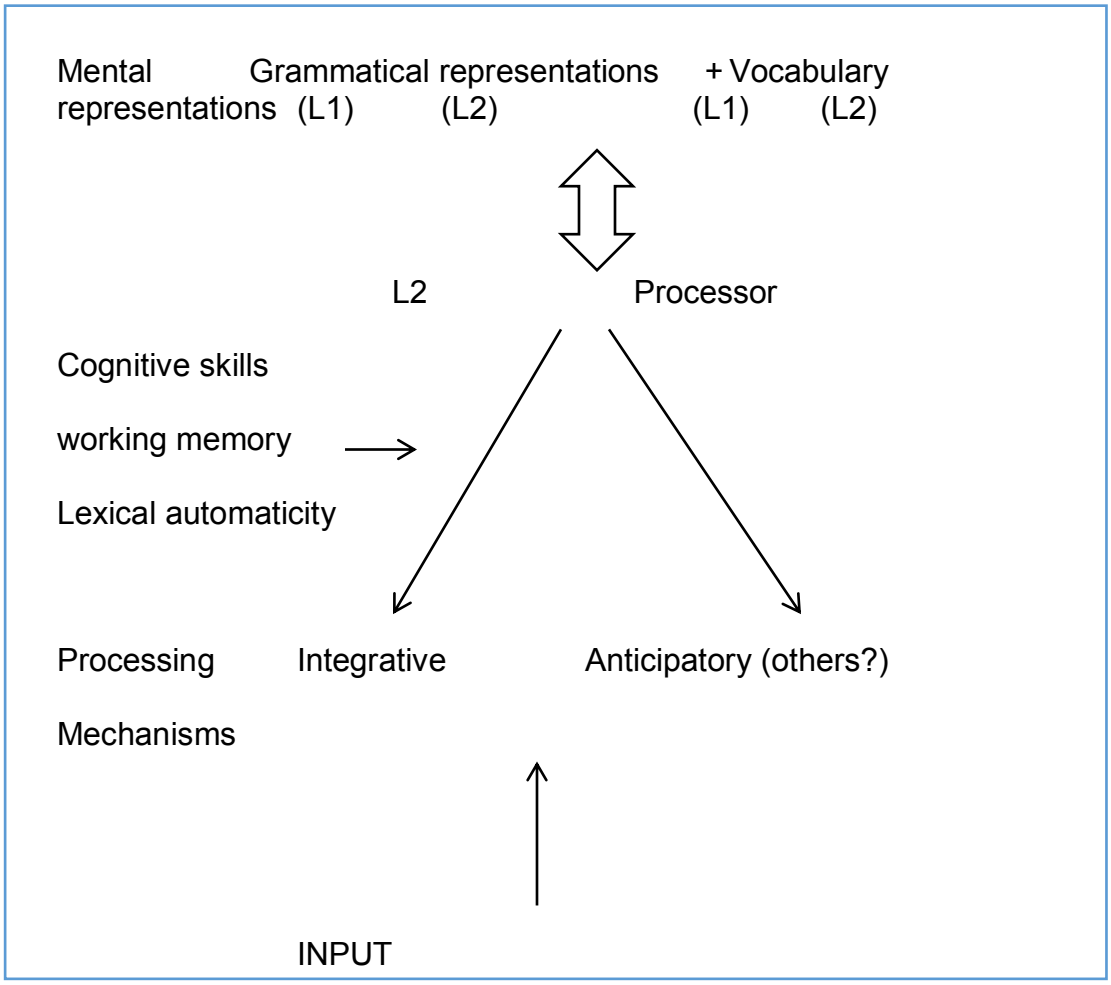


Figure 1. Model of L2 sentence processing

When the processor's efficiency is negatively impacted either by resource limitations or by impoverished mental representations of the language, individuals rely upon heuristics or "pseudosyntactic" parsing (Hopp, 2007), computed on the basis of canonical word order and semantic expectations (Townsend & Bever, 2001), to extract grammatically unlicensed but 'good enough' representations of the linguistic input (Christianson, Hollingworth, Halliwell, & Ferreira, 2001; Sturt, 2007; Tabor, Galantucci, & Richardson, 2004). Such "good enough" processing theories (e.g. Ferreira, 2003; Ferreira, et al., 2002; Ferreira & Patson, 2007; Sanford & Sturt, 2002), propose that

sentence processing proceeds via two routes. First, a shallow interpretation is mapped to a semantic representation based on surface cues, that is, associatively acquired patterns, lexical-thematic and semantic information, then, a full-parse is computed and compared to the shallow parse. But, under time pressure or processing demands the full-parse route is abandoned to economize resources and sentence interpretation is based on incomplete processing (Ferreira, 2003).

Moreover, even monolinguals have been known to demonstrate "good enough" processing in a variety of circumstances of increased processing burdens (Phillips & Ehrenhofer, 2015), similar to those faced by L2 learners (e.g., Blackwell & Bates, 1995; Kilborn, 1991, 1992; McDonald, 2006). The fact that natives recur to similar processing strategies as L2ers when resources are taxed or overburdened offers a possible explanation for the differences between L1 and L2 processing in terms of resource limitations. As resources in L2 processing are saturated more rapidly than in native processing due to the additional burden caused by the interference and competition from the L1 and reduced automaticity of retrieving the grammatical representations, it is to be expected that "good enough" strategies are evinced more for L2ers than for native speakers. Thus, less efficient processing should be expected in the L2 in contexts where task complexity increases, proficiency is low, or when the L1 diverges or conflicts with the L2 constructions. Thus, dual-route models dismiss an a priori assumption that there is a fundamental difference of grammatical representations and mental processes between the L1 and L2 since both routes can be detected in native and non-native processing.

2.2 Predictive Mechanisms

A growing body of evidence indicates that listeners utilize a strategy of continually generating expectancies about upcoming information to increase the efficiency of the processor under time demands. This updating mechanism proactively generates expectations for plausible sentence continuations, and preactivates linguistic representations, from multiple cues, enhancing the efficiency of comprehension (Kuperberg & Jaeger, 2016).

In this current study, the terms "prediction," "anticipation," and "expectation" are used interchangeably. Furthermore, I adopt Kuperberg and Jaeger's (2016) definition that these terms minimally refer to the notion that contextual information (from multiple sources) is used to change the state of the language processing system before new bottom-up input becomes available, thereby facilitating processing of this new input. In this regard, prediction is not restricted to fully producing a sentence constituent mentally before it appears in the input, but rather the mechanism of prediction offers a temporal advantage by preactivating features or conditions which will facilitate integration of an upcoming constituent. This mechanism allows for the rapid formation of representations which increases the efficiency of interpretation (see Garrod & Pickering, 2009).

Most current models of language processing posit that the comprehender employs a predictive strategy to anticipate some syntactic or semantic information prior to the unfolding of the bottom-up information of such constituents (Kuperberg & Jaeger, 2016). What remains controversial is the scope and nature of the mechanism. For example, there is debate as to whether the mechanism is serial in nature such that only one upcoming possibility is considered at a time and when bottom-up input disconfirms the prediction

the parser has to start over and fully reanalyze the structure for interpretation, or whether it can consider multiple anticipated possibilities in parallel. Another area of controversy concerns the type of information that can be utilized to generate expectations to facilitate processing of new information and whether such facilitation actually reflects predictive preactivation rather than priming effects (see Kuperberg & Jaeger, 2016 for a detailed discussion). Current theoretical models of predictive language processing have yet to adequately account for the interplay of individual mediating factors, such as cognitive resources and language experience. This latter point is most relevant to the current study.

2.2.1 Predictive Mechanisms in the L1

Numerous empirical studies using behavioral and neurophysiological techniques have provided evidence that native speakers apply a parsing strategy that integrates information across domains and generates predictions based on complex cues. For example, as summarized by Huettig and Janse (2016), "reading studies have shown that readers can make use of transitional probabilities (i.e., word co-occurrence statistics, McDonald & Shillcock, 2003) to predict upcoming words. ERP studies have shown that native speakers are able to use sentence (Federmeier & Kutas, 1999) and discourse context (van Berkum, Brown, Zwitserlood, Kooijman, & Hagoort , 2005) for prediction" (p. 4). Native-speakers are also sensitive to predictive information available from cues such semantic features (Bicknell, Elman, Hare, McRae, & Kutas, 2010; Hald, Steenbeek-Planting, & Hagoort, 2007; Kamide, Scheepers, & Altmann., 2003; Metusalem, Kutas, Hare, McRae, & Elman, 2010), prosody (Salverda, Dahan, & McQueen, 2003; Weber, Grice, & Crocker, 2006), phonology (DeLong, Urbach, & Kutas, 2005; van Berkum et al., 2005), temporal marking on verbs (Altmann & Kamide, 2007), subject-verb

agreement (Lukyanenko & Fisher, 2016), inflection of grammatical and biological gender (Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000; Lew-Williams & Fernald, 2010; Tanenhaus, Magnuson, Dahan, & Chambers, 2000; Wicha, Moreno, & Kutas, 2004; Huettig & Brouwer, 2015), case-marking (Kamide et al., 2003), verb selectional restrictions (Altmann & Kamide, 1999), pronominal adjectives (Sedivy, Tanenhaus, Chambers, & Carlson, 1999), verb structural biases (Trueswell, Tanenhaus, & Kello, 1993), and referential restrictions (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995) to create expectations regarding an upcoming referent. Evidence from ERP studies has additionally shown that native speakers can pre-activate the semantic/conceptual features (Federmeier & Kutas, 1999; Federmeier, McLennan, Ochoa, & Kutas, 2002), morphosyntactic features (van Berkum et al., 2005; Wicha, Moreno, & Kutas, 2004), the phonological form (DeLong et al., 2005), and the orthographic form (Laszlo & Federmeier, 2009) of upcoming words.

Of particular relevance to the current study, Lukyanenko and Fisher (2016ccc) examined how English speaking children and adults used verbal agreement as a cue to pre-activate number features of upcoming nouns. Participants were presented two pictures which differed in number and kind (e.g., one apple, two cookies). Then, they heard sentences with a target noun naming one of the pictures. In informative trials the target noun was the subject of a preceding agreeing verb (e.g., Where are the good cookies?), but in uninformative trials it was not (e.g., Do you see the good cookies?). The results showed that both adults and very young children (2.5 years old) were able to use the agreeing verbs to predict the number features of an upcoming noun (faster RTs to shift gaze to the target in the informative trials than in the uninformative trials). These

findings suggest that predictive processing of number agreement is fully operational in L1 English from a very young age and that language comprehension is inherently predictive. Furthermore, the authors argue that anticipatory processing offers advantages for language learning. When predictions are confirmed, the predictive use of function words increases, which enhances the speed and accuracy of sentence comprehension. When predictions turn out to be incorrect, an error signal is produced. Such findings lend strong evidence for the broad scope of predictive processing on language learning and comprehension.

These highly developed linguistic abilities are robust in native speakers, but there is evidence that they are susceptible to the effects of cognitive demands most noticeably in the processing capacities of individuals on either end of the lifespan. For example, children have been shown to have non-target-like parsing in the domain of structural ambiguity resolution (Engelhardt, 2014; Snedeker & Trueswell, 2004; Trueswell, Sekerina, Hill, & Logrip, 1999) and aging adults show a decline in expectation generation (DeLong, Groppe, Urbach, & Kutas, 2012; Federmeier, Kutas, & Schul, 2010; Federmeier et al., 2002; Wlotko & Federmeier, 2012; Wlotko, Federmeier, & Kutas, 2012). In the case of complex linguistic phenomena, where cues are integrated across several domains of encoding (i.e., syntactic and pragmatic), generating predictions appears to be particularly difficult and late-developing, limited to certain phases of the lifespan, and specific to the processing situations. Federmeier (2007) summarized this age-related phenomenon by stating that "the language comprehension processes, even for simple sentences, appear to change qualitatively with age, although there are factors that seem to be able to protect against and/or compensate for such changes." She goes on to

explain that changes in resource availability or other factors can affect the ability of older adults to use contextual information to "rapidly build a message-level representation and anticipate features of upcoming words." Thus, at different stages in the life span, strategies other than predictive processing may be preferred. She concludes by stating that "given the information processing tradeoffs between predictive and integrative mechanisms for comprehension, it is perhaps not surprising that the brain seems to be able to use either strategy, depending on factors such as age and resource availability" (p. 497).

One way of understanding these propositions is from the perspective that individuals have limited cognitive resources and there are costs associated with the generation of expectations. Thus, when engaging in predictive strategies there is a risk that the generated expectation is not born out and reanalysis is required. When cognitive resources are limited or overly-burdened, an alternative strategy may be to forgo anticipation in favor of a more economic, if at times inaccurate, strategy of "good enough" processing relying solely on integration to build complete syntactic parses. (Ferreira, 2003; for related discussion, see Kuperberg, 2007). Accordingly, the balance of integration versus prediction in online comprehension will be expected to change with development in cognitive ability (e.g., Federmeier, 2007; Fernald, Perfors, & Marchman, 2006; Lukyanenko & Fisher, 2016) A resource-limited comprehender is most likely to maximize the utility of the predictive mechanism in light of his or her communicative goals: if catching the main idea is sufficient he or she may forgo the more resource demanding full-parse strategy.

In a recent study, Huettig and Janse (2016) recruited adult native Dutch speakers to participate in an eye-tracking experiment and to complete several cognitive tasks with the goal of assessing whether working memory and processing speed independently contributed to language-mediated anticipatory eye movements. Participants listened to simple instructions in Dutch, such as "kijk naar de afgebeelde piano" (look at the displayed piano), while viewing a visual-world scene that contained the target object (e.g., piano) and three unrelated distractor objects. The gender marking on the Dutch article was the only cue that could be used for anticipation as the targets, but not unrelated distractors, agreed in gender with the article presented in the spoken sentence. In addition to the eye-tracking task, participants completed an auditory non-word repetition task as an index of verbal/phonological short-term memory (Gathercole & Baddeley, 1996; Thorn & Gathercole, 1999) and a backwards digit span task to assess their individual differences in working memory, and a digit-symbol substitution task to measure processing speed. Results revealed that during the eye-tracking task, participants fixated on the target well before noun onset, strongly suggesting that they anticipated the target objects. Interparticipant variance was accounted for in terms of working memory capacity and processing speed. These findings are compatible with the view that measures of working memory capacity index an individual's ability to activate and keep active multiple long-term memory representations in order to efficiently bind arbitrary pieces of information and resolve competition during online processing. Variance beyond what was explained by working memory was accounted for in terms of processing speed. This suggests that the speed at which each individual can process information plays an important role in her or her ability to employ efficient predictive processing. Thus, it

appears that processing speed and working memory capacity play an important role in linguistic anticipation. Consequently, theoretical models of predictive language processing must fully account for the interplay of individual mediating factors and predictive mechanisms.

It is noteworthy that so far very few studies like the one described above have investigated the influence of individual cognitive differences as mediating factors on language processing in the first language, let alone in the second language. If the impact of working memory and general processing speed on anticipatory language processing can produce varied outcomes in native speakers, who possess complete and mature grammatical representations, the argument stands that L2 variation could also be a product of processing constraints.

2.2.2 Predictive Mechanisms in the L2

To date, we know even less about the efficiency of anticipatory processing in the L2 than in the L1. Most L2 processing studies have revealed that learners can show native-like sensitivities to grammatical violations concerning subject-verb, temporal adverb-verb, intrasentential anaphors, and gender and number agreement, especially when the learner's L1 and the target language are morphologically rich (e.g., Foote, 2011; Sagarra, Bel, Cominguez, García-Alcarez, 2013; Ellis & Sagarra, 2010; Sagarra & Ellis, 2013; Sagarra & Herschensohn, 2013) or when learners have reached a level of high proficiency (e.g., Alarcón, 2009; 2011; Keating, 2009; Osterhout et al., 2008; Rossi, Gugler, Friederici, & Hahne, 2006; Sabourin, 2003; Sabourin, Stowe, & Haan, 2006; Sagarra, 2007; Sagarra & Herschensohn, 2011; Tokowicz & MacWhinney, 2005).

However, in these previous studies it is not possible to tease apart the effects of predictive and integrative processes to determine which drives the learner's ultimate sensitivity.

This confound between the two processes stems from the fact that most L2 processing models consider the processor in holistic terms and learner performance is not interpreted in relation to the specific subcomponents of the processor due to the fact that the subprocesses remain ill-defined and controversial. Logically, the combined effect of highly efficient integrative and anticipatory processes is expected to result in more robust sensitivities then when efficiency is compromised in either or both processes. But, with most current methodologies (e.g., self-paced reading), when sensitivities are not evidenced, it is impossible to determine whether it is a result of inefficient bottom-up integrative processing or top-down predictive processing.

Tasks that more directly measure anticipatory mechanisms are necessary to dissociate the effects of integration from anticipation. For example, by contrasting performance on a self-paced reading task to a task that measures L2 ability to use morphosyntactic features as an anticipatory cue for sentence continuation, that is, a picture-selection task. Then, the relationship between integration and prediction can be evaluated through correlational analyses between performance on the two tasks. This would offer insight into whether an individual's capacity for integration ties in with their predictive abilities[2].

I turn now to the limited number of studies that have specifically investigated predictive abilities in L2 processing. Although small in number, their initial findings have

[2] It seems obvious that processes other than integration and anticipation are also at play, but for interest of this study, I make the categorical distinction and comparison between "bottom-up" processes grouped together and termed as "integration," and top-down, forward-looking processes as "anticipation". Future research is charged with further refining this distinction as the subcomponents and processes of the parser are identified and nuanced.

potentially wide ramifications for the theoretical models of L2 sentence processing. For instance, Grüter, Rohde, and Schafer (2014, 2016) proposed the RAGE hypothesis that holds that L2 learners anticipate upcoming information to a lesser degree than natives, in line with a similar previous proposal by Kaan, Dallas, and Wijnen (2010). Specifically, the RAGE hypothesis proposes that L2 speakers' processing capacities are overwhelmed by the demand of incremental processing of incoming information (i.e., lexical access and structural integration), severely limiting the resources available to generate expectations, irrespective of whether the cue for prediction is semantic, lexical or morphosyntactic. Yet, it remains an open question if the reduced ability to generate expectations in the L2 is general in nature or limited to a specific domain of linguistic processing (e.g., syntactic, semantic, morphological, etc.) and whether increased L2 linguistic knowledge or cognitive capacity can lead to target-like anticipatory processing.

In a novel attempt to contrast learner ability to interpret certain linguistic cues from their ability to use the cue to generate expectations, Grüter, Rohde, and Schafer (2014) conducted a story-continuation experiment to test whether native and non-native participants make different use of available cues in coreference processing. This study extended previous L2 work focused on non-expectation-driven processing of coreference (e.g., Roberts, Gullberg, & Indefrey, 2008; Sorace, 2011) and on expectations at non-discourse levels. Additionally, the authors investigated the role of proficiency and L1 background on the learner's ability to generate expectations. To this end, L1 Japanese and Korean learners of English and native English speakers completed a battery of proficiency tests including a written cloze test (Brown, 1980), self-ratings of English language ability, and performance on the Versant English Test, a commercially available

assessment of oral fluency (Pearson, 2009). Only learners completed the last task given previous evidence showing that native speakers typically perform at ceiling (Pearson, 2009) They also completed two experimental tasks: a written story continuation task adapted from Rohde, Kehler, and Elman (2006) and a truth value judgment task designed to assess participants' understanding of referential form and event structure to anticipate a story's continuation. With regard to referential form native speakers prefer pronominal forms to re-mention a referent that has appeared as the previous subject, whereas more explicit referring expressions like names are preferred for non-subject referents (e.g., Stevenson, Crawley, & Kleinman, 1994; Arnold, 2001; Miltsakaki, 2007; Kehler, Kertz, Rohde, & Elman 2008; Fukumura & van Gompel, 2010; Rohde & Kehler, 2014). Thus in a sentence like (1) the use of the pronoun "*she*" offers a bottom-up cue that the story continuation will focus on the previous subject, in this case also the source of the transfer-of-possession described in the previous sentence, regardless of the verbal aspect, which also offers a cue of the event structure and probable story continuation.

(1) Emily **brought/was bringing** a drink to Melissa. **She**_____.

However, in the absence of a referent form at the start of the following sentence, only the verbal aspect offers a cue for probable story continuation, as in example (2). In transfer-of-possession contexts a perfective condition offers a predictive cue that story continuation will elaborate on the goal, whereas in the imperfective condition an elaboration on the source is expected (Kehler et al., 2008; Ueno & Kehler, 2010, for Japanese; Kim, Grüter, & Schafer, 2013, for Korean).

(2) Emily **brought/was bringing** a drink to Melissa. _____.

Thus, in the story continuation task, the context sentences manipulated grammatical aspect of the verb (perfective/imperfective) and referential form (presence/absence of pronominal form) to create four conditions as in (3a and 3b).

(3a) Completed event (perfective)

-Emily **brought** a drink to Melissa. **She_____.**

-Emily **brought** a drink to Melissa. **_____.**

(3b) Ongoing event (imperfective)

-Emily **was bringing** a drink to Melissa. **She_____.**

-Emily **was bringing** a drink to Melissa. **_____.**

The participants were instructed to write a natural continuation of the story as it occurred to them. To verify that the participants had knowledge of verbal aspect they completed a truth judgment task that was an adaption of a story compatibility task originally designed by Gabriele (2009). The participants read stories describing events that were either complete or incomplete and were asked to judge the truth of a (written) test sentence that referred to a specific time within the story context.

The results of the truth-value task showed that, in general, all participants had a good understanding of verbal aspect. Yet, the findings of the story-continuation task indicated that the learners only showed native-like sensitivity to the bottom-up cue of the referential form. Learners were not able to exploit the top-down anticipatory cue offered by the verbal aspect to provide a native-like continuation of the story. For example, both native speakers and learners were more likely to provide a source-continuation following a pronoun prompt than following no prompt. This indicates that both groups were sensitive to the bias of a pronominal form to take an antecedent in subject position (here

the source). Additionally, native speakers, but crucially not learners, were more likely to produce a source-continuation following imperfective compared to perfective aspect; this is the case for both pronoun and free/no prompts. (There is a trend in the right direction for pronoun prompts in the L2 group, but this is not significant.) This indicates that learners did not appear to be sensitive to the aspect cue. The authors suggest that learners do not build a coherence relation proactively like L1 natives. Rather, they wait until after the end of the context sentence and draw on information already present in discourse such as the prompt type to make processing decisions at that point. Furthermore, the authors argue that this is "similar to how processes such as lexical retrieval and structural integration are forced in reaction to incrementally incoming cues that helps the comprehender derive meaning" (p.10). The aspect effect is directly mediated by expectations about coherence and the learners failed to anticipate the coherence relation for the upcoming sentence and showed a reduced effect of aspect on referential choice.

Taken together, these results showed that learners were capable of native-like sensitivity to interpreting cues but were less sensitive to using the cue for predictive computation. L1 transfer and proficiency effects were ruled out as the source of divergence because the truth-value task confirmed the prerequisite L2 knowledge of the predictive cue, and, in both Korean and Japanese, the cue of verbal aspect affects predictive coreference biases in transfer-of-possession contexts similar to English. The authors concluded, "these results are consistent with the RAGE hypothesis: Non-native speakers show native-like sensitivity to a cue that is available at the point of coreference interpretation but show weaker sensitivity to a cue whose effect requires predictive computation" (Grüter, Rohde, & Schafer, 2014, p. 2)

Turning specifically to morphosyntax and the operation of agreement, according to a bottom-up approach, agreement is established after encountering an element carrying agreement features, in which case the parser works backward to the preceding context to search for its controller (e.g., Nicol, Forster, & Veres, 1997; Pearlmutter, Garnsey, & Bock, 1999). Alternatively, under a top-down approach, predictions are generated upon encountering an agreement trigger (morphosyntactic cue) regarding the specification of dependent elements bearing agreement features (e.g., Gibson, 1998). To investigate whether L2 learners of Spanish would employ top-down processes to triggered gender markings on determiners to anticipate a referent in a two-picture visual display, Lew-Williams (2009), Lew-Williams and Fernald (2007, 2010) and Grüter et al. (2012) carried out a series of experiments that used a visual world paradigm and eye-tracking methodology. Participants were presented two images of objects referred to by nouns of either the same (la pelota – la galleta, 'the$_{\text{-fem}}$ ball – the$_{\text{-fem}}$ cookie') or different gender (la pelota – el zapato, 'the$_{\text{-fem}}$ ball – the$_{\text{-masc}}$ shoe'). At the same time, they listened to a sentence that asked them to identify one of them (¿Dónde está la pelota? 'Where is the$_{\text{-fem}}$ ball?'). The results showed that the native speakers were faster to orient to the target picture on different-gender trials, where the gender-marked determiner constituted an informative cue, than on same-gender trials, where no prenominal cues were available (Lew-Williams & Fernald, 2007). For the L2 group, no facilitative effect was observed (Lew-Williams & Fernald, 2010) even among the highly proficient learners (Grüter, Lew-Williams and Fernald (2012). These findings are consistent with the RAGE hypothesis and with earlier studies done in French that showed that native speakers are faster to process a noun when it is proceeded by a gender marked determiner (e.g., le

bateau "the$_{\text{-masc}}$ boat") relative to a neutral control (e.g., leur bateau "their boat") but L2 learners showed no such effect (Colé & Segui, 1994; Dahan, Swingley, Tanenhaus, & Magnuson, 2000; Guillelmon & Grosjean, 2001).

In Lew-Williams' dissertation (2009) the influence of experience-related factors, such as age and context of acquisition, were explored to determine how L1 and L2 Spanish-speaking adults understood article-noun sequences. In a series of experiments he examined how cues to grammatical gender, natural gender, and number were processed in the L1 and L2. Using a look-while-listening paradigm, where eye movements were recorded as the response measure, he found that L2 adults were not able to exploit informative gender-marking on the article to orient more rapidly to the referred object. However, when frequency of exposure to noun-article pairs was manipulated through a training session, in which L1 and L2 adults learned novel words paired with a definite article, both groups performed equally as well in anticipating the correct target image based on the gender cue. These findings were initially interpreted as evidence that when learners had similar exposure to gender inflected noun-article pairing they were "native-like" in exploiting the gender cues. But, this interpretation was not upheld in a follow-up experiment that required participants to generalize from the gender-marked definite determiner used in the training phase to a gender-marked indefinite article in the testing phase. The L1 adults were able to generalize from one article type to another to continue to utilize the gender-marking in informative conditions to more rapidly orient towards the target object, but the L2 adults failed to generalize the use of the gender feature across constructions. In another experiment, the author explored the processing of article-noun sequences that conveyed perceptually accessible features of referents, such as natural

gender or number. In this experiment both L1 and L2 adults were successful at taking advantage of the informativity of the article in both cases. Lew-Williams argued that this suggests that the L2 adults did not possess full syntactic knowledge about gender agreement, a feature absent in their L1, to use gender cues predictively, but were able to exploit semantic cues of biological gender and number markings on the determiner to anticipate upcoming referents. Additionally, L2 performance was not found to correlate with self-reported Spanish proficiency, years of Spanish classes, or age of exposure to Spanish.

To extend the studies of gender-marked determiners as predictive cues (Lew-Williams, 2009; Lew-Williams & Fernald, 2007, 2009, 2010; Grüter et al. 2012), Dussias et al. (2013) varied the carrier phrase to increase complexity, included a secondary task to add cognitive load, examined the effects of L1 experience and L2 proficiency, and broke down the effect for both masculine and feminine agreement structures independently. The learner population included Italian learners of Spanish, whose L1 overlaps significantly with the gender system of Spanish, and English learners of Spanish, whose L1 does not have an instantiated grammatical gender system. Hence, L1 transfer effects were expected to be beneficial for the Italian learners, but not for the English learners. Furthermore, the learners were evenly divided into high and low Spanish proficiency groups. The participants completed an eye-tracking experiment which was designed to measure the facilitatory effect of gender during the processing of sentence contexts. Participants saw two-picture visual scenes in which items matched or did not match in gender, while they listened to sentences in which masculine and feminine target items were preceded by an article that agreed in gender with the two pictures or agreed only

with one of the pictures. Eye movements were recorded and analyzed. A picture-naming verification task and a picture-identification task were also administered to confirm that that all participants could identify the pictures from the eye-tracking task and that they knew the agreement rules in Spanish and applied them with a high degree of accuracy.

The results from the eye-tracking task showed that monolingual Spanish speakers looked sooner at the referent on different-gender trials than on same-gender trials, as did the Italian-Spanish bilinguals, but only for the feminine condition. Highly proficient English-Spanish speakers also showed evidence of a gender anticipation effect, but the less proficient learners did not. The authors concluded that both proficiency in the L2 and similarities between the L1 and the L2 modulated the usefulness of morphosyntactic information during comprehension. However, it is interesting to note that the Italian learners were only able to capitalize on gender cues in the feminine condition. The authors proposed that native speakers of Spanish and highly proficient learners were able to exploit gender cues and that this finding could be understood from the perspective of cross-linguistic activation and interference. The Spanish *el* corresponds to both *il* and *lo* in Italian; whereas the Spanish feminine determiner *la* maps isometrically onto the Italian feminine determiner *la*. The cross-linguistic activation of both Italian masculine determiners when hearing the Spanish masculine determiner may have interfered with the learner's ability to efficiently utilize this predictive cue. Hence, the authors, following the proposal of Sabourin and Stowe (2008), argued that L1 transfer can fail to facilitate when there is not sufficient congruence between the L1 and the L2 systems. In contrast to the previous studies, these findings show that despite a higher cognitive load (i.e., the complex frames condition), native speakers of Spanish and highly proficient learners

were able to exploit gender cues on articles to process later occurring nouns and showed differential effects for the masculine and feminine genders. These findings provide evidence that predictive performance can be achieved by learners who lack grammatical gender in their L1 at high levels of proficiency. The authors attribute the difference between their findings and those of the previous studies to the fact that the proficiency levels of the participants in the previous studies were lower (e.g., Lew-Williams & Fernald, 2010). However, it must be kept in mind that these findings are not compatible with the more recent Grüter et al. (2014) study which also examined L1 and proficiency effects and found no effect on predictive processing of morphosyntax. However, the morphosyntactic structure under investigation in the two studies, (i.e. gender and verbal aspect) was different which raises the question of the role of the linguistic phenomenon under investigation.

To address the role of the linguistic phenomenon, Hopp (2015a) investigated case-marking cues and proficiency in anticipatory processing. The choice of case-marking was motivated by a previous findings that cue reliability appeared to be a modulating factor and case-marking as a cue to thematic role is very reliable in German (Hopp, 2013). In the previous study, Hopp had investigated grammatical gender processing by examining L1 English advanced learners of L2 German (Hopp, 2013). He found that L2 learners who were consistent in producing the target gender showed anticipatory effects of grammatical gender, but that the learners who were less consistent in gender production, even though they were accurate on a subset of words, did not use grammatical gender predictively even for that subset. He argued that it was the reliability of a cue that was

affecting how L2 speakers utilize it during comprehension and that this finding may have been specific to the linguistic phenomenon of gender.

To address cue reliability and to examine a different linguistic phenomenon, in the more recent study Hopp (2015a) tested whether L1 English learners of German (low-intermediate, high-intermediate, and advanced) integrate case, a highly reliable morphosyntactic cue, and verb semantics to form predictions in L2 comprehension. Participants completed a visual-world eye-tracking task in which they viewed scenes that contained four objects, that is, the first NP (the wolf), a potential agent (the hunter), a potential patient (the deer), and an unrelated distractor (the mountain) while listening to either subject-first (2a) or object-first (2b) sentences.

(2) a. Der Wolf tötet gleich den Hirsch.

The$_{NOM}$ wolf kills soon the$_{ACC}$ deer

'The wolf will soon kill the deer.'

b. Den Wolf tötet gleich der Jäger.

The$_{ACC}$ wolf kills soon the$_{NOM}$ hunter

'The hunter will soon kill the wolf.'

The authors expected participants to exploit nominative and accusative case on the determiner of the first noun phrase (e.g., Der/Den Wolf) to anticipate the thematic role of the second noun phrase (e.g., den Hirsh/der Jäger) and to launch looks to its depiction prior to its enunciation. Using eye-tracking methodology, eye-movement data was recorded and analyzed and the results revealed that the native listeners rapidly integrated case-marking on the first noun and the lexical semantics of the verb to make predictions about upcoming referents. For example, in both the SVO (Sentence 2a) and OVS

(Sentence 2b) order natives initiated looks toward the patient (den Hirsch) and the agent (der Jäger), respectively, after hearing the adverb. In this manner, the natives demonstrate that they were able to integrate the case-marking of the determiner of the first noun phrase as well as the lexical semantics of the verb to correctly anticipate the second noun phrase, based on the expected assigned thematic role (for, it is most logical to assume that hunters kill wolves and wolves kill deer and not the other way around). In contrast, the learners after hearing the first noun phrase about the wolf all made anticipatory looks to the patient object, the deer, suggesting that they were relying solely on canonical word order and the lexical and semantic information of the noun and verb to generate predictions. They failed to utilize the case-marking cues to generate predictions and in both SVO and OVS sentences they expected the second noun to be the patient, irrespective of their proficiency.

Hopp concluded that proficiency does not affect the ability to use morphosyntactic information for prediction, although it did modulate the speed of integration of lexico-semantic information. For example, in both SVO and OVS sentences, L2 learners were not sensitive to the thematic cue on the first noun phrase and utilized the semantics of the first noun phrase and the verb to anticipate the second noun would be the patient. However, once the high-intermediate and advanced groups received partial lexico-semantic information encoded in the second noun phrase they were able to revert their preference for looks to the patient within the second noun phrase segment, whereas the low-intermediate group did not change its preference until after the full lexico-semantic information of the second noun phrase had been provided. Such findings are in-line with previous studies that indicate that L2 speakers are able to integrate lexico-semantic

information incrementally online (e.g., Chambers & Cooke, 2009, Dussias & Scaltz 2008; Frenck-Mestre, 2002; Hopp, 2013) and extend these previous findings to show that they are also able to use such cues to generate predictions in L2 processing but that they have a reduced ability to use morphosyntax, that is, case marking, to generate predictions.

In a similar fashion, Mitsugi and MacWhinney (2015) also tested learner sensitivity to case-markers in Japanese. Like German, Japanese is a verb-final language which permits scrambling. In contrast to Hopp's (2015a) study that required assigning a thematic role to either a nominative or an accusative NP from a single unambiguous cue, the use of scrambling of ditransitive sentences increased the complexity of the predictive task. In this case, the participants had to attend to the cues offered by the first two NPs (NP-NOM, NP-DAT; NP-NOM, NP-ACC) in order to anticipate the presence or absence of a third NP. Thus, anticipation encompassed both the thematic role and the lexical semantics of the third NP prior to its appearance. Using the visual world methodology of Tanenhaus et al. (1995), intermediate English learners of Japanese and Native Japanese speakers viewed a visual display containing images of four objects: an agent, a recipient, a theme, and a distractor, while listening to spoken sentences. For example, while viewing a visual scene that depicted a director, an actress, a flower, and a theater stage, the participants heard in Japanese: "At the contest, the demanding director happily gave the actress flowers," followed by a comprehension question such as "Did the director give flowers to the actress?" Eye-movements were recorded and analyzed. In addition, the participants completed a grammar test and a background questionnaire. Although the L2 learners possessed good knowledge of case markers and were highly accurate on the comprehension questions, they did not use such knowledge to anticipate upcoming

linguistic items like the native speakers did. In fact, it appeared that the L2 participants relied more on the visual cues than the lexical and syntactic cues to narrow the scope of reference. The learners appeared to assume that the distractor image of a possible theme implied that there would be another referent that had not been mentioned, which biased them to consider a ditransitive analysis even though the linguistic cues indicated an accusative condition. The authors argued that L2 learners prefer the salient and reliable nature of the visuocontextual evidence over their rather weak knowledge of morphosyntax highlighting the L2 learner's preference for the least effortful strategy available for interpretation.

To summarize, whereas previous studies indicate that native-like predictive processing is possible for lexico-semantic cues (Hopp, 2015a), there is conflicting evidence with regard to morphosyntactic cues. On one hand, some studies have shown that learners fail to exploit morphosyntactic cues to generate anticipations, regardless of L1/L2 similarity (Grüter et al., 2014; Hopp, 2015a) and proficiency (Lew-Williams & Fernald, 2007, 2010; Grüter & Rhode, 2013, 2014), but on the other hand, some studies have shown that when proficiency is high, and/or when the L1/L2 show a high degree of overlap, native-like predictive processing is possible (Dussias et al, 2013). Therefore, the strong claim of the RAGE hypothesis that learners are systematically incapable of generating native-like expectations, does not appear to be supported by available evidence as it does not account for the specific processing situations in which learners successfully employ anticipation. However, due to the limited number of L2 predictive studies and their narrow focus on gender, verbal aspect, and case-marking, little is known about the nature of predictive processing with regard to other morphosyntactic cues, the

influence of the reliability of the cue, the immediacy of the predictive cue, the types of linguistic outcomes predicted, and the length of the temporal buffer required for the generation of expectations. Thus, in order to delineate the contexts for successful L2 predictive processing there is an apparent need for further research along these lines.

2.3 Individual Differences in L2 Processing

Relevant to the question of whether language learners can employ anticipatory strategies is how each learner's individual linguistic profile can affect these strategies. Language comprehension has previously been shown to be influenced by several independent variables which are subject to individual differences, for example, linguistic factors such as interfering or competing crosslinguistic representations, processing abilities such as the speed and accuracy with which lexical information can be retrieved, and cognitive resources such as working memory, inhibitory control, and task-switching abilities. These factors may mediate the degree to which comprehenders can employ anticipatory mechanisms in real time (Kaan, 2014). Furthermore, as these variables are interdependent and interact, they can have a summative or compensatory effect on comprehension, e.g., increased working memory could in theory compensate for L1 interference. Thus it is difficult to reduce processing difficulties to one single underlying factor and individual variation can be found within native-speakers, within learners, and between learners and natives (Kaan, 2014). Below, I discuss each of these variables and hypothesize as to how they may influence L2 predictive capabilities.

2.3.1 L1 effects

Second language learners are uniquely different from their native-speaker counterparts in that they must contend with possible interactions with their dominant

language when processing their second language. Previous studies have robustly shown cross-linguistic activation occurs even in contexts in which only one language is necessary for the task, especially when the unnecessary language is the dominant language (e.g., Dijkstra, Grainger, & van Heuven, 1999; Frenck-Mestre, 2002ccc; Spivey & Marian, 1999; van Hell & Dijkstra, 2002). This may account, in part, for why non-natives are characterized by slower processing and production in comparison to native speakers.

These findings are in line with my previous work on the effects of crosslinguistic activation (Marull, 2015) and L1 experience (Sagarra, Bel, Marull, & Comínguez, in prep). In Marull (2015), I investigated whether crosslinguistic lexical activation is modulated by L1-L2 syntactic similarity. The participants, Spanish-speaking advanced learners of English, listened to English sentences that were either congruent (i.e., the of-genitive) or incongruent (i.e, the saxon-genitive) with Spanish syntax and then made a lexical decision on a Spanish translation-equivalent of the target noun phrase or a distractor. The results showed that lexical decisions were faster when the target word was presented in a congruent rather than in incongruent constructions in the preceding sentence. Similar findings were obtained in a more recent study (Sagarra, Bel, & Marull, in preparation) which investigated the effects of processing complexity, L1 transfer, and L2 proficiency on the processing of morphosyntax by adult learners of L2 Spanish. Spanish native-speakers, and Arabic and English-speaking learners of L2 Spanish completed a self-paced reading task containing subject and object relative clauses (RCs) with number violation/non-violation on the matrix verb. The results revealed that all participants were more accurate in simpler subject RCs than complex object RCs. English

learners, who relied on word order in their L1, were more accurate in syntactic constructions similar to their L1 (OSV) than Arabic learners, who relied more on agreement in their L1 and showed more sensitivity to subject-verb violations on the matrix verb. This finding supports the notion that L1-L2 similarity influences processing efficiency and that such effects are modulated by processing complexity. Ultimately, these effects are predicted to extend to L2 predictive mechanisms as shown by Dussias et al. (2013), motivating the research questions of the current study. In addition to influence from cross-linguistic activation, L2 learners must also contend with the potential conflict between biases they have established in their L1 and those preferred in the L2 (MacWhinney & Bates, 1989; McDonald, 1987). Within the field of psycholinguistics, the competition model framework (MacWhinney, 1987) proposes that learners transfer the cues that they prioritize in their L1, such as word order, agreement, case, and animacy, to the L2. Such cue biases are established differently across languages in accordance to their reliability. For example, languages that have an impoverished morphological system typically have a strict word order which provides a more reliable cue for thematic mapping, whereas word order is a less reliable cue in languages with a rich morphological system. Previous studies within this framework (e.g., Tokowicz & MacWhinney, 2005; Morett & MacWhinney, 2013), have found that L2 learners rely on L1 cues that are reliable in the L1, such as word order in L1 English, until they reach a certain level of proficiency in the L2 and are able to reorganize their hierarchy of cue dependencies to be more reliable in the L2. For example, Tokowicz and MacWhinney (2005) demonstrated that L2 learners are more sensitive to morphosyntactic violations that are similar to L1 structures than to those that are unique to L2 structures.

Additionally, Morett and MacWhinney (2013) showed that English learners of Spanish were more accurate assigning thematic roles in Spanish when word order presentations were similar in both languages. Only the highly proficient learners were equally accurate when the word order presentations were language-specific. Hence, the similarity/dissimilarity of cue dependencies appears to modulate the difficulty of L2 processing and partially accounts for why certain L2 grammatical structures appear to be relatively easy for L2 learners to acquire, whereas other structures present greater challenges (DeKeyser, 2005).

Previous processing studies that have systematically manipulated L1/L2 similarity have found that L2 learners can exhibit native-like online morphosyntactic processing behavior when the constructions were crosslinguistically similar. For example, Tokowicz and MacWhinney (2005) tested L2 learner sensitivities to grammatical violations in the three conditions, similar, different, and unique, by using electroencephalography (EEG) methodology to measure the P600 ERP component. This component shows a greater positivity in response to a grammatical violation in native speakers (e.g., Osterhout & Mobley, 1995). English learners of Spanish with beginner to intermediate proficiency (enrolled in one of four semesters of beginning Spanish) read sentences containing three experimental syntactic constructions, i.e., subject verb agreement, tense omission, and reflexive agreement (see Table 1 for examples) half of which contained a grammatical violations. Immediately following the sentence, the participants were prompted to make an acceptability judgment about the sentence (data was also collected with English stimuli, but it is not relevant to this current review). Words were presented one at a time at a fixed rate on a computer screen and acceptability judgments were made by pressing

"Y" or "N" on the keyboard. During the task ERP recordings were collected and monitored.

Table 1.

Sample stimuli (Tokowicz & MacWhinney, 2005)

Construction	Similarity	Example/Translation
Tense	Similar	Su abuela *cocinando/cocina muy bien. His grandmother *cooking/cooks very well.
Determiner Number	Different	*El/Los niños están jugando. *The (s.)/the (pl.) boys are playing.
Determiner Gender	Unique	Ellos fueron a *un/una fiesta. They went to *a (m.)/a (f.) party.

The results showed that P600s were more positive in the ungrammatical conditions for the similar and unique constructions, but not for the constructions that were different. This is in line with the competition model's predictions that learners would be more sensitive to violations of constructions that are similar or unique across languages than those are that are different due to the L1 influence/interference. Although, it should be noted that although P600 effects were significant, the learners were only at chance on the grammaticality judgments.

Tokowicz and Warren (2010) extended the previous study by addressing some of its possible limitations. For example, in this study by using self-paced reading methodology the possible effects that speed of presentation may play were avoided and by controlling the number of words following the critical word prior to the grammaticality judgment the authors were able to examine the influence of the amount of evidence gathered across an

entire sentence. The same constructions as in Tokowicz and MacWhinney (2005) were used with the addition of another similar construction, demonstratives (4).

(4) Similar2: Esa/*Esas clase empieza al mediodía.

This/*These class begins at noon.

The same population of L2 learners (enrolled in one of four semesters of beginner Spanish) participated in the experiment. Each participant read word-by-word at their own pace sentences containing the four morphosyntactic constructions, half of which presented a grammatical violation. Following each sentence the participants indicated if the sentence was acceptable or not and rated their confidence of their judgment. Reading times on the critical word (N) and those that followed (N+1) were recorded and were compared across conditions as an index of sensitivity. Sensitivity to grammatical violations (slower reading times) were found in the similar and different conditions, but not in the unique condition. This contrasts with the findings from Tokowicz and MacWhinney (2005) and the authors attributed these differences to the methodological differences which allowed the learners to take more time to process the constructions. They suggested that other variables such as the reliability and validity of the cue along with the type of information the cue carries must be taken into consideration under the competition model framework.

Tolentino and Tokowicz (2014) returned to this topic to specifically examine the role of exposure, that is, instructional techniques, and cue saliency in processing cross-language similarity. Following the previous studies on cross-language similarity (e.g., Tokowicz & MacWhinney, 2005; Tokowicz & Warren, 2010), the morphosyntactic constructions consisted of similar, demonstrative determiner-noun, different, singular

noun phrase definiteness marking, and unique, indefinite singular article-adjective gender agreement in Swedish constructions. In this study, English speakers who were ab initio learners of a subset of Swedish were pseudorandomly assigned to Control (no training), Salience (contrast and color highlighting), or Rule and Salience (contrast and highlighting with grammatical explanations) training groups. Training took place over three sessions and comprehension of the three morphosyntactic constructions was measured in three posttests. All participants improved in grammaticality judgments across the three posttests regardless of their training group, however all were least accurate in the different condition and the Control and Salience groups were most accurate in the similar condition, and to a lesser extent the unique constructions. A more fine-grained interpretation of the data, suggested that enhanced L2 input is an effective instructional technique for morphosyntactic features that are different in the L1 and L2, whereas grammatical rule explanations are more effective for the instruction of unique constructions, at least for the beginner learner. These findings are consistent with the competition model and suggest that instructional methods also interact with crosslinguistic similarity.

In sum, it appears that crosslinguistic similarity makes L2 processing easier: constructions that are more similar across languages have an advantage over the constructions that are different or unique. But it is unclear why in some studies unique constructions, those in which the grammatical feature is only instantiated in target language but not in the L1, show an advantage over different constructions (e.g., Tokowicz & MacWhinney, 2005; Tolentino & Tokowicz, 2014) and in others the opposite pattern is observed (e.g., Tokowicz & Warren, 2010). Possible explanations may

be found in the methodology employed (e.g., self-paced reading vs serial visual presentation), proficiency level of the participants, and the exposure or instructional contexts of the learners (e.g., grammatical explanations vs. typographical saliency marking), and the type of linguistic mapping required among others. The reasons for such discrepancy remain a question of empirical research.

Turning to the relationship between crosslinguistic similarity and morphosyntactic cues in L2 predictive mechanisms, most studies have focused on unique constructions that contain features not present in both the L1 to the L2 as part of the experimental stimuli. For example, Lew-Williams and Fernald (2007, 2010), Grüter et al. (2012), Hopp (2013), and Dussias et al. (2013) have looked at the ability of English learners to exploit gender cues on the determiner, in L2 Spanish or German, to anticipate the upcoming noun phrase, and Hopp (2014), looked at the ability of English learners of German to exploit case-marking. Each one of these linguistic phenomenon is quite challenging for L2 learners because they require the acquisition of features that are absent in the L1. In all of these cases, the learners systematically failed to utilize these cues that were unique to the L2 to generate expectations.

Only Grüter et al. (2014), Dussias et al. (2013), Lew-Williams (2009), Lew-Williams and Fernald (2009) included constructions that have equivalents present in both languages, verbal aspect for Japanese and Korean learners of English, gender marking on the determiner for Italian learners of Spanish, biological gender, and number marking on articles. The findings of these studies were mixed with Grüter et al. (2014), who found no evidence of anticipation based on verbal aspect, and Dussias et al. (2013), who found native-like anticipation only for the feminine inflected determiners by the Italian-

speaking learners of Spanish. Lew-Williams (2009) and Lew-Williams and Fernald (2009) found that L2 learners reliably succeeded in exploiting Spanish articles that were informative about the biological gender or number of upcoming referents.

Therefore, it appears that the role of L1 facilitation varies across structures. As such, unique constructions appear to deplete resources during integrative processing, which necessarily precedes anticipation, leaving the processor incapable of generating expectations. This interpretation is compatible with the evidence from the above studies (i.e., Tokowicz & MacWhinney, 2005; Tokowicz & Warren, 2010; Tolentino & Tokowicz, 2014). Under certain contexts (i.e., those in which semantic information about the referential context is conveyed), constructions similar across languages are more efficiently integrated allowing for resources to be dedicated to exploiting morphosyntactic cues for anticipatory purposes, in line with the RAGE hypothesis. However, since crosslinguistic similarity has not been systematically addressed in prediction studies, such conclusions are preliminary at best. Further studies which compare different types of L1 overlap and facilitation are necessary to complement the numerous ones which examine cases of constructions that are very different in the L1 and L2. Also, L2 linguistic knowledge of the participants has varied across studies and needs to be accounted for, as discussed below.

2.3.2 Proficiency and Vocabulary Size

The effect of proficiency on L2 processing is widely acknowledged. A correlation between native-like processing of morphosyntax and high proficiency has been found in numerous online studies including neuroimaging studies (e.g., Perani et al., 2003), ERP studies (e.g., Friederici, Steinhauer & Pfeifer, 2002; Mueller, 2006; Mueller, Hahne,

Fujii, & Friederici, 2005; Ojima, Nakata, & Kakigi, 2005; Osterhout, McLaughlin, Pitkänen, Frenck-Mestre, & Molinaro, 2006; Rossi et al., 2006; Weber-Fox & Neville, 1996), and behavioral studies (e.g., Alarcón, 2009, 2011; Keating, 2009; Rossi et al., 2006; Sabourin, 2003; Sabourin, Stowe, & Haan, 2006; Sagarra, 2007; Sagarra & Herschensohn, 2011; Tokowicz & MacWhinney, 2005). Taken together, these studies have revealed that native-like performance varies in accordance to proficiency and experience with the L2. At the initial stages, processing and outcome variance is most likely due to the learner's incomplete acquisition of target-like metal representations of the grammar in the L2 compounded by the effects of resource limitations. In contrast, performance differences at advanced stages may be more directly related to resource limitations assuming that L2 grammatical representations have already been acquired and extend to L2 predictive behavior (Dussias et al., 2013; Hopp, 2013).

A specific pillar of proficiency - vocabulary knowledge - has been shown to correlate with reading comprehension, listening comprehension, and grammatical accuracy (Mochida & Harrington, 2006; but see Cameron, 2002; Meara & Jones, 1988) and has been highly associated with the speed of comprehension in L1 acquisition (Fernald, Perfors, & Marchman, 2006; Marchman & Fernald, 2008). Moreover, vocabulary size has been correlated with predictive abilities in adult native speakers (Borovsky et al., 2012).

Language learners typically have less exposure to (naturalistic) L2 input, and the quality of such input may be less rich than what a native speaker would typically receive, resulting in reduced vocabulary knowledge and lower-quality lexical representations. "Quality" of lexical representations is defined by Perfetti (2007) and Perfetti and Hart

(2001) as the stability and accuracy of the language user's knowledge of a word's form, meaning, and use (as cited in Kaan, 2014, p. 11). For L2 learners, an impoverished lexical representation can lead to a less consistent and more effortful retrieval of lexical information. In fact numerous studies have shown that bilinguals are slower at picture naming and suffer more often from tip-of-the-tongue effects (Gollan, Montoya, Fennema-Notestine, & Morris, 2005). Thus, L2 vocabulary knowledge may serve an important role in language tasks that require meaning and structure to be parsed, interpreted, and anticipated across multiple words, as in online sentence comprehension.

Although vocabulary size and proficiency appear to be tightly linked, the standard way to assess proficiency in L2 studies has been to make use of self-assessments, language history questionnaires (e.g., Dunn & Fox Tree, 2009; Li, Sepanski, & Zhao, 2006), and/or adaptions of standardized tests such as the Diploma de Español como Lengua Extranjera, DELE (Instituto Cervantes, 2007; e.g., Montrul & Slabakova, 2003), and vary to the extent in which they directly take into account vocabulary size, per se. Consequently, from these proficiency measures it is often difficult to make claims regarding the size of a participant's vocabulary knowledge. In response, Lemhöfer and Broersma (2012) presented the Lexical Test for Advanced Learners of English (LexTALE) as a new and validated test of vocabulary knowledge in English at rather high proficiency levels. This test which is typically employed as an offline lexical decision task was designed as an easily employable tool to provide a standardized assessment of participants' language proficiency in psycholinguistic experiments. Word frequency is the basic criterion and words are chosen in such a way that some should be known to participants with low proficiency levels, whereas others are known only to participants with high proficiency

levels. Distractor non-words are also included. A simple scoring technique computes the final score according to the number of words correctly identified and the number of false positives.

This additional measure of proficiency has been useful for identifying nuances between L1 and L2 speakers, such as word frequency effects in a visual word recognition experiment that disappeared once differences in vocabulary size were taken into account (Diependale, Lemhöfer, & Brysbaert, 2013; Yap, Balota, Tse, & Besner, 2008). The LexTale test has been translated into several languages with the recent addition of Spanish (Izura, Cuetos, & Brysbaert, 2014). The advantage of including the LexTale test in the battery of proficiency measures is that it is a fast and effective way of directly measuring vocabulary size, and, as a standardized measure of vocabulary size, it will permit direct comparisons between studies. Therefore, it will be included in the current study as a way to complement and independently confirm the proficiency scores from the more traditional DELE test as well as to provide an alternative measure to investigate individual differences in language processing (Andrews & Hersch, 2010; Chateau & Jared, 2000; Diependale et al., 2013; Yap et al., 2008).

2.3.3 Lexical Automaticity

Related to vocabulary size, but independent, is the speed and efficiency with which individuals can retrieve a lexical item. This ability has often been referred to as "lexical automaticity" (i.e., Hopp, 2014) and I will adopt that term from here on out. Lexical automaticity is experience driven and the age at which individual lexical items are acquired in the L1 or the L2 affects the speed and accuracy of retrieval (Montrul & Foote, 2014). In addition, the reduced input that typical L2 learners receive results in

comparatively weaker representations. As a result, L2 lexical access is slower (e.g. Coderre, Conklin, van Heuven, 2011) and less automatic (e.g., Segalowitz, Segalowitz, & Wood, 1998; but see Hulstijn, Van Gelderen, & Schoonen, 2009) than in natives, especially for lexemes that are less frequently found in the input (Montrul & Foote, 2014) and due to the lower frequency with which L2 lexical access routines are called upon. Greater demands on lexical processing can interfere with structure-building processes yielding delayed or annulled effects in L2 sentence processing (Hopp, 2014; 2015b).

With regard to morphosyntactic processing and lexical automaticity, Hopp (2014) investigated whether lexical automaticity modulated learner sensitivity to syntactic structure effects in assigning low or high attachments in ambiguous relative clauses (RCs). German learners of English and English natives read sentences with ambiguous RCs and answered comprehension questions while their eye movements were recorded. As a measure of an individual's automaticity of lexical processing, participants completed a lexical decision task on 40 English words which were considered most frequently named items in central semantic fields in addition to 40 pseudowords. To calculate automaticity, the coefficient of variance was computed by dividing average reaction times to all real English words that had been judged correctly by the standard deviation of the reaction times for each participant, following the reasoning in Segalowitz and Segalowitz (1993). This measure is similar to the one used in the current study, however the lexical items of this study were selected based on frequency bands rather than on central semantic fields. Hopp predicted that learners with less lexical automaticity would not show effects of syntactic structure attachment preferences. He divided the learners, which showed no statistical difference with regard to proficiency or

working memory, into three groups based their lexical automaticity scores, i.e. slow, mid and fast lexical decoders. Bear in mind that lexical automaticity was calculated as the coefficient of variance which captures the degree of variance in lexical recognition relative to its overall speed and is a better measure of the automaticity of lexical processing than speed per se. The study reported a correlation between lexical automaticity and attachment preferences. That is, as lexical automaticity increases, L2ers became more native-like in their attachment preference. Based on this finding, he argued that difficulties in basic-level lexical processing impact on higher-level syntactic processing, in line with findings by Dekydtspotter, Schwartz, and Sprouse (2006), and McDonald (2006). This highlights the fact that when L2 processing resources are taxed by the demands of lexical retrieval (Segalowitz et al., 1998) insufficient resources are available for syntactic processing. Hence, learners with reduced lexical automaticity are less likely to employ more strenuous, but more accurate, processing strategies such as full-parse structure building processes. Yet as processing resources become available learners in turn begin to employ higher-level syntactic processing which results in more native-like processing. Hopp's findings point to the importance of lexical automaticity in L2 online comprehension. But, since the task was based solely on reading times from a self-paced reading paradigm, it is impossible to disentangle the effect of lexical automaticity on integration from its effect on anticipation.

To the best of my knowledge, there is only study that has directly examined the speed of lexical access and predictive syntactic gender agreement during sentence processing: Hopp (2013), which was mentioned previously when discussing predictive processing and morphosyntactic cues. Using an elicited production task combined with a visual-

world eye tracking task Hopp probed accuracy in lexical gender assignment and predictive processing of syntactic gender agreement by English learners of German. The learners were divided into two groups according to their ability to systematically produce the same gender for a particular noun: those who were consistent and those who were not. He found that the group of learners that were consistent in their assignment of gender were indistinguishable from the native speakers in their ability to utilize the gender cue to anticipate the upcoming referent. Furthermore, to evaluate whether the speed of access to the gender of the noun in the mental lexicon determines whether it is useable for comprehension, Hopp performed a correlational analyses of the reaction times of the items that tested predictive lexical cues (considered a measure of lexical access speed) with the size of the predictive gender effect in comprehension. The results revealed a significant correlation suggesting that lexical access speed directly affects predictive performance on gender processing. Combined, these initial findings point to quality lexical representations, consisting of a fully specified, semantic, orthographic and phonological representation, as a prerequisite for anticipation.

However, due to the dearth of studies on lexical automaticity and anticipatory mechanisms, further research is needed to systematically probe the relation between the speed and consistency of lexical access and the predictive use of that information in L2 processing, and this current proposal aims to begin to fill this gap. If evidence is found that L2 learners who are “fast” lexical retrievers exhibit native-like anticipatory behavior, the notion that non-native processing patterns are a product of a shortage of cognitive resources would be supported. Such limitations can be overcome through experience with the language and increased efficiency in processing strategies in line with the continuity

hypothesis and related processing deficit approaches advocated by, for example, Hopp (2010) and McDonald (2006) in contrast to fundamental difference hypotheses (e.g., Clahsen & Felser, 2006, 2010).

Taking another approach, Sanoudaki & Thierry (2015) investigated to what extent syntactic processing is affected by verbal fluency abilities. They grouped highly-proficient Welsh-English bilinguals in accordance to verbal fluency, measured via a production task. This task taps into the lexical processing of an individual, but the verbal fluency task taps into the retrieval of a lexical item for production and, in contrast, the lexical decision task taps into the identification of a lexical item for comprehension. Both are important processes for language use, but lexical automaticity may be more directly correlated to integration whereas verbal fluency would be integral to anticipation, as anticipation is viewed by some perspectives a silent form of production. Participants completed a semantic verbal fluency task in English and Welsh (a semantic category was provided and participants had a limited amount of time to name as many exemplars within that category that they could), grammaticality judgment tasks in both languages, and a mental decision task which tested participants' response inhibition in anticipation of grammatical and ungrammatical elements (manipulation of noun-adjective word order) within English sentences. During this last task electrophysiological evidence was obtained. They expected that the subgroup with higher verbal fluency in Welsh would be more likely to activate in parallel both Welsh and English syntactic structures resulting in a stronger inhibition effect as compared to the subgroup with lower Welsh verbal fluency who were less likely to activate the translation equivalent to the same degree. If relative verbal fluency is irrelevant for syntactic processing, then no between-group difference

was expected. The results revealed that participants with higher Welsh verbal fluency did indeed show evidence of activating both English and Welsh syntactic structures during English sentence comprehension but those with lower Welsh verbal fluency did not. These results suggest a directionality in cross-language syntactic activation suggesting that the more fluent language can affect syntactic processing in the non-dominant language. Consequently, the effects of crosslinguistic syntactic activation are expected to subside as verbal fluency increases in the second or non-dominant language.

Therefore, in light of the goals of this current study to tease apart integrative and anticipatory processing as well as to identify the effects of individual differences on each component, measures of lexical automaticity and verbal fluency will be included. Each has been shown to affect sentence comprehension and, yet, have been generally overlooked in most L2 processing studies.

2.3.4 Working Memory

Working memory is an individual's limited capacity for storing and processing information while carrying out complex cognitive tasks (Baddeley, 2003, 2007; Just & Carpenter, 1992). The dominant view in the field is that working memory is functionally separate from long-term memory. Within this view, working memory is the space in which information from multiple sources such as morphology, syntax, semantics, and discourse information are retrieved from lexical entries and integrated to create structure. It is the locus of the application of parsing strategies and is, therefore, essential for sentence interpretation. Thus, the capacity for any individual to actively consult multiple information types in parallel at each stage of sentence processing is fundamentally linked

to his or her working memory capacity. Anything which compromises the efficiency of the working memory system will have direct implications for language processing.

Although there is no consensus in the field regarding whether language processing is served by domain-general (e.g., Just & Carpenter, 1992; Lewis, Vasishth, & van Dyke, 2006) or multiple domain-specific (e.g., Caplan & Waters, 1999) working memory systems, or whether processing tasks draw from a fixed resource pool or indexes language skills based on experience (e.g., MacDonald & Christiansen, 2002), on any of these accounts, working memory plays an essential role in sentence comprehension (for a review, see Lewis et al., 2006).

With regard to the L2, there is growing evidence that working memory affects L2 proficiency measures (Harrington & Sawyer, 1992; Miyake & Friedman, 1998), lexical retrieval and vocabulary use (e.g. Christoffels, De Groot, & Kroll, 2006), and text comprehension (Walter, 2004), as well as morphosyntactic processing (e.g., Havik, Roberts, Van Hout, Schreuder, & Haverkort, 2009; Miyake & Friedman, 1998; Miyake, Carpenter, & Just, 1994; Sagarra, 2007; Sagarra & Herschensohn, 2008; Sagarra & Herschensohn, 2011; Sagarra & Herschensohn, 2010; Dussias & Piñar, 2010; Sagarra & Herschensohn, 2012, Sagarra & Herschensohn, 2013). However, not all studies have found supporting evidence for the effects of working memory on morphosyntax (Juffs, 2004; Felser & Roberts, 2007; Foote, 2011). It may be possible to explain the conflicting findings by taking a closer look at the relationship between working memory and proficiency.

In a meta-analysis of the role of working memory in L2 processing, Linck, Osthus, Koeth, and Bunting (2014) analyzed data from 79 samples involving 3,707 participants,

which provided 748 effect sizes. The results indicate that working memory is positively associated with both L2 processing and proficiency outcomes, yet the numerous studies that have found working memory effects on proficiency have generally found them in learners with lower but not higher proficiency in the L2 (e.g., Havik et al., 2009; Sagarra, 2007, Sagarra, 2008, Sagarra & Herschensohn, 2010; Sagarra & Herschensohn, 2011, Sagarra & Herschenson, 2012). Thus, it seems L2 sentence processing at lower proficiency levels places larger demands on working memory resources and constrains L2 sentence processing (Indefrey, 2006). Once a certain automaticity is acquired at higher proficiency levels, individual capacity plays less of a role (Service, Simola, Metsaenheimo, & Maury, 2002), lending further support to the notion that divergent processing in the L2 is a product of capacity limitations and task difficulty.

The specific ability to generate predictions during processing is also likely to be modulated by the cognitive resources available to the comprehender (Slevc & Novick, 2013, but see Otten & Van Berkum, 2009). To explore this relationship this study utilizes two levels of proficiency (intermediate and advanced) and a non-linguistic working memory test to measure individual capacity.

2.4 Assumptions about the Structure of the Mental Representations of the Lexicon

In this dissertation, I assume a dual-route model of sentence processing. Compatible with the level of grammatical and lexical representation of the L1 and L2 in the dual route model is the parallel architecture (Jackendoff, 2002) approach to the lexicon, which differs from generative approaches in that it postulates no strict distinction between syntax, semantics, and phonology. Idiosyncratic rules dictate how the interfaces of the modules are represented in a continuum of generality. These “rules” are stored as lexical

entries in the lexicon. Under this view there is no strict lexicon-grammar distinction and the grammar is comprised of the independent generative components of phonology, syntax, and semantics, linked by interfaces and activated in parallel.

In this model, a "word", as traditionally understood, is not the limit of what is stored in the lexicon because units such as affixes, larger constructions such as idioms, semantic entries, phonological representations and syntactic treelets (phrase constraints that represent the available pieces of grammatical structure necessary to build phrase structure) are all stored as lexical entries. As Jackendoff (2015) stated,

Words, rules, and everything in between are lexical items—pieces of stored structure. What makes an item word-like is that it is a grammatical word whose structure is fully specified. What makes an item rule-like is that some of its structure consists of variables, such as the V and NP in the VP schema, (Jackendoff, 2015).

Consistent with dual-route models, concatenation of items in the lexicon is also susceptible to resource limitations because the parallel architecture posits working memory as the locus of the application of parsing strategies essential for sentence interpretation (Jackendoff, 2007). Thus, any variable which additionally taxes working memory, will have negative consequences for the building of linguistic constructions in real time. The implications of assuming lexical representations from this perspective will be discussed in more detail below in the next section that outlines the specific linguistic constructions of interest for this study.

2.5 Linguistic Constructions

The framework of the parallel architecture (Jackendoff, 2002) for linguistic representation is compatible with constraint-based processing models, such as dual-route models, and will be used as a possible model of the linguistic representations under analysis in this study. Within Jackendoff's framework, the lexicon is not distinct from the grammar, rather each lexical entry is an idiosyncratic rule that links the independent and generative phonological, syntactic, and conceptual systems. Each component is constrained by its own formation rules and lexical entries are "rules in a continuum of generality with more general grammatical structures" (p. 5). Under this view all rules of morphology are also encoded as lexical entries. The lexicon is categorized according to regular productive rules and semi-productive words. For example, on the one hand, the English past tense can be formed by applying the productive rule of the regular past tense ending *–ed*, which is a lexical entry containing the phonological structure and the specification that it is a clitic affix to the lexical entry of the regular verb root. But on the other hand, irregular past-tense verbs such as slept have a lexical entry that corresponds to the full word. For instance, *walked* is comprised by the unification of two lexical entries [walk] and [ed] via a productive rule, while [slept] is a single lexical entry. With high frequency words it is possible that both whole words and the compositional rules are stored in memory of a speaker. This redundancy is not seen as problematic as it can confer certain cognitive advantages: for high frequencies words it is more economic to have the inflected form stored as a whole word thereby decreasing the demand on working memory to compile its form, but if all possible compositions of words were stored in memory the cognitive demand for storage and retrieval would be quite costly. In

this latter case the storage burden can be reduced via the application of compositional rules to less frequent entries. In fact, dual-route models claim that morphological decomposition and whole-word access are simultaneously activated to maximize processing speed (Gor, 2010, p. 6).

Therefore one speaker may compose *walked* from *walk* and *-ed*, whereas another retrieves it as a single entry based on their own experience with the language and frequency of encounters with the word walked. Hence, their output would be the same and it would be difficult, barring cleverly crafted lexical tasks, to determine which process they employed. With both formation rules and linking rules represented as lexical entries, we can consider the mental lexicon as the individual speaker's knowledge of the language.

2.5.1 Number Inflection and Agreement

Turning now to the specific linguistic constructions for this study, two constructions have been selected because they vary in similarity/dissimilarity in English and Spanish, namely the demonstrative and definite article (see Table 2).

Table 2

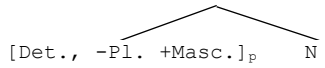
Linguistic Constructions

	English		Spanish	
	singular	plural	singular	plural
Demonstratives	this	these	este$_{masc.}$ esta$_{fem.}$	estos $_{masc.}$ estas$_{fem.}$
Definite Articles	the	the	el $_{masc.}$ la$_{fem.}$	los $_{masc.}$ las$_{fem.}$

These structures are of interest because they represent crosslinguistic differences which are relevant for number agreement within the determiner phrase. In contrast to most generativist models, such as the representational deficit hypothesis by Hawkins (2009), which would not allow us to make different predictions about the importance of these non-overlapping structures for L2 learners, within the parallel architecture framework, it is easy to identify why crosslinguistically English learners of Spanish would have more difficulty with definite articles than with the demonstratives. In Spanish, the plural features of the noun always trigger agreement with the determiner, but not always in English. Take for example (5) - (7).

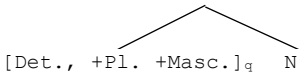
(5) Spanish definite article: "EL" (the$_{sing}$)

a. $[el]_p$ b. NP c. $[+Def., +Spec., -Plural, +Masc.]_p$



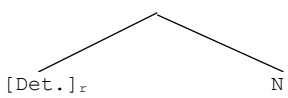
(6) Spanish definite article: "LOS" (the$_{spl}$)

b. $[los]_q$ b. NP c. $[+Def., +Spec., +Plural, +Masc.]_q$



(7) English definite article: "THE"

a. $[ðə]_r$ b. NP c. $[+Def., +Spec.]_r$

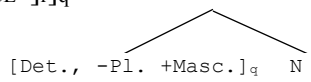


In (5), the lexical entry of *el* is represented by the three levels of parallel architecture with indices encoding the links between individual components. (5a) is the phonological structure, (5b) is the syntactic structure and the index p in (5a) and (5b) shows that *el* is a determiner in syntax the features [-plural] and [+Masc.] are necessary to agree with the singular masculine noun. In the semantic representation (5c), [+Def.], [+Spec.], [-Plural, +Masc.] provide conceptual information regarding the relationship between the determiner and the noun. In (6) we find the lexical entry of *los* which is similar to (5) except it is marked with the syntactic and semantic feature of [+plural], manifested in the phonological representation, and which will have syntactic consequences for agreement. However, in the English equivalent (7) we find only one lexical entry *the*, which represents [+Def.] and [+Spec.] but bears no syntactic or semantic number or gender feature. The challenge of the English learner of Spanish then isn't just developing two phonological realizations for [+Def] and [+Spec.] but rather the instantiation of additional gender and number features which require additional mapping at the interface of the conceptual, syntactic, and phonological level.

In the case of the demonstrative the presence of a number feature in both languages can facilitate acquisition (8) – (11).

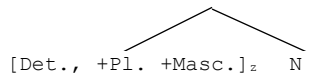
(8) Spanish demonstrative: "ESTE"

a. $[est_p\,[_{CL}e]_r]_q$ b. NP c. $[+Def., +Spec., Proximal]_p[-Plural, +Masc.]_r$



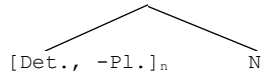
(9) Spanish: "ESTOS"

a. $[est_x\,[_{CL}os]_y]_z$ b. NP c. $[+demonstrative\ Def., +Spec., Proximal]_x[+Plural, +Masc.]_y$



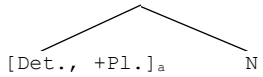
(10) English demonstrative: "THIS"

a. [ðIS]$_n$ b. NP c. [+Def., +Spec., -Plural, Proximal]$_n$



(11) English demonstrative: "THESE"

a. [ðiz]$_a$ b. NP c. [+Def., +Spec., +Plural, Proximal]$_a$



As seen in (8) through (11) a number feature is present in the semantic and syntactic components. The presence of this feature in the syntactic component drives agreement with the modified noun. Hence, is expected that the L1/L2 overlap will facilitate the processing of the Spanish demonstrative for L1 English learners than in the case of the definite article because it won't require the instantiation of a new number feature[3] and learners will be able to transfer their processing patterns from English to Spanish. The challenge in this case requires only development of the phonological form derived from the compositionality of a stem and a plural affix. Since this follows the regular pattern of pluralization of nouns in English, it does not require the instantiation of a new productive rule only the application of the rule to these particular cases.

To summarize, the parallel architecture framework would predict that it is difficult for L2 adults to develop new representations for the Spanish definite article because it requires the instantiation of a syntactic number feature which is far more challenging than the application of an already instantiated pluralization rule as in the case of the demonstrative. Therefore, a processing advantage is expected for the similar

[3] It will also require the instantiation of a gender feature. Arguably, this would be a source of processing difficulty for both demonstratives and definite articles as it requires a mapping with a feature that is inexistent in English. Hence, neither structure would offer an advantage if processing strategies are transferred from English to Spanish and any such advantage is anticipated to stem directly from the presence of a syntactic number feature in the demonstratives and a lack thereof in definite articles. Therefore, as number is the feature of interest, in this study gender is held constant (masculine) for all critical items.

crosslinguistic structure (the demonstrative) than for the dissimilar crosslinguistic structure (the definite article).

The parallel architecture analysis is more fine-grained but yields similar expectations as the psycholinguistic approach adopted by Tokowicz and MacWhinney (2005) and Tokowizc and Warren (2010): that similarity is determined when specific morphosyntactic features are similar on the basis of a word-by-word translation. Within this framework, constructions can be classified into three different categories: grammatically similar, dissimilar, or unique as in the following examples in English and Spanish, as in (12) – (14) cited in Tolentino and Tokowicz (2011).

(12) Similar construction

a. **Este chico** es alto.

"This boy is tall."

b. **Estos chicos** son altos.

"These boys are tall."

(13) Dissimilar construction

a. **El chico** es alto.

The$_{\text{- SING}}$ boy$_{\text{- SING}}$ is tall

"The boy is tall."

b. **Los chicos** son altos.

The$_{\text{- PL}}$ boys$_{\text{- PL}}$ are tall

"The boys are tall."

c. * **El chicos** son altos.

The- SING boys- PL are tall

(14) Unique construction

a. **El chico** es alto.

The- MASC boy- MASC is tall

"The boy is tall."

According to the competition model, as described in Tolentino and Tokowicz (2011), a linguistic construction is classified as similar if it has a morphosynactic feature that is expressed in both languages in a similar fashion and if word-by-word translations yield legal sentences maintaining the original meaning. For example, in the construction of the demonstrative (12) number agreement is marked similarly on the determiner in both English and Spanish. In contrast, a construction is categorized as different when a feature is present in both languages but is instantiated differently, that is, the definite article (13). In this case, in Spanish the definite determiner bears a morphological marker for number which must agree with the number of the noun. But, in English the definite determiner is not morphologically marked for number and hence there is no overt agreement between the article and the noun. Therefore, a direct translation from English to Spanish would yield and ungrammatical sentence, as in (13c). The remaining categorization is that of a unique construction. In this case the feature is only instantiated in one of the languages, as exemplified by gender markings on definite articles as in (14). In Spanish, the definite article is inflected for gender in agreement with the gender of the noun. This feature is absent in English, making it unique to the L2. This categorical distinction from the psycholinguistic approach glosses over the nuanced and gradient mapping issues treated by the parallel architecture approach, yet according to either approach the argument is

sustained that the demonstrative is more "similar" across languages than the definite article.

Therefore, this current study will contrast the demonstrative construction ("*this*" and "*these*") to the definite article construction ("*the*"). The former represents less complex crosslinguistic representations between phonology, semantics, and syntax due to the presence of a number feature in both Spanish and English, than the latter due the absence of said feature. The absence of the number feature in the L1 and L2 is anticipated to be a source of difficulty. Therefore when learner performance is compared across comprehension and anticipation tasks, both proficiency and linguistic structure effects are expected. In contrast to prior anticipatory studies that have analyzed only structures that required the instantiation of new features in the L2, the demonstrative construction provides an optimal condition for learners to demonstrate native-like predictive processing in the L2, if such abilities are indeed possible. Findings along these lines would provide evidence to refute the strong interpretation of the RAGE hypothesis, in which L2 learners are systematically incapable of generating native-like expectations, and would support a more nuanced interpretation that crosslinguistic similarities and resource limitations modulate predictive abilities.

2.6 Processing of Number Agreement in the L2

There is growing evidence from recent studies that grammatical features, such as number, present in the L1 (English), are likely to be acquired earlier and processed in more depth than grammatical features that do not exist in the L1, such as gender (e.g., Dowens, Vergara, Barber, & Carreiras, 2009; Sagarra & Herschenson, 2013). For example, White et al. (2004) evaluated English-speaking learners of Spanish at low,

intermediate, and high proficiency on oral production tasks and an interpretation task which required learners to select pictures according to number and gender contrasts. All learners were successful utilizing number morphosyntax in both tasks, but lower proficiency subjects were more accurate on number than gender, whereas the intermediate and advanced groups performed equally as well with gender and comparatively as well as the native speakers. These findings suggested a clear proficiency effect for gender, but did not offer any evidence for L1 effects, being that French-speaking learners of Spanish showed the same performance pattern. The authors argued that these findings were consistent with the Full Transfer Full Access hypothesis (Schwartz & Sprouse, 1996) that although the L1 grammar is the basis for L2 acquisition, with the continual exposure to L2 and increased proficiency, grammatical features and processing routines not originally present in the L1 can become functional in the L2. Similar findings for gender were found by Montrul, Foote, and Perpiñán. (2008), who also identified proficiency as the driving factor behind performance. However, the extent that their findings can be generalized is limited because the tasks were completely offline, such that processing patterns in real-time were confounded with the participant's metalinguistic knowledge. It is possible that certain kinds of tasks or communication pressures may be more revealing of the true state of the underlying representations of grammatical features and the automatized parsing strategies employed by L2 learners. In this sense, online behavioral measures are more likely to give a truer picture of the grammatical representations and parsing strategies employed by learners during real-time interpretation and production.

Studies that have incorporated online techniques, such as self-paced reading, eye-tracking, and picture-selection tasks, have confirmed that native-like number processing appears to be acquirable in the L2 however, proficiency may not be the only contributing factor (e.g., Sagarra & Herschensohn, 2013; Dowens et al., 2009; Lew-Williams, 2009; Lew-Williams & Fernald, 2009). For example, Sagarra and Herschensohn (2013), using a self-paced reading technique found that, beyond proficiency, semantic (animacy) features differentially impact agreement processing and an individual's working memory also affects L2 processing skills. Dowens et al. (2009), employed electroencephalogram methods and found that ERP responses were modulated by proficiency as well as factors such as age of acquisition and transfer processes from first language to L2.

Specifically regarding the processing of number agreement for anticipatory processing, as discussed above, some findings suggest that English-speaking learners of Spanish are able to process number agreement to anticipate upcoming nouns even at low levels of proficiency. In the studies carried out by Lew-Williams (2009) and Lew-Williams and Fernald (2009), English-speaking learners of Spanish and L1 adults took advantage of articles that were informative about number information to orient more quickly to the target referent(s) in a picture-selection task. Performance of the learners highly correlated to years of classroom exposure to the L2. Yet these participants were not able to take advantage of articles that were informative about grammatical gender to complete the same task, but they were when the information was regarding biological gender. The authors argued that in addition to proficiency L2 adults more effectively exploit cues that convey semantic information about the referential context.

Taken together the above finding suggest that using number agreement predictively will most likely be more successful in the L2 than other grammatical features such as gender and case-marking, due to the fact that number agreement is found in the L1, is less cognitively demanding, and contains semantic information. Consequently, it is an ideal structure to test the strong interpretation of the RAGE hypothesis that posits that the reduced ability to generate expectations in the L2 is a generalized processing deficit that is not influenced by the linguistic phenomenon. Simultaneously, number agreement also allows for an examination of the weak interpretation of the RAGE hypothesis which emphasizes the depletion of cognitive resources as the root cause of reduced anticipatory processing.

2.6. Conclusion

Previous research on L2 processing has identified gaps and shortcomings in our understanding of the factors potentially constraining efficiency in L2 predictive processing. Taking into account the recent proposal of the RAGE hypothesis, it becomes evident that little is known about non-native speakers' ability to generate expectations in real-time across different linguistic components (phonology, morphosyntax, semantics, etc.) and whether factors such as L1-L2 similarity, proficiency and vocabulary size, lexical automaticity, and working memory, interact at this level of processing. Thus, this dissertation will expand upon my previous work on the effects of crosslinguistic activation (Marull, 2015) and L1 experience (Sagarra, Bel, Marull, Comínguez, in prep) to contribute to filling this gap in the literature to refine our understanding of L2 processing. If the L2 learner is capable of efficient processing (both integration and anticipation) under any circumstance, then it will be most parsimonious to assume that

the underlying processor itself is not necessarily different but rather processing of such knowledge is modulated by interactions across cognitive and linguistic domains.

In conclusion, I outline a number of desiderata that inform the design of the proposed study.

(1) To investigate a linguistic phenomenon that is evidenced in different linguistic constructions that vary in L1/L2 similarity.

Number agreement is a linguistic phenomenon involving several syntactic and semantic-related aspects whose basic operation can be observed across various linguistic constructions and domains. Previous L2 research has attested non-nativelike processing of various morphosyntactic structures during development. In order to identify what is driving processing inefficiencies, different morphosyntactic constructions need to be tested. It is desirable that these constructions be selected according to certain variables which, arguably increase or decrease their processing complexity, so that it can be determined which is potentially more influential on performance outcomes. To this end, the phenomenon of investigation will be two morphosyntactic constructions, namely, definite articles and demonstratives, which evidence number agreement via morphosyntactic and lexical markings, to determine whether inefficiencies in L2 processing are a result of differences in grammatical representations or cognitive effects on the processor. Specifically, the goal is to examine whether resource limitations influence non-native speakers' use of morphosyntactic cues to generate grammatical expectations during sentence processing. A theoretical model of these constructions has been outlined above and related to the psycholinguistic evidence available so far.

(2) To test various proficiency levels of English-speaking learners of L2 Spanish

As previous research indicates that proficiency levels underlie qualitative and quantitative differences between L1 and L2 processing, the present study will test L2 learners at different levels of proficiency – intermediate and advanced – in order to consider effects of proficiency on integrative and predictive processing mechanisms.

(3) To identify resource-limiting cognitive factors

Previous L2 research has attested to the effects of cognitive factors on L2 processing and have proposed that resources, first dedicated to integrative mechanisms (Grüter & Rohde, 2013; Grüter et al., 2014), may be saturated and unavailable for predictive mechanisms. This would be especially true for constructions that are found to be more complex to process, when task demands are costly, and when individual capacity is limited. To explore the effect of individual capacities, this investigation will focus on individual working memory capacities and lexical retrieval and production efficiency.

The overarching goal of this study is to contribute to the growing literature on second language processing in order to investigate potential key differences between native and non-native (L2 learners of Spanish) that speak to theoretical debates on the nature of linguistic representations and processing in these two types of speakers. In particular, this dissertation seeks to determine whether difficulties experienced by L2 learners during sentence processing results from inefficient processing mechanisms at the level of integration (a bottom up process) or prediction/anticipation (a top down process).

As detailed in the following chapter, two groups of learners of Spanish with different proficiency levels (intermediate and advanced) participated in two sentence processing tasks which tap into integrative and anticipatory processing respectively. Performance on these tasks was compared to the performance of native speakers of Spanish. The structure

of interest is number agreement with articles and demonstratives. Spanish marks number on articles and demonstratives, whereas English only marks number on demonstratives but not in articles, crucial for testing the influence of the L1 (English) on the processing of the L2 (Spanish). The non-native speakers also completed proficiency tests, tests of lexical automaticity, verbal fluency, and working memory, to see whether these factors play a role in the efficiency of L2 predictive processing of morphosyntax.

In the next chapter (Chapter 3 – Research Questions and Methods), I advance the specific research questions and hypotheses and present the experiments on integration, anticipation, and individual linguistic and cognitive differences. I also, provide a detailed description of the employed materials and procedures.

Chapter III: Research Questions and Methods

3.0 Introduction

This section describes the research questions, hypotheses and the methods employed in the project. Subsection 3.1 advances the research questions and hypotheses. Subsection 3.2 introduces an overview of the methods and experimental design. Subsection 3.3 describes the participants and subsection 3.4 provides a detailed description of the experimental materials and procedures.

3.1 Research Questions and Hypotheses

The series of experiments advanced in this study (a) tests whether L2 learners comprehend the selected morphosyntactic structures using offline screening tasks, (b) tests their ability to integrate number agreement in real time, and (c) explores L2 learner ability to use morphosyntactic number cues to generate expectations about upcoming input in real time. Furthermore this dissertation aims to identify the extent to which proficiency, working memory, lexical automaticity, and verbal fluency contribute to processing outcomes. To assess morphosyntactic integration and anticipation in real time and to compare native patterns to L2 patterns, Spanish native speakers and L1 English adult intermediate and advanced learners of L2 Spanish were asked to complete an online self-paced reading task, a picture-selection task, and offline grammatical tests.

The study aims to answer the following specific research questions:

1. Are intermediate and advanced L2 learners of Spanish sensitive to number violations between demonstrative-noun and definite article-noun constructions during reading of L2 Spanish?

2. Which of the following factors help L2 learners of Spanish detect number agreement errors between determiners and nouns: working memory, lexical automaticity, verbal fluency, vocabulary size, and proficiency?
3. Are intermediate and advanced L2 learners of Spanish able to use number information from the demonstrative and the definite article to anticipate an upcoming target object to improve accuracy and response time on a picture disambiguation task?
4. Which of the following factors help L2 learners of Spanish use number information from the determiner to anticipate an upcoming target object: working memory, L1/L2 similarity, lexical automaticity, verbal fluency, vocabulary size, and proficiency?
5. Does the ability to utilize number information on determiners to anticipate upcoming input correlate with increased sensitivities to determiner-noun number violations in reading?
6. What is the relationship between L2 learners' metalinguistic knowledge of number agreement between determiners and nouns and their online sensitivities to this phenomenon for the detection of violations and the anticipation of target objects?

According to the RAGE hypothesis, learners are expected to be capable of native-like integration of number agreement (sensitivity to violations in the self-paced reading task), but are expected to show reduced ability to generate expectations based on morphological number cues (no RT differences on picture-selection task). Additionally, individual cognitive resources are expected to play a central role such that learners will be more

likely to show native-like processing when the constructions share greater L1/L2 similarities, when learners have higher working memory capacity, lexical automaticity, verbal fluency, and/or proficiency.

3.2 Overview of Experimental Design

To explore the extent to which L2 learners are capable of integrating and generating expectations of number agreement, 68 native English speakers learning Spanish (intermediate, $n = 49$, and advanced proficiency, $n = 19$), and 32 native Spanish speakers completed a series of linguistic, cognitive, and metalinguistic awareness tasks. The learners completed the tasks in two sessions on separate days, a pre-session lasting approximately 35 minutes and the experimental session lasting approximately 60-90 minutes. The natives completed all tasks, including those of the pre-session, in a single session of 60-90 minutes.

All materials were administered via digital presentation on a computer screen which required participants to read, listen, speak, and click to answer. The experimental design is shown below in Table 3.

Table 3

Experimental Design

Pre-Session (Learners only)		
Language Background Questionnaire (5 minutes) (see Appendix B)	L2 Proficiency Test (25 minutes) (see Appendix C)	Vocabulary size test (5 min.) (see Appendix D)
Experimental Session		

Working memory task (10 min.) (see Appendix H)	Self-paced reading task (20 min) (see Appendix K)	Picture-selection task (15 min.) (see Appendix K & L)	Lexical automaticity (5 min.) (see Appendix I)	verbal fluency test (3 min.) (see Appendix J)	Grammar and vocabulary test (10 min.) (see Appendix E & F)	Metalinguistic Awareness Task (1 min.) (see Appendix G)

Note. The presentational order of the self-paced reading and picture-selection task was counterbalanced across participants such that half of the participants completed the self-paced reading task prior to the picture-selection task and the other half completed them in reverse order.

The experimental design provides the following data. First, the language background questionnaire screens participants for their language learning experience, that is, age of acquisition of Spanish and English, language use, instructional settings, time spent abroad, and information regarding proficiency in other languages learned in formal and informal settings. Second, the proficiency test and the vocabulary size test provide two independent measures of the participants' proficiency in Spanish. Third, the working memory task provides an independent measure of the participants' individual working memory capacity. Fourth, the lexical automaticity and verbal fluency test evaluates each participant's efficiency in lexical retrieval and production. Fifth, the self-paced reading task (SPR) measures participants' ability to integrate number agreement during reading comprehension by testing their sensitivity to number agreement violations between the definite article, the demonstrative, and the modified noun. Sixth, the picture-selection task obtains data regarding the participants' ability to exploit number morphology of the definite article and the demonstrative to generate expectation about the upcoming modified noun. And lastly, after the experimental task, participants completed an additional screening task comprised of an offline grammar and vocabulary test which elicited data on the grammatical knowledge of the aforementioned number agreement constructions in Spanish as well as a metalinguistic awareness task, where, in their own

words, participants were able to express what they knew about the grammatical constructions of interest, namely, how number agreement worked in Spanish.

The research project follows a mixed design (between and within participants) and mixed methods (both quantitative and qualitative data) with five experimental tasks. In order to address research question 1, participants' reading times in the SPR task were analyzed in three separate 2 (construction type) x 2 (number agreement) ANOVAs, one for each group (native speakers, advanced learners, intermediate learners) at the pre-target (N-1), target (N), and post-target (N+1) sentence region. To address research question 2, and to isolate the effects of the each individual variable (vocabulary size, verbal fluency, lexical automaticity, and working memory), multiple linear regressions were run for each additional factor to find the best fit to determine the predictive value that each variable added to performance at the critical regions in the SPR task. To address research question 3, participants' response times in the picture-selection task were analyzed in three separate 2 (construction type) x 2 (informativity) ANOVAs, one for each group (native, advanced learners, intermediate learners). To address research question 4, and to isolate the effects of the each individual variable, (vocabulary size, verbal fluency, lexical automaticity, and working memory) multiple linear regressions were run for each additional factor to find the best fit to determine the predictive value that each variable added to performance on the picture selection task. To address research question 5, correlations between performance on the picture-selection task (predictive effect size) and the SPR task (violation sensitivity effect) were analyzed at each critical region and for each proficiency group. To address research question 6 regarding metalinguistic knowledge and sentence processing a regression analysis would have been

run to determine the relationship between metalinguistic knowledge of number agreement between determiners and nouns and online sensitivities to this phenomenon for the detection of violations and the anticipation of target objects, but due to a lack of variability in responses and a ceiling effect, such analyses were not possible.

3.3 Participants

All participants were recruited either in Argentina (Spanish native-speakers) or from a large American university (English L2 Spanish learners). Utilizing a convenience sampling method one hundred 18 to 45-year-olds were recruited: Spanish native speakers (32) and English L2 Spanish learners (68 advanced and intermediate). All participants had completed high school.

The Spanish-native participants were mainly young professionals and university students recruited through personal networks from the interior regions of Argentina (e.g., Santa Fe and La Pampa). They were compensated for their participation with either 50$ARS or $5.00US according to their preference (see Appendix A for consent forms). As prior research has shown that crosslinguistic influence can be bidirectional (e.g., Palomar-García et al, 2015, Pavlenko & Jarvis, 2001; Vasilyeva et al, 2010), the native participants were recruited from an environment where L2 influence, especially L2 English, is minimal. This interior region of Argentina offers strong linguistic homogeneity and few languages in contact. Furthermore, final "*s*" deletion, which could affect the processing of plural morphology markers especially in the aural domain, is less extended in this region as compared to the capital and many of the neighboring countries. The Spanish native speakers were born, raised, and formally educated in Argentina. They

had spent minimal to no time abroad, and were currently residing in Argentina at the time of data collection.

The language learners were recruited at a large U.S. university in New Jersey through personal networks, flyers, classroom presentations, postings in on-line forums and newsgroups, and from language classes in the Department of Spanish and Portuguese. They were compensated with $5.00 or with class credit. During the recruitment phase the importance of intermediate and advanced proficiency in Spanish was emphasized, thus, participants who volunteered to collaborate with the study represented a self-selected, intermediate to highly proficient subsample of late L2 learners. All learners were native speakers of English who began learning Spanish in school or later (no heritage speaker data were analyzed in this study). Prior to age 12, the language of schooling was English with minimal Spanish instruction (no more than an hour or two a week in an enrichment program). After age 12, the learners began to receive approximately three to five hours a week of formal Spanish instruction. The learners had minimal to no knowledge of foreign languages other than Spanish. The language background questionnaire was administered using Qualtrics (Qualtrics, Provo, UT), a survey cloud service.

3.4 Materials and Procedure

3.4.1 Pre-screening Questionnaire

The purpose of the following questionnaire was to screen participants for inclusion into the study. The participants completed a language background questionnaire to determine linguistic background, dominant languages, and previous and current contact with Spanish and/or other languages. This questionnaire (see Appendix B) was prepared in both Spanish and English. The Spanish-natives completed the Spanish version and the

English learners completed the English version, which inquired about participants' place of birth, country of residence, time spent abroad, language used by family members, and language(s) in which the participants received formal instruction. In addition, the questionnaire prompted the participants to provide self-ratings of their production abilities, both speaking and writing, as well as their comprehension abilities of both spoken and written texts in all languages of proficiency. These self-ratings were further nuanced by providing specific contexts for each of these skills, such as "with friends," "on the phone," "television," "formal contexts," and so forth. Furthermore, language preferences were probed by asking the participants to indicate which language they preferred to use and for what percentage of the time with various interlocutors, for example, parents, siblings, friends, coworkers, at school, and so on. No participant was excluded based on the information collected in this questionnaire.

3.4.2 Linguistic Stimuli for the Self-Paced Reading and Picture-Selection Task

The critical sentences were adapted and modified from Tokowicz and Warren (2010) which manipulated crosslinguistic *similar* constructions, the demonstrative (e.g., "Por la tarde la periodista entrevistó a **esos$_{pl}$ payasos$_{pl}$** en el circo." "*In the afternoon the journalist interviewed those clowns at the circus.")* and the crosslinguistic *different* constructions, the definite article construction (e.g., "Por la tarde la periodista entrevistó a **los$_{pl}$ payasos$_{pl}$** en el circo." "*In the afternoon the journalist interviewed **the$_{pl}$ clowns$_{pl}$** at the circus.").*

All sentences were comprised of an adverbial phrase (manner or temporal – i.e., *in the afternoon*), a singular animate human subject (profession or generic human classification – i.e., *the journalist*), a transitive verb (preterit or imperfect – i.e.,

interviewed), a critical noun phrase that included the demonstrative or the definite article and a concrete noun (i.e., *those clowns/the clowns*), and, lastly, a prepositional phrase (i.e., *at the circus)*. In addition, phonological characteristics were taken into account such that no critical noun phrase began with a sibilant that could be easily confused with the plural marker on the determiner in the aural modality.

All sentences were controlled for length (9 to 12 words long) with the critical determiner occurring between words 5 and 9, L2 level (vocabulary and grammar adequate for students in their third semester of study of Spanish), and lexical frequency of the subject nouns, transitive verbs, and critical object nouns (non-cognates) (Guasch, Boada, Ferré, & Sánchez-Casas, 2013) (see Table 4).

The critical noun phrases were masculine and those that were animate human were controlled to appear only in the plural condition to avoid the contraction form *al* (the differential object marker and the masculine determiner *el*) in the singular. Each critical object noun was used only once and the subject nouns and transitive verbs were used no more than twice in the experimental conditions. The number-marking on the determiners was counterbalanced across stimuli such that 50% were marked singular and 50% were marked plural.

Table 4.

Descriptive statistics of linguistic stimuli

	N	Range	Minimum	Maximum	*M*	*SD*
Critical object noun						
Rel.Freq.	64	203.40	1.24	204.64	33.94	50.89
Length	64	7.00	4.00	11.00	6.50	1.74
Nsyll	64	3.00	2.00	5.00	2.84	.86
Subject Noun						
Rel.Freq.	64	104.63	.18	104.81	22.20	25.37
Length	64	9.00	3.00	12.00	7.30	2.18
Nsyll	64	3.00	2.00	5.00	3.13	.90
Transitive Verb						
Rel, Freq.	64	124.17	.18	124.35	18.30	26.02
Length	64	7.00	4.00	11.00	6.39	1.68
Nsyll	64	3.00	2.00	5.00	2.77	.75

A total of 64 master sentences were created. These sentences were split into two versions such that half the participants saw master sentences 1-32 in the self-paced reading task and master sentences 33-64 in the picture-selection task (version A) and the other half of the participants saw master sentences 33-64 in the self-paced reading task and master sentences 1-32 in the picture selection task (version B) (see Table 5).

Table 5

Distribution of sentence stimuli to task version

	Self-paced reading task	Picture-selection task
Version A	master sentences 1-32	master sentences 33-64
Version B	master sentences 33-64	master sentences 1-32

In the self-paced reading task, the master sentence was manipulated for construction type and grammaticality to create the following four conditions: demonstrative-noun

agreement, demonstrative-noun violation, definite article-noun agreement, or definite-noun violation condition (see Table 6). Determiner number was controlled, such that half of constructions were comprised of a singular determiner and a singular noun in the grammatical condition and a singular determiner and plural noun in the violation condition. The other half were comprised of a plural determiner and plural noun in the grammatical condition and plural determiner and singular noun in the violation condition.

Table 6

Sample linguistic stimuli for self-paced reading task

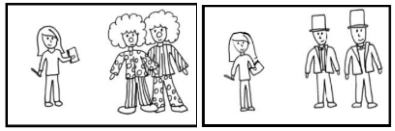
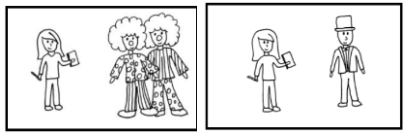
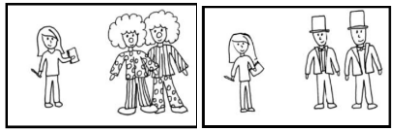
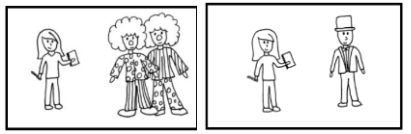
Condition	Construction type	Number Agreement	Sample Sentence	
			Singular Determiner	Plural Determiner
1	Demonstrative	Agreement	De repente el soldado detectó **ese$_{sg}$ avión$_{sg}$** en el radar.	Por la tarde la periodista entrevistó a **esos$_{pl}$ payasos$_{pl}$** en el circo.
			*Suddenly the soldier detected **that$_{sg}$ plane$_{sg}$** on the radar.*	*In the afternoon the journalist interviewed **those$_{pl}$ clowns$_{pl}$** at the circus.*
2	Demonstrative	Violation	*De repente el soldado detectó **ese$_{sg}$ aviones$_{pl}$** en el radar.	*Por la tarde la periodista entrevistó a **esos$_{pl}$ payaso$_{sg}$** en el circo.
			Suddenly the soldier detected **that$_{sg}$ planes$_{pl}$ on the radar.*	**In the afternoon the journalist interviewed **those$_{pl}$ clown$_{sg}$** at the circus.*
3	Definite article	Agreement	De repente el soldado detectó **el$_{sg}$ avión$_{sg}$** en el radar.	Por la tarde la periodista entrevistó a **los$_{pl}$ payasos$_{pl}$** en el circo.
			*Suddenly the soldier detected **the$_{sg}$ plane$_{sg}$** on the radar.*	*In the afternoon the journalist interviewed **the$_{pl}$ clowns$_{pl}$** at the circus.*
4	Definite article	Violation	*De repente el soldado detectó **el$_{sg}$ aviones$_{pl}$** en el radar.	* Por la tarde la periodista entrevistó a **los$_{pl}$ payaso$_{sg}$** en el circo.
			Suddenly the soldier detected **the$_{sg}$ planes$_{pl}$ on the radar.*	**In the afternoon the journalist interviewed **the$_{pl}$ clown$_{sg}$** at the circus.*

In the picture-selection task the master sentence was manipulated for construction type and cue informativity to create the following four conditions: demonstrative informative (number mismatch in the visual stimuli), demonstrative uninformative (number match in the visual stimuli), definite informative (number mismatch in the visual stimuli), or definite uninformative (number match in the visual stimuli). For example, in the informative condition, participants heard a sentence like, *"Por la tarde el periodista entrevistó a esos payasos en el circo,*" (English: In the afternoon the journalist interviewed those clowns in the circus) and both images contained a journalist but in the target image he is interviewing two clowns and in the distractor image he is interviewing just one magician (*mago*). Thus the plural number marking on the determiner is informative to initiate disambiguation between the two images prior to the unfolding of the bottom-up lexical content of the noun. In contrast, in the demonstrative uninformative condition, participants that heard the same sentence *"Por la tarde el periodista entrevistó a esos payasos en el circo,*" (English: In the afternoon the journalist interviewed those clowns in the circus) saw a target image in which the journalist is interviewing two clowns and in the distractor image in which he is interviewing two magicians (*magos*). Thus, plural number-marking is not informative to initiate disambiguation between the two images and participant must wait for lexical content of the target noun to proceed with disambiguation (see Table 7). Gender was held constant (masculine), and the images only varied in regard to the semantic content of the visually depicted target noun.

Table 7

Experimental Stimuli – Picture Selection Task

Experimental Stimuli – Picture Selection Task

Condition	Linguistic Construction	Aural stimuli	Informativity	Visual stimuli	
				Target	Distractor
1	Demonstrative	"Por la tarde la periodista entrevistó a **esos$_{pl}$ payasos$_{pl}$** en el circo."	Informative		
2		*"In the afternoon the journalist interviewed **those$_{pl}$ clowns$_{pl}$** at the circus.*	Uninformative		
3	Definite article	"Por la tarde la periodista entrevistó a **los$_{pl}$ payasos$_{pl}$** en el circo."	Informative		
4		*"In the afternoon the journalist interviewed **the$_{pl}$ clowns$_{pl}$** at the circus."*	Uninformative		

Together, this resulted in the creation of a total of 256 test items (128 for the self-paced reading task and 128 for the picture selection task). Four lists were created for each task (four lists were created for the self-paced reading task and four for the picture selection task) to counterbalance the experimental test items such that only one condition of each master sentence manipulation appeared in each list, and no master sentence was repeated across the two tasks for any participant, in line with methodological design of previous studies (e.g., Sagarra & Herschensohn, 2013). The critical items were assigned to one of the four lists following a Latin-square design (see Table 8).

Table 8.

Latin-square distribution of conditions to lists

LIST 1	LIST 2	LIST 3	LIST 4
Condition 1	Condition 2	Condition 3	Condition 4
Condition 2	Condition 3	Condition 4	Condition 1
Condition 3	Condition 4	Condition 1	Condition 2
Condition 4	Condition 1	Condition 2	Condition 3
etc.			

Thus, each list ultimately contained thirty-two critical items with determiner-noun pairs (eight per condition) and contained an equal number of singular and plural determiners. Sixty-four fillers were also included in each of the four lists. The filler sentences were comprised of two types of linguistic manipulations: grammatical and ungrammatical placement of an adverb or negative particle in auxiliary verb *haber* and corresponding participle constructions (e.g., *Observan que el bombero golosamente ha/ ha golosamente empapado la almohada con la manguera.* English translation: They observe that the fireman greedily has / has greedily soaked the

pillow with the hose.), and felicitous/infelicitous *Que* complements (e.g., *Ella me explicó que por mis notas y cartas tan competitivas (que) mi propuesta será aceptada muy pronto.* English translation: She explained to me that because of my competitive grades and letters **(**that**)** my proposal would be accepted very soon). Take note that in the picture-selection task only fillers of the first type were included since they were easy to depict visually, whereas those of the second type were not. The same ratio was maintained 1/3 critical items, 2/3 fillers (see Appendix K for full set of critical stimuli). The stimuli in each list was randomized and then manually manipulated to avoid having two experimental sentences appear consecutively. The stimuli in each list was presented in the same order to all participants assigned to that list.

Participants were pseudo-randomly assigned to a specific version (A or B), a certain task order (either self-paced reading followed by picture-selection or vice-versa), to one of the four lists in each task, and to a correct response key which was counterbalanced to be located on either the left-hand side or right-hand side of the key-board. To ensure that each combination was seen by a similar number of participants a spreadsheet of the possible combinations was designed prior to the recruitment of participants (see Table 9). There was one spreadsheet for native speakers and one for learners. Then, as each participant signed-up for the study, they were assigned the next available combination on the spreadsheet. Once all combinations had been assigned the spreadsheet was repeated until there were no further participants.

Table 9

Example of spreadsheet used to distribute participants

Participant Number	Version of Sentence processing tasks (Version A included master sentences 1-32 in SPR and 33-64 in PIC-SEL. Version B included master sentences 33-64 in SPR and 1-32 in PIC-SEL).	Order of SPR & PIC-SEL task presentation	Lists (each list contained 8 examples of each of the 4 conditions = 32 sentences as well as 64 filler sentences)	Location of correct response button
201	A	SPR –PIC	1	right side (button: k)
202	B	SPR –PIC	1	right side (button: k)
203	A	PIC-SPR	1	right side (button: k)
204	B	PIC-SPR	1	right side (button: k)
205	A	SPR –PIC	1	left side (button: d)
206	B	SPR –PIC	1	left side (button: d)
207	A	PIC-SPR	1	left side (button: d)
208	B	PIC-SPR	1	left side (button: d)
209	A	SPR –PIC	2	right side (button: k)
210	B	SPR –PIC	2	right side (button: k)
211	A	PIC-SPR	2	right side (button: k)
212	B	PIC-SPR	2	right side (button: k)
213	A	SPR –PIC	2	left side (button: d)
214	B	SPR –PIC	2	left side (button: d)
215	A	PIC-SPR	2	left side (button: d)
216	B	PIC-SPR	2	left side (button: d)
217	A	SPR –PIC	3	right side (button: k)
218	B	SPR –PIC	3	right side (button: k)

219	A	PIC-SPR	3	right side (button: k)
220	B	PIC-SPR	3	right side (button: k)
221	A	SPR –PIC	3	left side (button: d)
222	B	SPR –PIC	3	left side (button: d)
223	A	PIC-SPR	3	left side (button: d)
224	B	PIC-SPR	3	left side (button: d)
225	A	SPR –PIC	4	right side (button: k)
226	B	SPR –PIC	4	right side (button: k)
227	A	PIC-SPR	4	right side (button: k)
228	B	PIC-SPR	4	right side (button: k)
229	A	SPR –PIC	4	left side (button: d)
230	B	SPR –PIC	4	left side (button: d)
231	A	PIC-SPR	4	left side (button: d)
232	B	PIC-SPR	4	left side (button: d)

3.4.2.1 Self-paced reading procedure

In the noncumulative self-paced moving window task (Just, Carpenter, & Woolley, 1982), participants read sentences one at a time in the center of a computer screen with a series of dashes replacing all characters except for spaces. At the start of each sentence, the participants saw a fixation cross (+) which upon pressing the space bar disappeared to reveal the first word in the sentence. With each consecutive press of the space bar the next word in the sentence appeared and the prior word was replaced with dashes until the end of the sentence (see Figure 2). Participants were instructed to read the sentences at their normal pace. Time between button presses was recorded and reading times were calculated for each word region. Participants performed a

short practice block of six sentences. Data from the practice trials were not included in analyses nor repeated as part of the experimental stimuli.

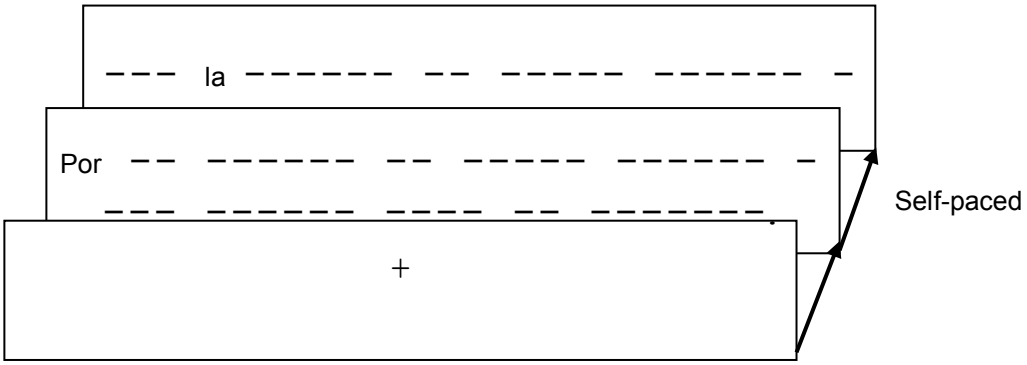


Figure 2. Stimuli presentation of self-paced reading task

None of the participants were informed that some of the sentences were ungrammatical so as to avoid biasing the results, however, if a participant commented on the ungrammatical sentences, either during the testing procedure or afterwards, they were told not to pay attention to them and that the researcher was aware of them. The sentences were presented using E-prime on PC computers with 17 point font Courier New black characters on a white background. Letters were presented in standard upper and lower case font. Each sentence was presented in the vertical center of the screen and started flush left. All critical sentences were presented in one single line.

Following each sentence the participants were prompted to respond to a comprehension question. Participants were instructed to press a "yes" button on the keyboard to respond if the question was correct (i.e., matched with the content of the previous sentence) or a "no" button to indicate if it was incorrect. The comprehension questions addressed the semantic content of the sentence and were counterbalanced to include 25% that related to the verb (i.e., Did the journalist take pictures of the clowns?), 25% that related to the subject (i.e., Did a firefighter interview the clowns?), 25% that related to the adverbial phrase (i.e., Did the journalist interview

the clowns in the afternoon?), and 25% that related to the prepositional phrase (i.e, Were the clowns interviewed at the circus?). For the filler items the comprehension questions also focused on different aspects of sentence meaning. For all experimental stimuli and filler items, half of the comprehension questions had a correct "yes" response and half had a correct "no" response. In addition, handedness of the participants was controlled so that for half of the participants the correct-key button was on the left side of the keyboard and for the other half of the participants it was on the right side of the keyboard. Reverse counterbalancing was taken into account for left-handed participants.

3.4.2.2 Picture-selection task procedure

Design. A native speaker of Colombian Spanish[4] read each critical and filler sentence (total of 384) two to three times at a comfortable speaking rate in a sound-attenuated chamber. The audio was recorded using a Zoom H4next Handy Recorder placed 17 inches from the speaker at a sampling rate of 48 kHz/16bit and saved in *.wav format. The sentences were produced using standard, broad-focus intonation (i.e., no narrow focus or other emphasis on any of the critical items). Post-recording editing was performed using Audacity®, the Free, Cross-Platform Sound Editor. All background noise was minimized using the noise-removal tool and each sentence was cut and saved as its own *.wav file. From the master recordings, one token of each stimulus was selected for inclusion in the experiment. To avoid artificial manipulation

[4] Standard (Highland) Colombian Spanish is known to be linguistically conservative, in that it retains the syllable final /s/. In addition to consistently maintaining sibilant productions of /s/, Standard Colombian Spanish speakers also have a much weaker production of /x/, the voiceless velar fricative, when compared to Castilian Spanish. Fernández (2014) states that Highland Colombian Spanish is a variety that distinguishes between the following phonemes - /ʎ/ and /ʝ/ (the palatal lateral approximant and the voiced palatal fricative, respectively). These characteristics of Standard (Highland) Colombian Spanish have contributed to the impression that Standard (Highland) Colombian Spanish is spoken with greater clarity than other variations. For this reason, specifically the strong /s/ retention which is critical for plural morphology and number agreement across constituents, a speaker of this variation was selected to create the aural stimuli for this study. Additionally, this variation would be equally understandable to the learners and native speakers participating in the study.

of sound properties which could affect the prosody of the sentence, the duration of the critical determiners were not standardized. Instead, a time-stamp was manually placed at the offset of each critical determiner for later analyses.

The images were hand-drawn by an artist in black and white. Each image represented a simplified scene including the subject, object, and contextual information. All other visual details were kept to a minimum to reduce distraction (see appendix L for the complete set of images). All images were tested in a pilot study to guarantee that the critical information was salient and easily recognizable. Eight native speakers of Spanish from, Argentina, Spain, Colombia, and Mexico completed an online questionnaire employed via Qualtrics (Qualtrics, Provo, UT). None of the participants later participated in the experimental trials. In each questionnaire the images were presented with the matching sentence stimuli. In each sentence a blank space appeared in the place of the object's name. The participants were instructed to write the name of the missing object in the blank. They were permitted to write more than one response. Any object that was not agreed upon in one of their offered responses by seven of the eight participants was modified until the final version was easily identifiable. Participants were allowed to leave comments and suggestions. Some indicated that dialectical variations would determine which word they would use. Taking this into consideration when dialectical variation offered multiple options, the most often suggested word was selected. As these are very common objects it is likely both the native control participants in Argentina and the L2 learners in the United States had been exposed to various Spanish terms for these items, either through media and television or through academic classroom instruction and would have been able to recognize their meaning. All hand-drawn images were scanned and post-edited using Microsoft Paint and Adobe Photoshop. Editing included darkening

of lines, cropping of images, eliminating unnecessary detail, redrawing of objects, and pasting black and white images from Google Images (public domain) when the drawn images were not sufficiently iconic. All images were resized to 500 x 500 pixels and were saved in bitmap (*.bmp) format.

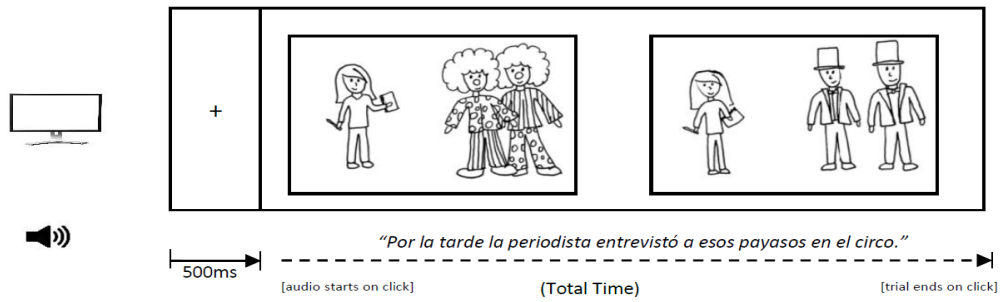
The image presentations, respective to the screen, were vertically centered and counterbalanced so that the target image appeared 50% of the time on the right-hand side and 50% of the time on the left-hand side of the screen in a pseudo-random design. The image on the left-hand side of the screen appeared horizontally centered at 30% on the x-axis of total screen size and the image on the right-hand side of the screen appeared horizontally centered at 70% of the x-axis of total screen size. The black and white images appeared on a black background with approximately one inch between the two images in the center of the screen. Only grammatical filler sentences were included and the corresponding images were designed similarly to the critical images and differed by the semantic content of the object.

Procedure. The picture-selection task was adapted from Morett and MacWhinney's (2013) picture-selection task and Fernald, Zangl, Portillo, and Marchman, (2008) looking-while-listening procedure. This task was designed to measure linguistic predictive mechanisms. The advantage of this type of task over self-paced reading is that it allows for a differentiation between top-down proactive prediction and bottom-up retroactive integration. In self-paced reading tasks it is not possible to separate the two as the RT effects observed during critical word processing could be the result of either or the combination of both processes. In this experiment, number marking on the article or demonstrative in the informative trials offered an early cue to correct picture selection whereas in uninformative trials the number markings were of no benefit since both images contained equal number of

objects and only the semantic content of the lexical noun disambiguated between the two images. Hence, the difference between the recorded RTs in the uninformative and informative condition offers a direct measure of predictive mechanisms.

At the start of each trial, the participants saw a 500 ms fixation cross (+), which was replaced by a pair of images, one on the left and one on the right side of the screen. Once the participant was familiar with the images, they pressed the space bar to start the presentation of the auditory stimulus sentence delivered through individual headphones. The aural stimulus matched only one of the picture's semantic content. The pictures remained on the screen until the participant selected one by pressing a specified key that corresponded to the side of the screen on which it appeared. Participants were instructed that they would see two images and needed to select "the picture that best matches the sentence they hear as quickly as possible" (see Figure 3). They were explicitly told that they did not need to wait till the end of the sentence to choose an image. In the experimental trials, the images either matched or mismatched in number of the critical noun. The participant's button press was time-locked to the offset of the critical determiner in the auditory stimuli. This point in the acoustic stimulus was chosen over the onset due to the inherent length difference between demonstratives (bisyllabic ranging from three to five phonemes) and articles (monosyllabic ranging from two to three phonemes). Participants performed a short practice block of four sentences and data from the practice trials were not included in the analyses. Sentence comprehension was measured by participants' picture selection accuracy.

Uninformative Condition



Informative Condition

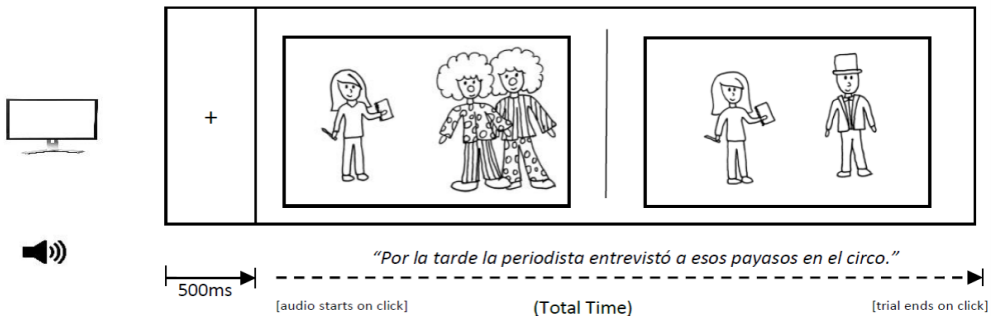


Figure 3. Picture Selection task

In the following chapter, I will present the specific scoring methods for each task as well as the results of the statistical comparisons for each group. The analyses will be summarized at the beginning of each section and subsequently reported in detail.

3.4.3 Post-Screening Tests

Finally, after the sentence processing tasks the learners completed a final screening task - a grammar and vocabulary test to control for familiarity with the target words and grammatical constructions in the experimental sentences. The data collected from this test provided data about the participants' offline knowledge of the experimental linguistic constructions and was used to determine if their data from all tasks would be included into the final analyses. Participants who scored less than 80% on the vocabulary section and/or less than 90% on the first grammar block were excluded from further analyses. The vocabulary section included the object and subject NPs and the verbs of the critical trials as well as adverbs used throughout the stimuli. A

total list of 224 words was compiled and the learners were presented 25 randomly selected words from this list (see Appendix E). The learners were instructed to match the target item to the corresponding English translation. For example, the learners were presented with the stimulus word "COJIN" and three multiple choice options were offered as the correct English translation: a) basket, b) small pillow, c) store (correct response is b). The three possible English answers were all from the same linguistic category. The position of the correct answer (a, b, or c response) was pseudo-randomized across the 224 trials.

The grammar section was divided into three blocks. The first block was comprised of ten critical sentences from the experimental stimuli used in the self-paced reading and picture selection task. Each sentence contained a blank space in the position of the determiner. Half of the sentences required for a correct response the selection of a number-inflected definite article and half of the sentences required the selection of a number-inflected demonstrative. The choice was always between the singular and plural variant of these constructions. See example (15) below.

(15) "El jefe observaba a _____ trabajador en el techo." a.) ese b.) esos

The sentences were equally distributed so that half of the correct responses required a plural determiner and half required a singular determiner. Following this first grammar block, the participants were presented a metalinguistic task in which they were prompted to verbally express in English how they had chosen their answers. They had one minute to provide an explanation and all responses were audio-recorded (see Appendix G). The following two grammar modules assessed knowledge of the filler sentences (stimuli for other experiments) including adverb and auxiliary placement as well as wh- operators, and are not discussed in detail in this dissertation. The stimuli were presented electronically using E-Prime 2.0 software (Psychology

Software Tools, Pittsburgh, PA). Ultimately only learner participants who scored above 80% on the vocabulary section and 90% on the first grammar block were included in the study's analyses leading to the exclusion of the data collected from 6 learners (See Chapter IV: Scoring and Results for summary of results).

3.4.4 Proficiency Test

Both Native and Learner participants also completed a Spanish proficiency test - a modified version of the Diploma de Español como Lengua Extranjera (DELE) (Diploma of Spanish as a Foreign Language). The scores on this test were used to divide the latter group into advanced and intermediate proficiency groups. This test included a section of 21 multiple-choice items assessing grammatical knowledge at the basic, intermediate, and advanced levels. This was followed by another 12 items evaluating reading comprehension, in which participants read a paragraph about the benefits of bike riding. The paragraph contained missing words and for each blank, the participants selected the appropriate word(s) from three possible options in a drop-down window. The proficiency test was digitally administered using Qualtrics (Qualtrics, Provo, UT), a survey cloud service.

3.4.5 Vocabulary Size test

As a secondary measure of language knowledge all participants completed, the Spanish Lextale-Esp vocabulary test (Lexical Test for Advance Learners of Spanish, Izura et al., 2014; see Appendix D). This test provides a reliable and valid estimate of vocabulary size in less than four minutes. Participants were given a list of 60 items (40 words and 20 non-words) for which they had to indicate whether or not the word was a real Spanish word or not. The words were selected on the basis of word frequency at various difficulty levels. Words were selected in such a way that some should have been known to participants with low proficiency levels, whereas others

should have been known only to participants with high proficiency levels. None of the words were English cognates and none of the non-words were real words in Spanish or English. Participants' score was calculated on the basis of the number of words and non-words selected. Lextale-Esp vocabulary test was digitally administered using Qualtrics (Qualtrics, Provo, UT), a survey cloud service.

3.4.6 Working Memory Task

Participants completed a computer generated non-linguistic working memory task of Letter-Number sequencing, a standard test on the Wechsler Memory Scale-III (Millis, Malina, Bowers, & Ricker, 1999). In this task, participants saw a fixation cross (+) followed by letters and numbers presented one at a time randomly and non-cumulatively. There was a total of 21 sets ranging from two to nine letter-number combinations. The participants were instructed to remember the sequence and then to repeat it by typing, first, the numbers in ascending order, then the letters in alphabetical order. For example, if they saw 9-L-2-A, they would type 2-9-A-L. Participants completed two practice trials at the beginning of the task that were not included in the final analyses nor repeated in the experimental trials. The stimuli were presented electronically using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). Both accuracy and response time were automatically recorded for analyses (full list of stimuli can be found in Appendix H).

3.4.7 Lexical Automaticity

In order to test individual lexical automaticity a lexical decision task was designed following the methods of Segalowitz and Segalowitz (1993; see also Segalowitz et al., 1998) and Hopp (2014). In this task, participants were presented real Spanish words and pseudo-Spanish words in random order in the center of a computer screen. Participants were instructed to decide if each word was real or not by clicking a "yes"

or "no" button on a keyboard. It is important to note that previous L2 studies, using similar tasks but with other language pairs, have shown that lexical automaticity and proficiency are not correlated and are not correlated and have different effects on processing abilities (e.g., Hopp, 2014; Jackson & Bobb, 2009).

The real Spanish word stimuli were selected from the 4,000-5,000 frequency band as reported in "A frequency dictionary of Spanish: Core vocabulary for learners" (Davies, 2006). The motivation for this selection comes from the findings of Harrington (2006) which revealed that advanced learners show ceiling effects at the 2k and 3k frequency band with performance falling at 5k. Hence, by selecting words only from the 4-5k frequency band, it is expected that the participants' performance will show enough variability so as to be statistically significant and theoretically interesting. Thus, 72 Spanish words (non-cognate), 24 nouns, 24 verbs, and 24 adjectives with rank frequencies ranging from 4,418 - 4,998 and controlled for syllable count (range = 1-5; $M = 3.06$) were selected as the real-word stimuli. In addition, 72 Spanish pseudowords were created by using the Keuleers and Brysbaert (2010) pseudoword generator which uses a specific algorithm to produce pseudowords that conform to Spanish phonological constraints and meet certain criterion (e.g., segment length, frequency, etc.) based on a template of the real words (e.g., *plato* → *blaco*[5]). Examples of the real-word stimuli, the English translation, category, and rank frequencies along with matched pseudowords are shown in Table 10, with the full list of critical stimuli available in Appendix I.

[5] Pseudoword generated according to the phonological properties of the real Spanish word "*plato*" (plate).

Table 10

Example of stimuli from the Lexical Automaticity Task

Real word	Category	Rank Frequency	Pseudoword
Molino *Mill*	Noun	4,893	sorano
Verter *to pour/spill*	Verb	4,924	vercor
Sabroso *Flavorful*	Adjective	4,605	dalloco

The stimuli were presented randomly and the correct response button was counterbalanced across participants so that for half of all participants the correct response was the "k" button on the keyboard and for the other half it was the "d" button. A reverse counterbalance was taken into consideration for left-handed participants. The participants were limited to 5000 ms to make a decision and response times below 225 ms were excluded from analyses, resulting in the exclusion of less than 1% of the data (the range is based on Blanchard, Rayner & Pollatsek's 1989 findings that English monolinguals need between 225 and 300 ms to process single words). All stimuli were presented electronically using the E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA) and response time and accuracy was recorded. As argued by Segalowiz and Segalowitz (1993), a coefficient of variance computed by dividing the average reaction time to all real Spanish words that have been accurately identified by the standard deviation of each participant's response time is more indicative of the automaticity of lexical processing than speed per se. Hence, the coefficient of variance was chosen as the measure of lexical automaticity for all analyses.

3.4.8 Verbal Fluency Task

To complement the lexical automaticity task, which taps into receptive lexical identification, a verbal fluency task was administered to tap into the participants' productive lexical retrieval. To measure each participant's verbal fluency, participants completed a semantic fluency test. In this test, participants are prompted with a semantic category[6] (e.g., animals, fruits, professions) and are instructed to name as many examples from that category as possible in 60 seconds. All participants were presented with the category of "animals" first as a practice, and then the critical trials of "fruits" and "professions" were counterbalanced in their order of presentation. After the instruction screen, the participant clicked the space bar to reveal the category. As soon as the category appeared a countdown clock also appeared counting backwards from 60 seconds to 1 second. The stimuli was presented electronically using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA) which automatically recorded all spoken responses as *.wav files. Each trial was later transcribed and the total number of semantically appropriate examples produced was taken the measure of each participant's performance of verbal fluency (see Appendix J).

[6] Although in these types of Verbal Fluency tasks it is common practice to include a letter/phoneme category (i.e., words that begin with the sounds "f" or "s"), this category is problematic because it asks participants to retrieve words by surface form which is likely counter to how they are stored in the brain (by meaning, not by surface form). By focusing only on semantic categories, my design is more in line with studies which have more specifically focused on late L2 verbal fluency (e.g., Linck, Kroll, & Sunderman, 2009; Baus, Costa, & Carreiras, 2013) and is more appropriate for the semantic nature of the other experimental tasks included in this study.

Chapter IV: Scoring and Results

4.1 Determination of Proficiency Groups

The learner participants were placed into groups based on their performance on a modified version of the Diploma de Español como Lengua Extranjera (DELE) (Diploma of Spanish as a Foreign Language). This test is comprised of 33 multiple choice questions and participants received 1 point per correct answer and 0 per incorrect answer. The total scores of the learners were then used in a k-means clustering analysis (Forgy, 1965) to group them into two proficiency groups: intermediate and advanced. The decision to create two learner groups of these levels of proficiency was determined a priori based on the course levels from which students were recruited (minimum 4 semesters of college-level Spanish or equivalent). The DELE test was also modified to specifically assess learners at the level of intermediate and beyond. The choice to apply a K-cluster statistical grouping was made to increase the internal validity of the study. Whereas the convention in many SLA studies is to base group distributions solely on cut-off scores of the DELE exam, the K-clustering statistical distribution provides a more precise and accurate grouping based on the k-means algorithm which produces tighter clusters around a centroid and has been found to be suitable to group students according to academic test performance (for a review see NorSyazwaniRasid & Ahmad, 2014; Ganga & Meyyappan, 2014). As the goal of this study is to identify the developmental patterns of the L2 integrative and predictive processing mechanisms in relation to language proficiency, it was of the utmost importance that members of the advanced group be statistically more proficient than the intermediate group and this could not be guaranteed by distributing groups in accordance to predetermined cutoff values on the adapted DELE proficiency test. Consequently, the application of the k-mean

clustering produced group 1 (advanced), which had a center cluster score of 26 and was comprised of 19 learners, and group 2 (intermediate), which had a center cluster score of 16 and was comprised of and forty-three learners (see Table 11).

Table 11

Proficiency Scores by Group

	N	*M*	*SD*	Minimum	Maximum
Native	29	28.34	2.857	21	32
Advanced	19	25.63	3.403	21	33
Intermediate	43	15.60	2.638	9	20

A one-way between subjects ANOVA confirmed that the groups were significantly different in proficiency at the $p < .05$ level [$F(2, 88) = 19.351$, $p < .001$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the native group ($M = 28.34$, $SD = 2.857$) was significantly greater than the Advanced Learner Group ($M = 25.63$, $SD = 3.403$, $p = .005$) which in turn was significantly greater than the Intermediate Learner Group ($M = 15.60$, $SD = 2.638$, $p < .001$).

4.2 Pre-Screening Questionnaire

In Table 12 is a summary of the information derived from the language background questionnaire from which, in part, eligibility to participate in the study was determined.

Table 12.

Participant information by group

				Natives	Learners	
					Advanced	Intermediate
Number				34	19	49
Age (years)			range	19-44	19-43	18-34
			avg.	32.44	26.42	21.12
Age of onset of L2			range		6-24	5 -19
			avg.		11.63	9.9
Time spent abroad in L2 dominant country (months)			range		0-123	0-16
			avg.		16.9	1.6
Self-ratings in Spanish L2						
	(speaking) 0-10	Conversing with friends in SPANISH:	range		5-10	3-10
			avg.		7.95	6.09
		Talking on the phone in SPANISH:	range		4-9	1-10
			avg.		7.21	5.33
		Making a formal complaint in SPANISH:	range		3-9	1-10
			avg.		7.11	5.02
	(aural comprehension) 0-10	Movies/TV without subtitles in SPANISH:	range		4-10	1-10
			avg.		7.53	5.6
		Conversation with your friends in SPANISH:	range		6-10	4-10
			avg.		8.11	6.84
		In a store /bank /restaurant in SPANISH:	range		6-10	2-10
			avg.		7.79	6.56
	(writing) 0-10	Letter/e-mail to friends/family in SPANISH:	range		7-10	4-10
			avg.		8.89	7.58

		Letter/e-mail to a boss, a complaint in SPANISH:	range	5-10	3-10
			avg.	8.32	6.81
		Paper/project summary/composition in SPANISH:	range	7-10	3-9
			avg.	8.79	6.95
	(written text comprehension) 0-10	Newspapers/magazines/Internet in SPANISH:	range	7-10	4-10
			avg.	8.68	7.21
		Books/textbooks in SPANISH:	range	7-10	3-10
			avg.	8.68	6.93
		Letters/e-mail in SPANISH:	range	8-10	3-10
			avg.	9.26	7.4

4.3 Post-Screening Tests

4.3.1 Follow-Up Vocabulary Test

As a screening for inclusion in analyses, participants completed a follow-up vocabulary test consisting of 25 randomly selected words from a list of 224 critical vocabulary items used in the experimental tasks. The learners were instructed to match the target item to the corresponding English translation. There were three possible English answers of the same linguistic category which were pseudo-randomly assigned a response position (a, b, or c) across the 224 trials. Participants received one point for each correct answer and zero points for each incorrect answer. All participants who scored less than 80% accurate were excluded from all other analyses due to the fact that they were unlikely to have understood a large portion of the critical items. This led to the exclusion of six intermediate learners. Take note that due to technical failure, data for one advanced learner are missing for this measure. In table is the summary of scores after this cut-off criterion was implemented.

Table 13.

Follow-up vocabulary test

	N	*M*	*SD*	Minimum	Maximum
Advanced	18	97.111	4.0713	88.0	100.0
Intermediate	43	91.628	6.1606	80.0	100.0
Total	61	93.246	6.1337	80.0	100.0

4.3.2 Follow-Up Grammar Test.

The learners also completed a follow-up grammar task comprised of ten critical sentences from the grammatical constructions manipulated in the experimental stimuli

of the self-paced reading and picture selection task to confirm an offline understanding of the linguistic structures of interest. The learners were given one point for each correct answer and the percentage of correct answers over total possible correct answers were calculated. All learners scored 90% accurate or above (see Table 14) and therefore met the a priori criterion for inclusion (80%). Also, as noted for the follow-up vocabulary test, data from one advanced learner participant are missing due to technical failure.

Table 14

Follow-up Grammar Test

	N	*M*	*SD*	Minimum	Maximum
Advanced	18	98.333	3.8348	90.0	100.0
Intermediate	43	99.767	1.5250	90.0	100.0
Total	61	99.344	2.4959	90.0	100.0

4.4 Sentence Processing Tasks

For all inferential statistics, alpha level was set up at .05, pairwise comparisons were calculated with Bonferroni post hoc tests. Natives were analyzed separately from learners as a control group to set a benchmark of native-like performance. Due to the unequal sample sizes of the advanced and intermediate learner proficiency groups, repeated measures ANOVAs were run separately for each group to avoid violating the homogeneity of variance assumption (Keppel, 1991).

4.4.1 Self-Paced Reading Task

To answer research question 1 regarding whether intermediate and advanced L2 learners of Spanish sensitive to number violations between demonstrative-noun and definite article-noun constructions during reading of L2 Spanish the results from the self-paced reading task were analyzed for both accuracy on the comprehension

questions as well as for reading times in the critical N and N+1 regions. Below I discuss first the descriptive statistics followed by the inferential statistics.

4.4.1.1 Scoring and descriptives

Accuracy. After each stimulus sentence participants answered a yes-no comprehension questions which focused on the semantic content of different parts of the sentence (i.e., the verb, the subject, the adverbial phrase, and the prepositional phrase). One point was given for each correct answer with a total possible score of 32. Eighty-five participants scored above 70%, and nine participants scored above 62.5% demonstrating that all participants were paying attention to the task (see Table 15).

Table 15

Accuracy on comprehension questions in the self-paced reading task

	N	*M*	*SD*	Minimum	Maximum
Native	32	29.00	2.31	20.00	32.00
Advanced	19	28.53	1.50	26.00	32.00
Intermediate	43	25.84	2.96	20.00	31.00

Reading times. The self-paced reading task produced reading times (RTs) for each word at the N-3, N-2, N-1, N, N+1, N+2, and N+3 with the critical noun region (N), and the preposition region (N+1) considered the critical regions of interest (see Example 16).

(16) **Por**	**la**	**tarde**	**la**	**periodista …**		
In	*the*	*afternoon*	*the*	*journalist*		
…entrevistó	**a**	**estos**	**payaso*/s**	**en**	**el**	**circo.**
interviewed	*[differential object marker]*	*these*	*clown*/s*	*in*	*the*	*circus*
N-3	N-2	N-1	N	N+1	N+2	N+3

Analyses were run only those items for which participants gave correct responses to the comprehension questions, as it was important to assess processing during comprehension. The comprehension questions always focused on aspects of the sentence that did not include the number of the determiner or noun. Moreover, it is important to note that accuracy scores were distributed equally across conditions, such that excluding items with incorrectly answered comprehension questions would not violate the assumption of homogeneity of variance, and thus, did not increase the likelihood of a type I error, that is, rejecting the null hypothesis when in fact it is true.

RTs above 5000 ms and below 225 ms were excluded from analyses, which corresponded to 2.8% of the total RT values (the range is based on Blanchard, Rayner, & Pollatsek's 1989 findings that single words require minimally 225 to 300 ms to be processed). The analyses of reading times were run for raw reading times rather than residual reading times because as Keating and Jegerski (2015ccc) put it "individual reading speed is known to correlate with some other individual differences, such as L2 proficiency, working memory, lexical access, and semantic integration (Hopp, 2013), so residual reading times may be inappropriate for the investigation of individual differences." As individual differences are a large part of the research question of this current study, raw reading times were chosen as the measure for analyses. See Table 16 for the descriptive statistics by word region.

Table 16

Self-paced reading task reading times: Descriptive statistics by group and word region

	Definite Agreement		Definite Violation		Demonstrative Agreement		Demonstrative Violation	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
	N-3							
Natives	472.82	124.66	499.29	179.35	472.36	134.20	467.65	142.73
Advanced	654.19	326.29	605.08	277.91	624.11	297.99	572.39	217.38
Intermediate	776.93	337.82	723.45	281.45	732.55	261.08	712.95	273.36
	N-2							
Natives	525.33	197.22	456.83	127.50	482.95	148.32	480.03	125.76
Advanced	636.66	259.39	581.16	178.32	599.12	211.61	560.46	172.35
Intermediate	676.18	210.10	698.01	217.90	699.10	235.13	731.01	198.26
	N-1							
Natives	434.05	99.22	441.62	123.46	446.49	99.31	438.78	94.37
Advanced	444.52	103.35	459.80	83.31	473.01	133.58	510.57	142.38
Intermediate	506.74	128.33	496.54	118.13	584.78	168.16	536.17	100.06
	N							
Natives	460.72	120.36	493.43	149.35	460.13	122.92	510.49	176.60
Advanced	616.52	266.52	728.98	363.30	634.76	270.83	736.84	383.58
Intermediate	618.64	180.32	722.33	260.88	687.48	252.09	750.55	257.22
	N+1							
Natives	422.53	88.77	514.48	140.71	426.98	98.76	541.78	152.21
Advanced	465.27	138.28	566.64	180.74	504.24	270.64	565.29	249.13
Intermediate	471.17	126.46	490.15	141.16	470.10	103.06	519.50	120.02
	N+2							
Natives	418.89	108.70	411.19	109.69	399.24	91.01	410.20	98.11
Advanced	430.47	120.95	477.64	213.31	409.16	97.92	456.11	172.68
Intermediate	419.47	106.42	414.13	82.03	394.94	67.75	432.36	120.08
	N+3							
Natives	646.95	227.93	693.50	346.81	685.40	302.73	679.89	341.67
Advanced	692.59	302.05	711.63	394.16	654.01	225.20	638.82	233.51
Intermediate	666.27	202.69	665.37	212.96	627.19	190.67	613.93	183.65

4.4.1.2 Inferential statistics

Natives' accuracy. A two-way repeated measures ANOVA with a 2 (Agreement) x 2 (Construction type) was conducted to compare the effect of number agreement/violation and the type of linguistic construction (Demonstrative/Definite article) on comprehension question accuracy. The findings revealed that there were neither significant main effects nor any interactions ($p > .05$), indicating that native participants were equally accurate in all conditions (see Figure 4).

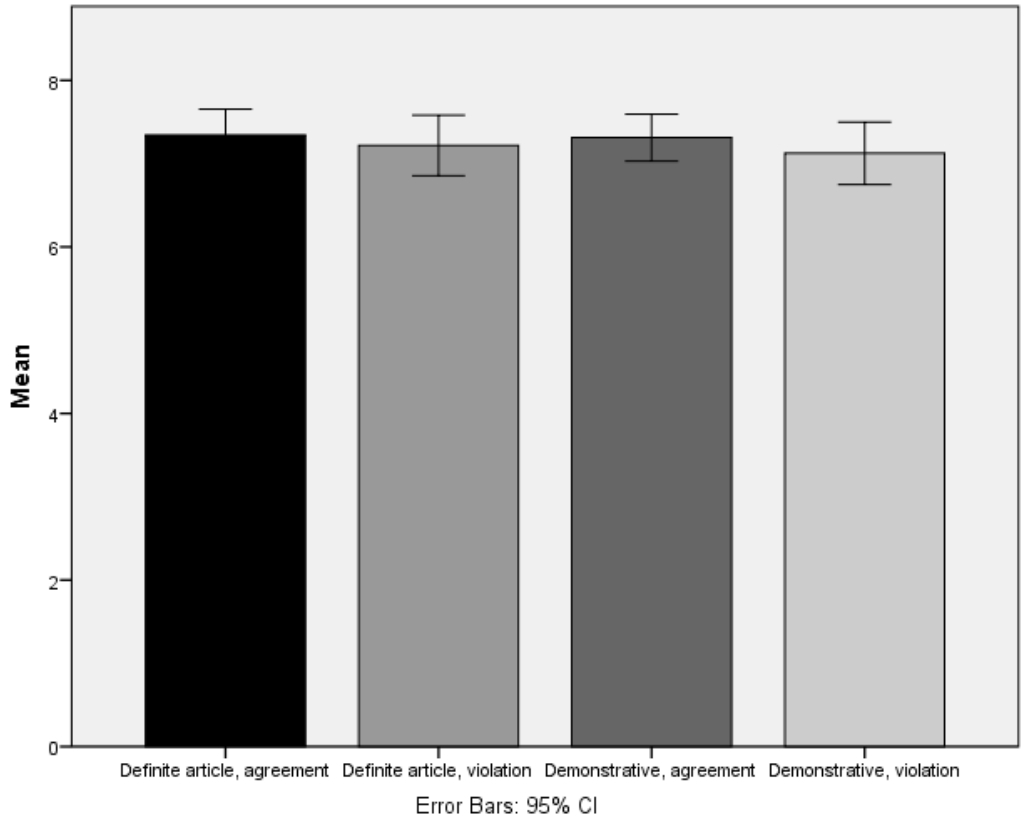


Figure 4. Natives' accuracy by condition

Advanced learner groups. A two-way repeated measures ANOVA with a 2 (Agreement) x 2 (Construction type) was conducted to compare the effect of number agreement/violation and type of linguistic construction (Demonstrative/Definite article) on comprehension question accuracy. The findings revealed no main effects

of Agreement or Linguistic construction, nor any significant interaction (p >.05) (see Figure 5).

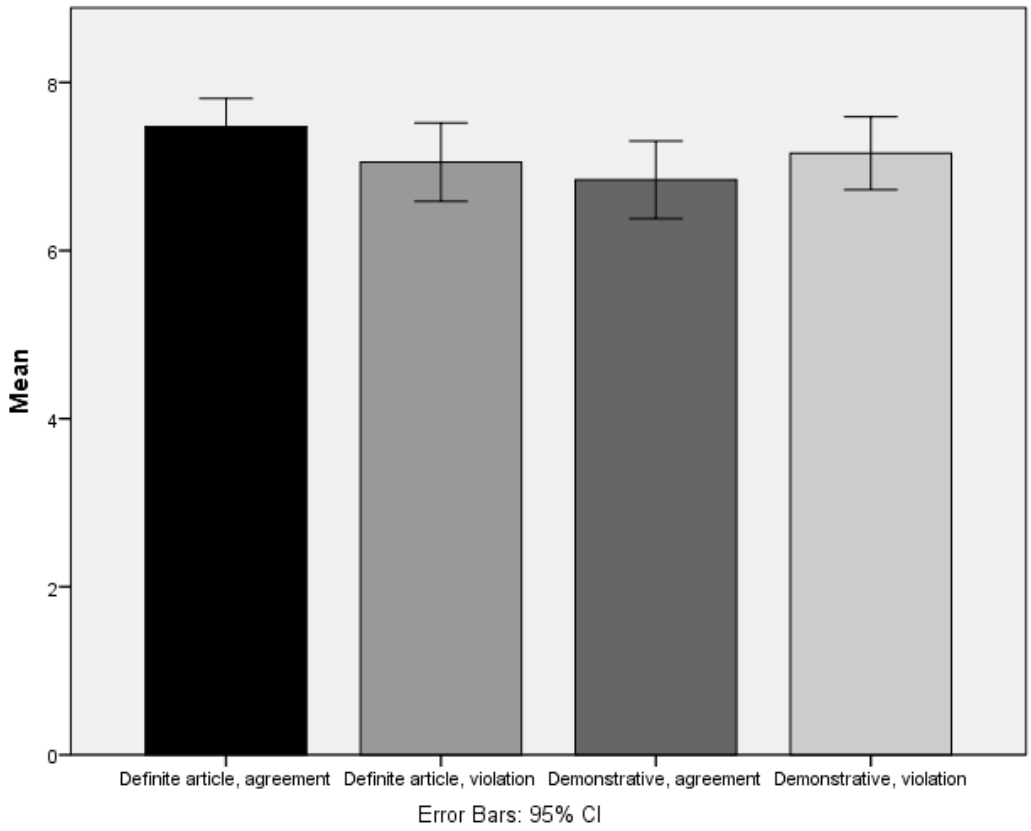


Figure 5. Advanced learners' accuracy by condition

Intermediate learner groups. A two-way repeated measures ANOVA with a 2 (Agreement) x 2 (Construction type) was conducted to compare the effect of number agreement/violation and type of linguistic construction (Demonstrative/Definite article) on comprehension question accuracy. The findings revealed no main effects of Agreement or Linguistic construction, nor any significant interactions (p > .05) (see Figure 6).

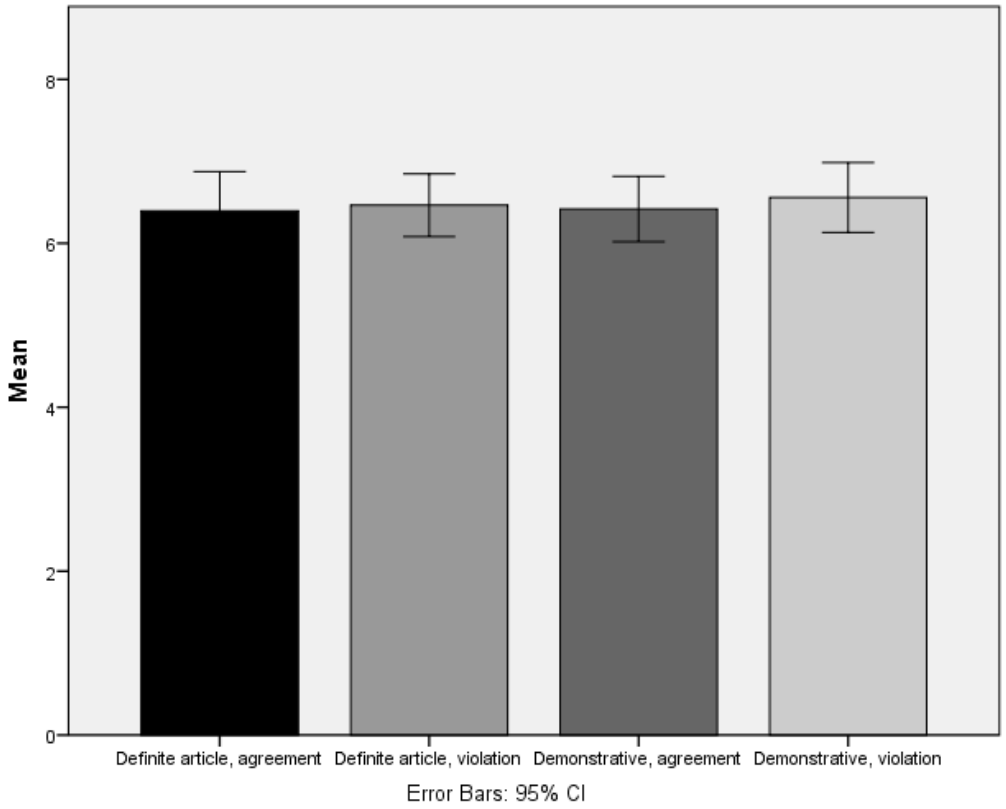


Figure 6. Intermediate learners' accuracy by condition

Summary. The above findings reveal that all participants were fairly accurate in responding to the comprehension questions. This confirms that they were paying attention to the task and were able to understand the sentences and the questions. The type of linguistic construction or agreement had no effect on response accuracy.

Reading times. Only analyses and findings of the N and N+1 region are discussed below as they are the critical region of interest (the region in which condition effects were expected). A summary of main effects and interactions in the non-critical word regions (N-3, N-2, N-1, N+2, and N+3) can be found in Appendix M, critically there were no significant response time differences for grammaticality in the region (N-1) immediately preceding the critical regions (N and N+1) for any group ($p > .05$).

Natives. A 2 (Construction type) x 2 (Agreement/Violation) repeated measures ANOVA was run for each critical word position (N and N+1). Significant main

effects for Agreement were found in the N region [$F(1,31) = 8.48$, $p = .007$] and in the N+1 region [$F(1,31) = 30.011$, $p < .001$] revealing that the natives read significantly slower at N (Agreement: $M = 460.42$, $SE = 20.00$; Violation: $M = 501.96$, $SE = 28.11$) and N+1 (Agreement: $M = 424.76$, $SE = 15.7$; Violation: $M = 528.128$, $SE = 23.88$) when the number marking on the determiner did not agree with noun. No main effects of Construction type in the N region [$F(1, 31) = .719$, $p = .403$] nor in the N+1 region [$F(1, 31) = 1.593$, $p = .216$], nor were any significant interactions found (see Figure 7).

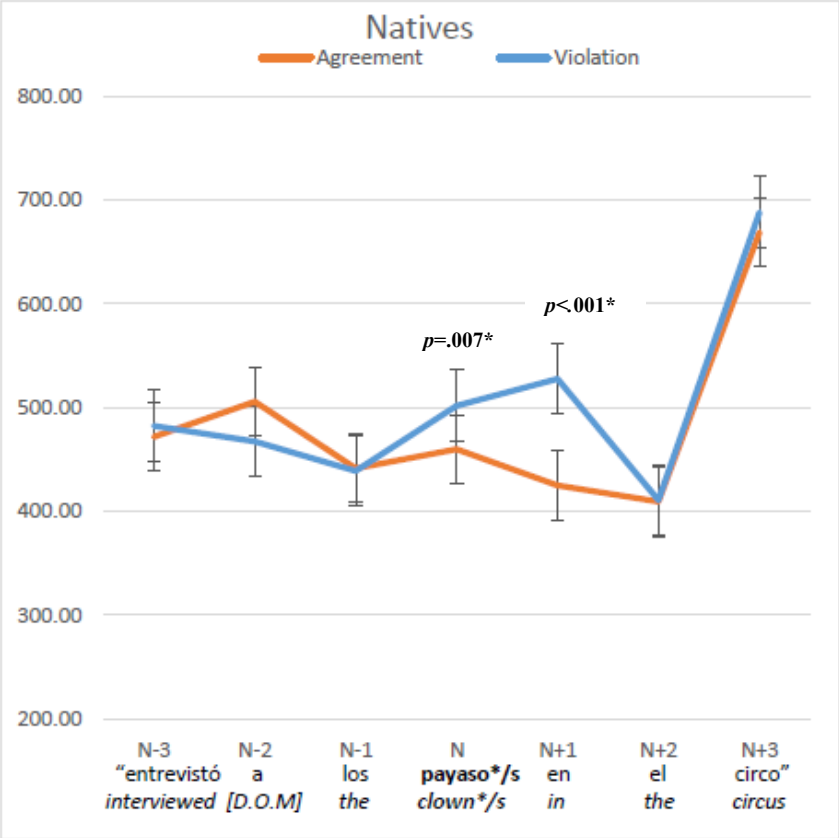


Figure 7. Self-paced reading task – RTs - Natives

Advanced learners. A 2 (Construction type) x 2 (Agreement/Violation) repeated measures ANOVA was run for each critical word position (N and N+1). There was a main effect for agreement at the N region [$F(1,18) = 5.130$, $p = .036$)] and the N+1 region [$F(1,18) = 4.962$, $p = .039$)] revealing that the advanced learners, like the

natives, read significantly slower at N (Agreement: $M = 625.64$, SE = 60.13; Violation: $M = 732.911$, $SE = 83.91$) and N+1 (Agreement: $M = 484.75$, SE = 37.89; Violation: $M = 565.96$, $SE = 666.35$) when the number marking on the determiner did not agree with noun. No main effects of construction type in the N region [$F(1, 18) = .462$, $p = .505$] nor in the N+1 region [$F(1, 18) = .334$, $p = .571$], nor were any significant interactions found (see Figure 8).

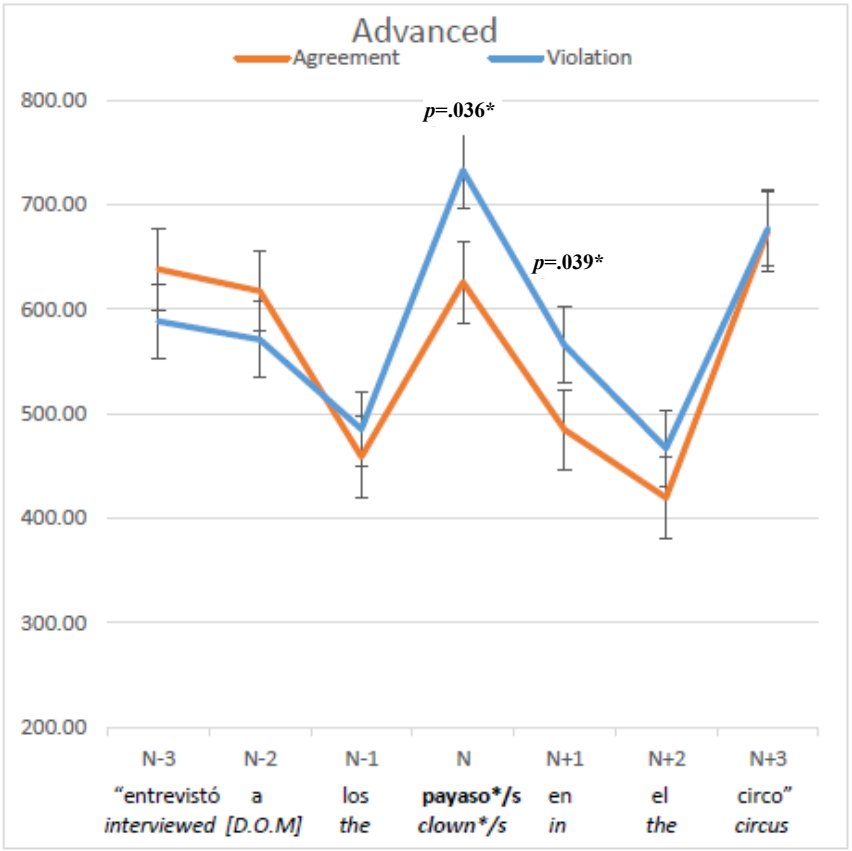


Figure 8. Self-paced reading task – RTs – Advanced

Intermediate learners. A 2 (Construction type) x 2 (Agreement/Violation) repeated measures ANOVA was run for each critical word position (N and N+1). There was a main effect for agreement [$F(1, 42) = 10.937$, $p = .002$)] and for construction type at the N region [$F(1, 42) = 5.834.$, $p = .02$] but no main effects were found for either agreement [$F(1, 42) = 3.777$, $p = .059$)] or for construction type [$F(1, 42) = 1.167$, $p = .286$)] at the N+1 region. These findings reveal that intermediate

learners, like the natives and the advanced learners, read significantly slower at N when the number marking on the determiner did not agree with noun (Agreement: *M* = 653.06, *SE* = 31.03; Violation: *M* = 736.44, *SE* = 36.73). Unlike the other groups, the intermediate learners also read significantly slower at N when the determiner was a demonstrative than when it was a definite article (Demonstrative: *M* = 719.02, *SE* = 35.72; Definite Article: *M* = 670.48, *SE* = 30.33). No significant interactions were found in either N or N+1 regions (see Figure 9).

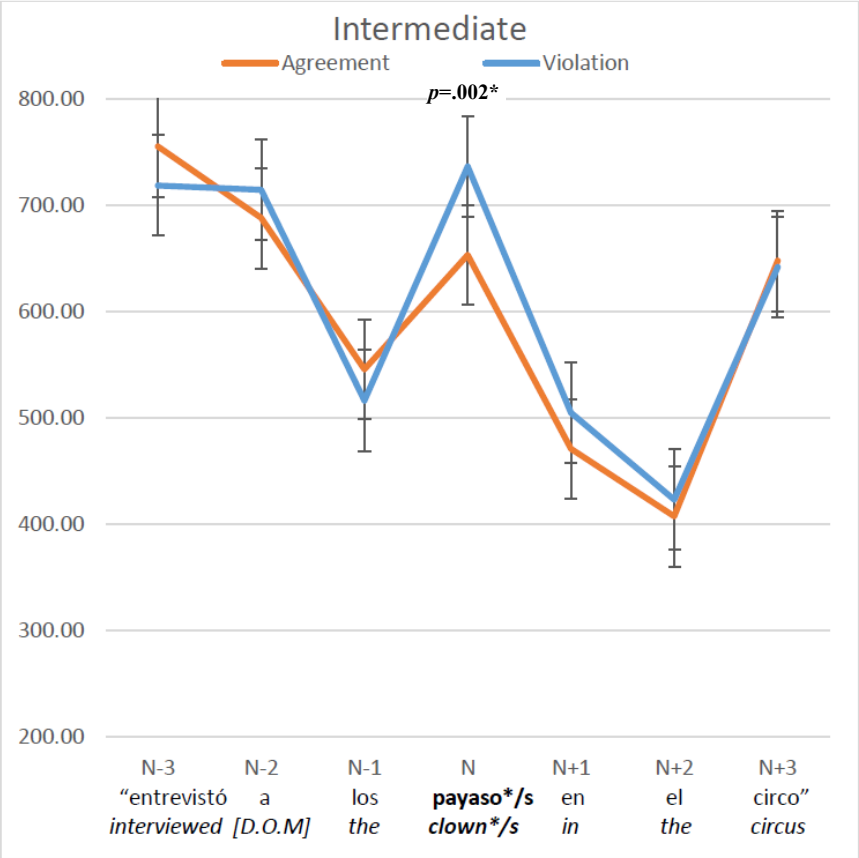


Figure 9. Self-paced reading task – RTs - Intermediate

4.4.2 Effect of Individual Differences on Self-Paced Reading Performance

To answer research question 2 regarding which of the following factors help L2 learners of Spanish detect number agreement errors between determiners and nouns: working memory, lexical automaticity, verbal fluency, vocabulary size, and proficiency, multiple linear regressions were run to identify which factors predicted

performance. Below I first describe how these individual differences were measured and scored, followed by the descriptive statistics, and finally I offer a description and results of the inferential statistics.

4.4.2.1 Scoring and descriptives

4.4.2.1.1 Vocabulary size test. Participants completed the Spanish Lextale-Esp vocabulary test (Lexical Test for Advance Learners of Spanish, Izura et al., 2014) to measure vocabulary size. Participants saw a list of 90 items (60 words and 30 non-words) and indicated whether or not they thought it was a real Spanish word or not. Participants' score was calculated on the basis of the number of words and non-words selected. The LexTALE score consists of the number of correct responses, corrected for the unequal proportion of words and nonwords in the test by averaging the percentages correct for these two item types. It was calculated as follows:

Score = Nyes to words – 2 * Nyes to nonwords.

Thus the highest possible score was 60 and the lowest possible score was -40. See Table 17 for group scores. Take note that due to technical errors data are missing from two native participants.

Table 17

Vocabulary Size by Group

	N	Minimum	Maximum	*M*	*SD*
Native	30	19	57	46.17	8.510
Advanced	19	1	55	33.11	12.449
Intermediate	43	-7	41	10.44	9.825

*4.4.2.1.2 Lexical automaticity***.** Participants completed a lexical decision task on 72 real Spanish words and 72 pseudowords. A coefficient of variance was calculated for each participant by dividing the average reaction time of all real Spanish words that

were accurately identified by the standard deviation of each participant's response time. A lower coefficient of variance corresponds to increased lexical automaticity (see Table 18).

Table 18

Lexical automaticity scores

		Coefficient of variance		Percent Accuracy	
	N	*M*	*SD*	*M*	*SD*
Native	31	.319	.083	92.61	5.04
Advanced	19	.435	.112	85.78	8.94
Intermediate	43	.425	.107	70.32	6.35

4.4.2.1.3 Verbal fluency. In this task, participants were given one minute to produce as many exemplars of a semantic category as they could. They completed one practice and two critical trials (e.g., fruits, professions). All responses were recorded and transcribed. One point was given for each distinct exemplar that was provided within each category. Total scores were averaged across conditions to provide one final score for the measures (see Table 19). Data from one native participant are missing due to technical failure.

Table 19

Verbal fluency

	N	M	SD	Minimum	Maximum
Native	31	15.05	3.49	6.0	23.0
Advanced	19	12.18	3.43	7.0	18.0
Intermediate	39	7.49	2.65	3.5	15.5

4.4.2.1.4. Working memory test. The participants completed 21 trials of a letter-number sequencing task. In each trial the participants were instructed to remember a sequence ranging from two to nine letter-number combinations and to repeat it by

typing, first, the numbers in ascending order, then the letters in alphabetical order. The received one point for each correct sequence they recalled. No points were awarded for partially accurate sequences. Therefore, scores could range from 0 - 21. Please take note that data from one native participant and one intermediate learner are missing due to technical failure recording the raw data files. Furthermore, two native speakers appeared to have misunderstood the directions and did not reorder the sequence resulting in outlying scores of four and, hence, have been excluded from analysis. See Table 20 for descriptive statistics for each group.

Table 20

Working memory scores

	N	M	SD	Minimum	Maximum
Native	29	10.28	2.120	8	16
Advanced	19	14.11	2.961	10	19
Intermediate	42	13.12	2.948	6	21

4.4.2.2 Inferential statistics

Various multiple linear regressions were run to predict from the participants' individual differences (i.e., proficiency, vocabulary size, verbal fluency, lexical automaticity, and working memory) their ability to detect violation of number agreement between the determiner and the critical regions in the self-paced reading task (calculated by collapsing the two critical regions together, N and N+1, as well as the construction types due to lack of main effects, and then determining the RT difference between the agreement and violation condition per participant by subtracting the agreement RTs from the violation RTs) (see Table 21 for descriptives of this violation sensitivity score).

Table 21

Descriptive statistics of effect size of violation sensitivity in the SPR task

	Violation Sensitivity Effect			
	M	*SD*	*Max.*	*Min,*
Native	144.72	143.59	480.21	-51.94
Advanced	188.10	196.00	463.37	-272.13
Intermediate	117.38	214.91	529.44	-537.82

A separate multiple linear regression was run for each proficiency group (Native, Advanced Learners, and Intermediate Learners). None of the five variables added statistically significantly to the prediction, $p > .05$ in any of the regressions. Thus, it was not possible to identify the predictive contribution of these variables on performance of this task. Regression coefficients and standard errors can be found in Table 22 (below).

Table 22

Summary of multiple regression analysis on violation sensitivity effect

	Variable	*B*	SE_B	*β*	sig.
Native					
	Intercept	-1100.447	872.581		.221
	Vocabulary size	-2.897	7.658	-.150	.709
	Verbal Fluency	-12.252	9.505	-.285	.211
	Lexical Automaticity	205.339	389.735	.118	.604
	Working Memory	9.328	15.109	.134	.544
Advanced					
	Intercept	69.628	373.064		.855
	Vocabulary size	3.183	5.251	.202	.554
	Verbal Fluency	-4.066	18.820	-.071	.832
	Lexical Automaticity	46.770	476.359	.027	.923
	Working Memory	3.001	17.669	.045	.868
Intermediate					
	Intercept	161.313	240.249		.507
	Vocabulary size	4.522	3.322	.240	.183
	Verbal Fluency	5.041	13.379	.069	.709
	Lexical Automaticity	-99.746	304.648	-.058	.745
	Working Memory	-6.080	10.603	-.096	.570

Note. *p <.05; B = unstandardized regression coefficient; SE_B = Standard error of the coefficient; β = Standardized coefficient.

A report of the correlations among the individual differences discussed above (e.g., Proficiency, Vocabulary Size, Lexical Automaticity, Verbal Fluency, and Working Memory) within groups and comparisons between groups can be found in Appendix N.

4.4.3 Picture Selection Task

The results from the picture selection task were analyzed to answer research question 3 regarding whether intermediate and advanced L2 learners of Spanish able to use number information from the demonstrative and the definite article to anticipate an upcoming target object to improve accuracy and response time of picture disambiguation. Below I discuss first the descriptive statistics followed by the inferential statistics.

4.4.3.1 Scoring and descriptives

Accuracy. Participants received one point for each correct picture selected for a total possible score of 32. All participants demonstrated that they were paying attention to the task and were able to match the aural stimuli to the visual images in over 75% of the cases. The descriptive statistics for the total number of correct responses are displayed in Table 23. An item analysis of the target noun (e.g., *payaso* "clown") revealed a high level of internal consistency, as determined by a Cronbach's alpha of .889. Two items folleto (flyer) and funicular (cable car) were removed from the picture-selection task only due to the fact that participants were less than 80% accurate only on these items indicative of either limited familiarity with the critical noun or a less than ideal artistic rendering of it.

Table 23

Picture-selection task accuracy

	N	*M*	*SD*	Min.	Max.
Native	32	31.28	.958	29	32
Advanced	19	31.16	1.015	29	32
Intermediate	43	29.02	1.779	25	32

Response times. Response times (RTs) were calculated as the time elapsed between the manually placed time-stamp at the offset of each critical determiner to the button press for each picture selection. Only RTs from correct trials were included in analysis. RTs below 225 ms were excluded from analyses, because they were likely to represent random selections initiated prior to the possible influence of the determiner (Haith, Wentworth, & Canfield, 1993; Matin, Shao, & Boff, 1993), which corresponded to 1.2% of the total RT values.

The upper limit was determined by applying the outlier labeling rule (Hoaglin & Iglewicz, 1987) with the demarcation criteria set at $g = 2.2$. This rule was applied separately to each group due to the significant response time differences found between groups. The application of this rule resulted in the exclusion of 1.5% of the native RT values, 1.8% of the advanced learners' RT values, and 2.2% of the intermediate learner's RT values. Below is a summary of the mean RTs for each group in the uninformative and informative condition after data trimming procedures has been carried out (see Table 24).

Table 24

Picture-selection task response times

	Definite Article				Demonstrative			
	Uninformative		Informative		Uninformative		Informative	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Native	1165.27	438.12	1105.30	373.47	1098.86	438.09	998.36	330.07
Advanced	1571.35	499.02	1352.37	447.49	1491.71	529.16	1244.96	400.85
Intermediate	1683.00	453.24	1715.58	507.13	1706.37	550.69	1616.67	475.74

4.4.3.2 Inferential statistics

Accuracy of native group. A two-way repeated measures ANOVA with a 2 (Informativity) x 2 (Construction type) was conducted to compare the effect of cue informativity (informative / uninformative) and the type of linguistic construction (Demonstrative/Definite article) on picture selection accuracy. The findings revealed that there were neither main effects nor any significant interaction ($p > .05$) indicating that native participants were equally accurate in all conditions (see Figure 10).

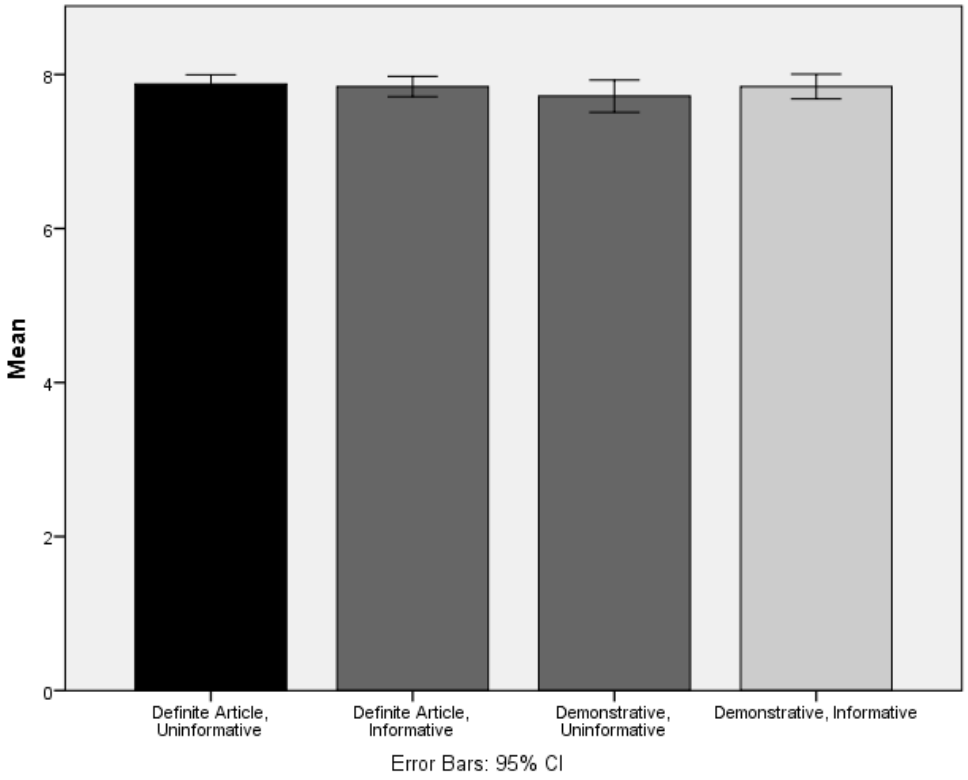


Figure 10. Natives' accuracy on picture-selection task

Advanced Learners. A two-way repeated measures ANOVA with a 2 (Informativity) x 2 (Construction type) was conducted to compare the effect of cue informativity (Informative / uninformative) and the type of linguistic construction (Demonstrative/Definite article) on picture selection accuracy. The findings revealed that there was a main effect for Informativity [$F(1, 18) = 6.429$, $p = .021$)], but not for Construction type. No significant interaction was found. These findings indicate that advanced learners were more accurate when the cue was informative (Definite Article: $M = 7.95$, $SD = .229$; Demonstrative: $M = 7.89$, $SD = .612$) than when it was uninformative (Definite Article: $M = 7.79$, $SD = .535$; Demonstrative: $M = 7.53$, $SD = .315$) in both linguistic constructions (see Figure 11).

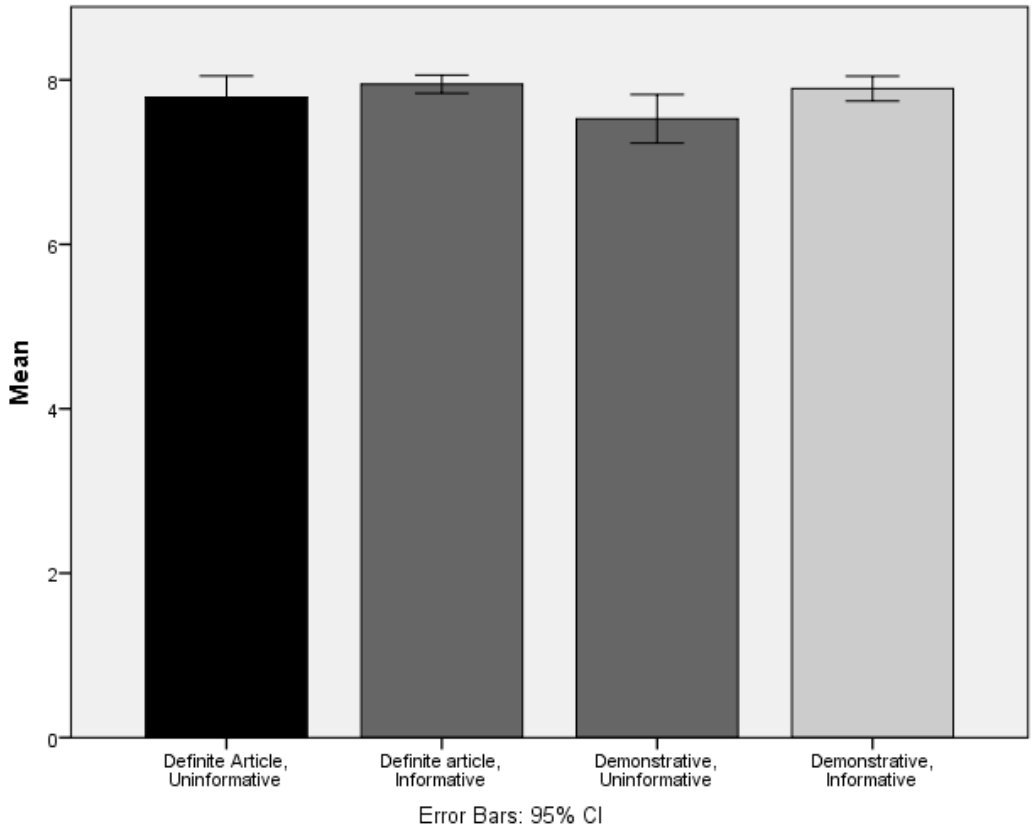


Figure 11. Advanced learner's accuracy on picture selection task.

Intermediate learners. A two-way repeated measures ANOVA with a 2 (Informativity) x 2 (Construction type) was conducted to compare the effect of cue informativity (Informative / uninformative) and the type of linguistic construction (Demonstrative/Definite article) on picture selection accuracy. The findings revealed that there was a main effect for Informativity [$F(1, 42) = 5.787$, $p = .021$)], but not for Construction type. No significant interaction was found. These findings indicate that, like the advanced learners, the intermediate learners were more accurate in the when the cue was informative (Definite Article: $M = 7.49$, $SD = .768$; Demonstrative: $M = 7.42$, $SD = .763$) than when it was uninformative (Definite Article: $M = 7.14$, $SD = .889$; Demonstrative: $M = 6.98$, $SD = 1.205$) in both linguistic constructions (see Figure 12).

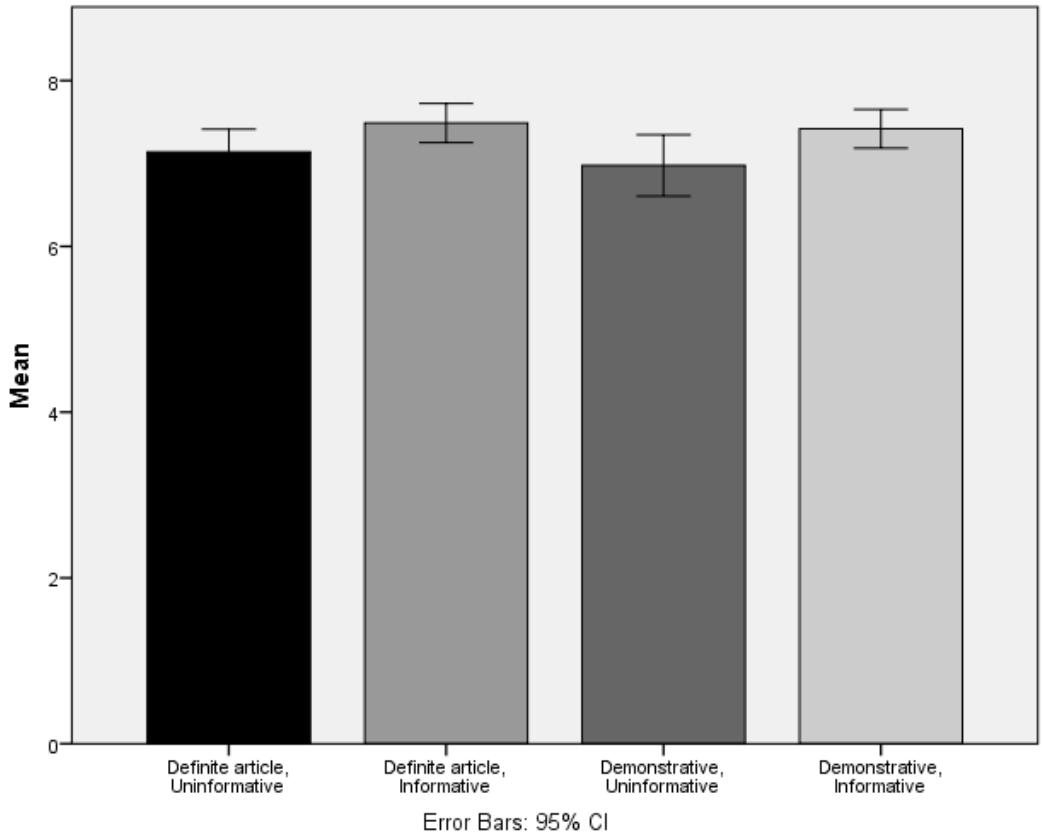


Figure 12. Intermediate learner's accuracy on picture selection task.

Response times. To specifically respond to research question 3 regarding whether participants were able to exploit number marking cues to anticipate the target object and to increase response time in picture selection the following analyses were carried out.

Natives. To analyze performance by the native group a 2 (Construction type) x 2 (Informativity) repeated measures ANOVA was run for the RT of picture selection. Significant main effects for Construction Type [$F(1, 31) = 4.729$, $p = .037$] and for Informativity [$F(1, 31) = 7.948$, $p = .008$] were found revealing that the natives responded faster in the demonstrative condition ($M = 1048.61$, $SD = 384.1$) than in the definite article condition ($M = 1135.29$, $SD = 405.8$) and in the informative condition ($M = 1132.07$, $SD = 73.077$) than in the uninformative condition ($M = 1051.83$, $SD =$

58.07). However there was no significant interaction between Construction type and Informativity [$F(1, 31) = .552$, $p = .463$) (see Figure 13).

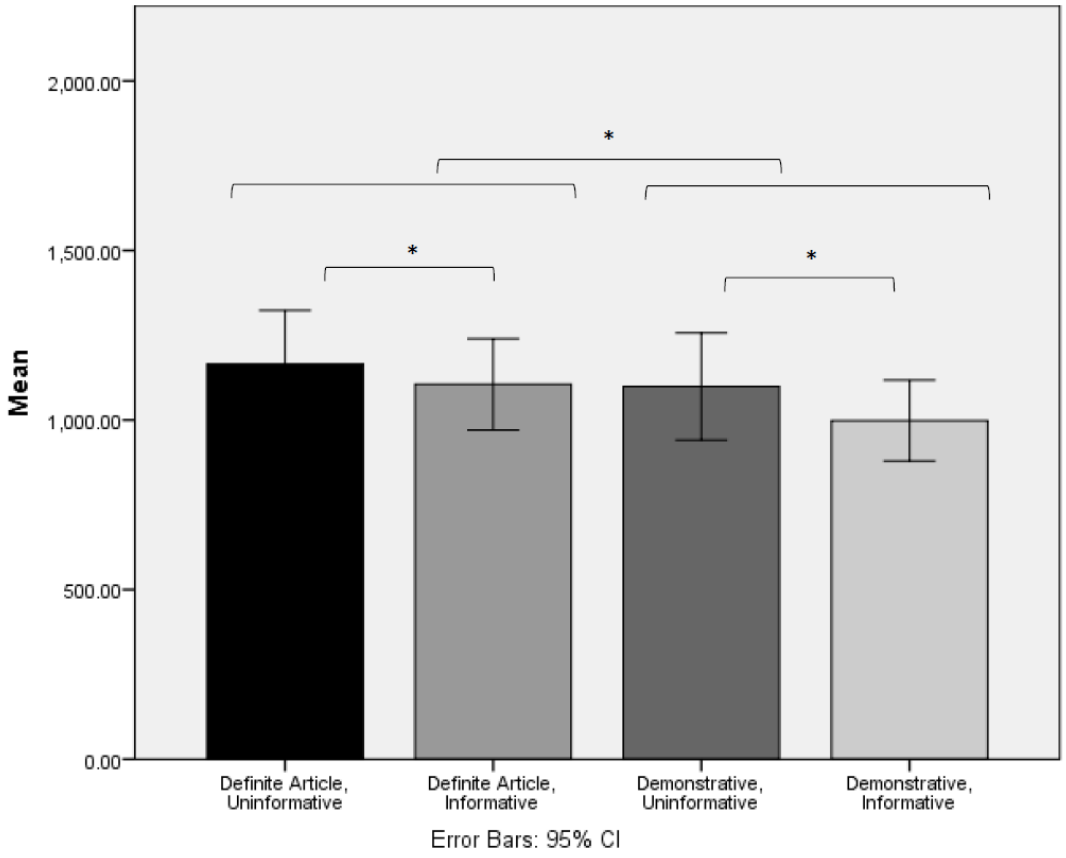


Figure 13. Native response times per condition in picture-selection task

Advanced Learners. To analyze performance by the advanced learners a 2 (Construction type) x 2 (Informativity) repeated measures ANOVA was run for the RT of picture selection. A significant main effect for Informativity [$F(1, 18) = 14.151$, $p < .001$] was found revealing that the advanced learners, like the natives, responded faster in the informative condition ($M = 1298.67$, $SE = 91.481$) than in the uninformative condition ($M = 1531.54$, $SE = 111.467$). However, unlike the natives, there was no main effect for Construction type [$F(1, 18) = 3.180$, $p = .091$] nor a significant interaction between and Informativity and Construction type [$F(1, 18) = .077$, $p = .785$) (see Figure 14).

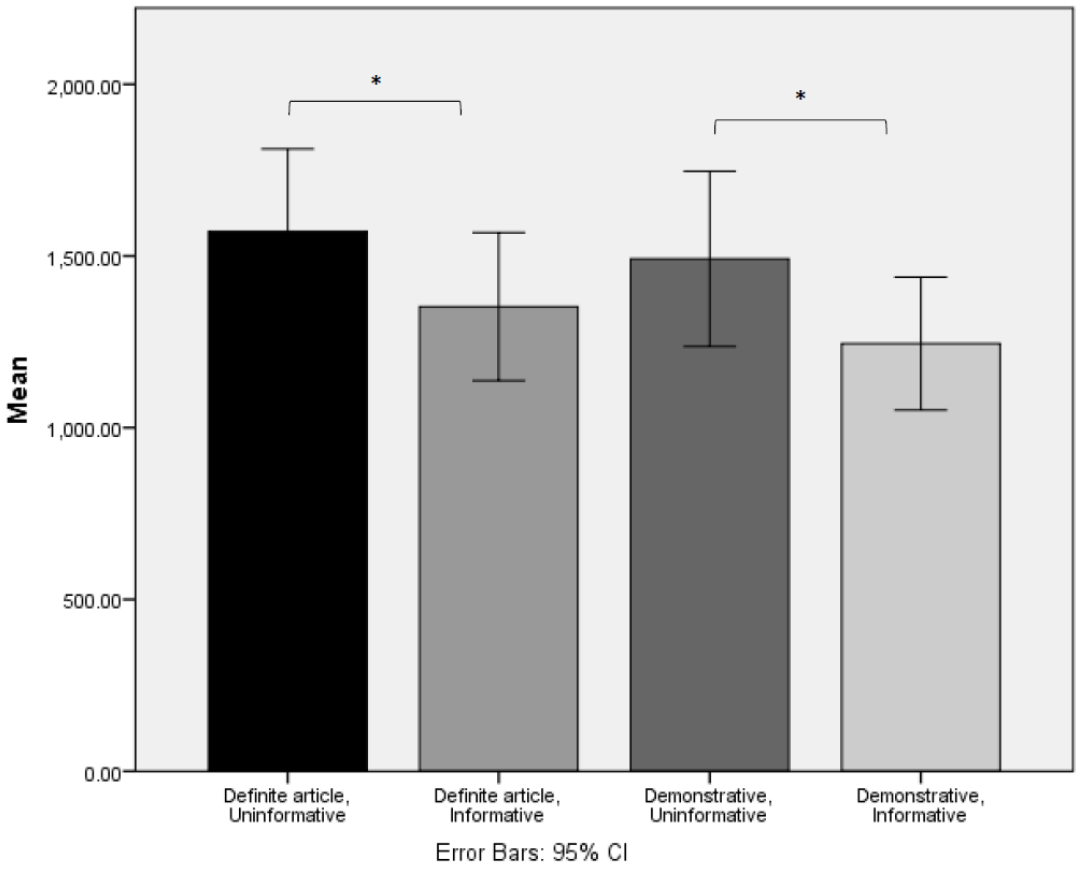


Figure 14. Advanced learners' response times per condition in picture-selection task

Intermediate. In the Intermediate Learner group there were no significant main effects for Informativity [$F(1, 42) = .130$, $p = .720$], Construction Type [$F(1, 42) = .678$, $p = .415$], nor for the interaction between the variables [$F(1, 42) = 1.247$, $p = .270$]. Unlike the natives and the advanced learners, the intermediate learners did not perform faster when number marking was informative: participants responded similarly in the Informative and Uninformative condition, and in both construction type conditions (see Figure 15).

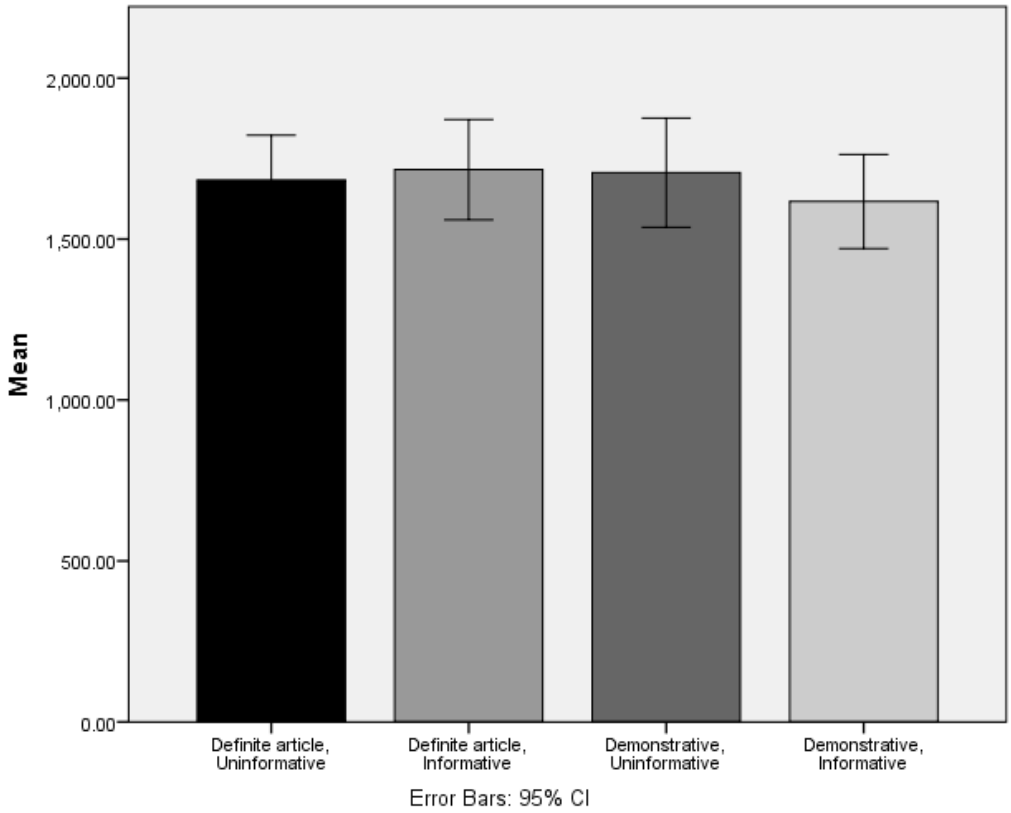


Figure 15. Intermediate learners' response times per condition in picture-selection task

4.4.4 Effect of Individual Differences on Picture Selection Performance

To answer research question 4 regarding which of the following factors help L2 learners of Spanish use number information from the determiner to anticipate an upcoming target object: working memory, L1/L2 similarity, lexical automaticity, verbal fluency, vocabulary size, and proficiency Multiple linear regressions were run to identify which factors predicted performance. Below are a description and results of the inferential statistics.

4.4.4.1 Scoring and descriptives

The scoring and descriptive statistics of these tasks were presented in section 4.5.1.

4.4.4.2 Inferential statistics

Various multiple linear regressions were run to predict from the participants' individual differences (i.e., proficiency, vocabulary size, verbal fluency, lexical automaticity, and working memory) their ability to exploit number markings on the determiner to anticipate the upcoming target image in the picture selection task (calculated by collapsing the two construction types together due to lack of interactions with Informativity, and then determining the RT difference between the uninformative and informative condition per participant by subtracting the informative RTs from the uninformative RTs) (see table 25 for descriptives of this informativity sensitivity score).

Table 25

Descriptive statistics of effect size of informativity sensitivity in the SPR task

	Informativity Sensitivity Effect			
	M	*SD*	Max.	Min.
Native	78.58	158.78	448.14	-195.06
Advanced	229.79	264.53	832.81	-136.06
Intermediate	23.37	506.93	1707.47	-765.99

A separate multiple linear regression was run for each proficiency group (Native, Advanced Learners, and Intermediate Learners). None of the five variables added statistically significantly to the prediction in any of the regressions. Thus, it was not possible to identify the predictive contribution of these variables on performance of this task. Regression coefficients and standard errors can be found in Table 26.

Table 26

Summary of multiple regression analysis on prediction effect

	Variable	*B*	SE_B	β	sig.
Native					
	Intercept	-163.863	655.217		.804
	Vocabulary size	-2.837	9.059	-.057	.756
	Verbal Fluency	-8.545	36.487	-.044	.816
	Lexical Automaticity	699.260	830.848	.152	.406
	Working Memory	-.123	28.916	-.001	.997
Advanced					
	Intercept	74.999	446.641		.869
	Vocabulary size	4.216	6.287	.198	.513
	Verbal Fluency	-18.887	22.532	-.245	.416
	Lexical Automaticity	-565.152	570.308	-.239	.339
	Working Memory	34.808	21.154	.390	.122
Intermediate					
	Intercept	-163.863	655.217		.804
	Vocabulary size	-2.837	9.059	-.057	.756
	Verbal Fluency	-8.545	36.487	-.044	.816
	Lexical Automaticity	699.260	830.848	.152	.406
	Working Memory	-.123	28.916	-.001	.997

Note. *$p < .05$; *B* = unstandardized regression coefficient; SE_B = Standard error of the coefficient; β = Standardized coefficient.

4.4.5 Relationship between Anticipation and Integration

To address research question 5 regarding how sensitivity to number marking in the self-paced reading task and picture selection task are related, and taking into consideration that both learner groups showed sensitivity on the integration task, but only the advanced group did so on the anticipation task, I conducted the following correlational analyses to determine the relationship between integration and prediction. First, to determine the effect size of violation in the self-paced reading task construction types were collapsed together (due to a lack of interaction between construction type and agreement) in the critical regions. Then, in both the N and N+1 region the difference scores between the grammatical and ungrammatical conditions

were computed for each participant by subtracting the agreement reading times from the violation reading times. To calculate the size of the prediction effect in the picture selection task, the difference between the uninformative and informative conditions were computed as described in the previous section (the response times of the informative condition were subtracted from the response times in the uninformative condition). The association between an individual's capacity for integration and their predictive abilities were examined separately for each group to explore the role of proficiency on in both the N and N+1 region, as well as when the regions were collapsed together since sensitivity to violations changed within groups and regions. The findings revealed the following:

Natives. In the N region there was no correlation (r = -.06, p = .746), but in the N+1 region, there was a negative correlation between the effect of violation sensitivity and predictive sensitivity (r = -.415, p = .018). However, when the two regions were collapsed together only a trend towards correlation was revealed (r = -.342, p =.056) (see Figures 16, 17, and 18).

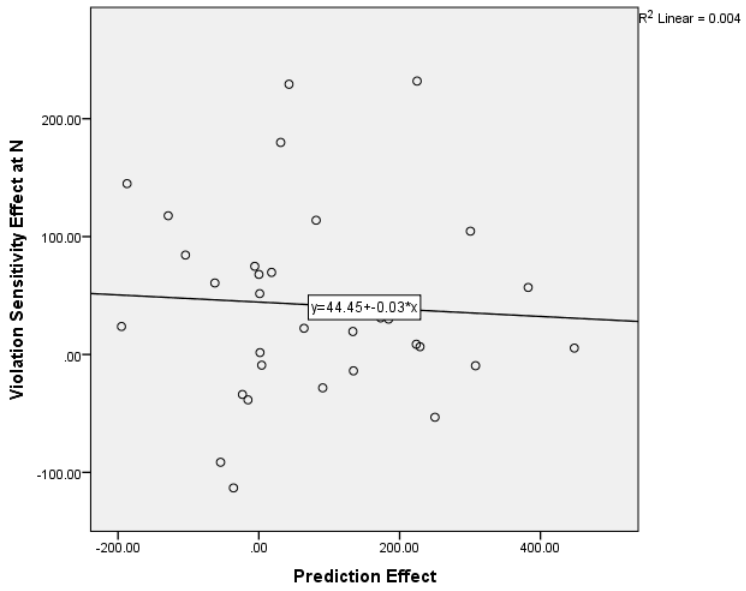


Figure 16. The relationship between the effect of violation sensitivity and prediction effect for natives at N region

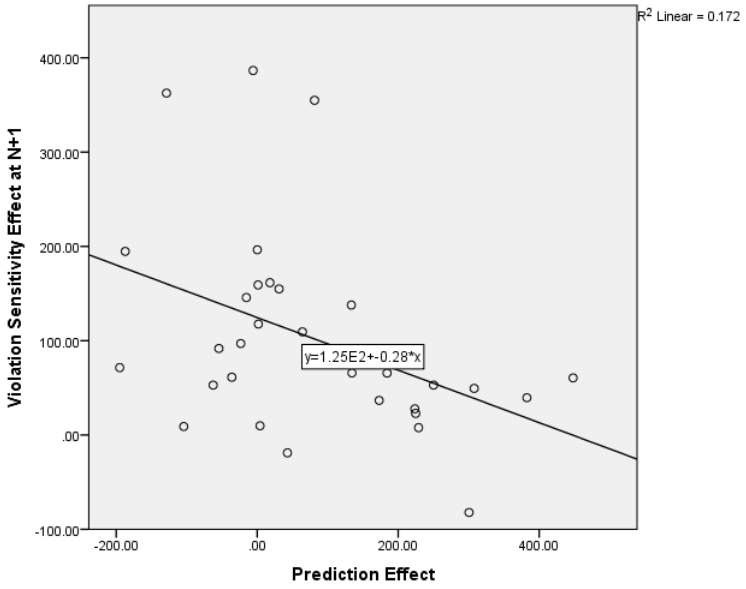


Figure 17. The relationship between the effect of violation sensitivity and prediction effect for natives at N+1 region

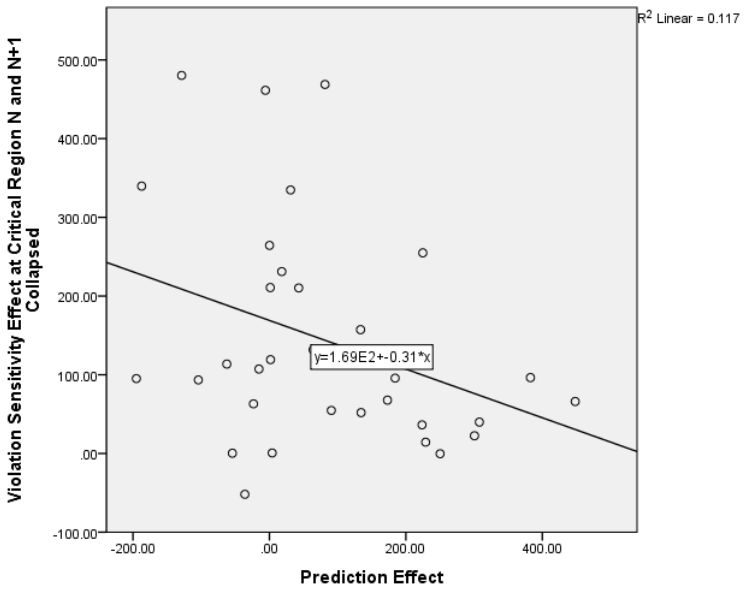


Figure 18. The relationship between the effect of violation sensitivity and prediction effect for native at collapsed N and N+1 regions

Advanced. In the N and N+1 region there was no correlation (N: r = -.335, p = .161; N+1: r = -.166, p = .496) between the effect of violation sensitivity and predictive sensitivity .However, when the N and N+1 region were collapsed together,

there was a negative correlation between the effect of violation sensitivity and predictive sensitivity (r = -.489, p = .036) (see Figures 19, 20, and 21).

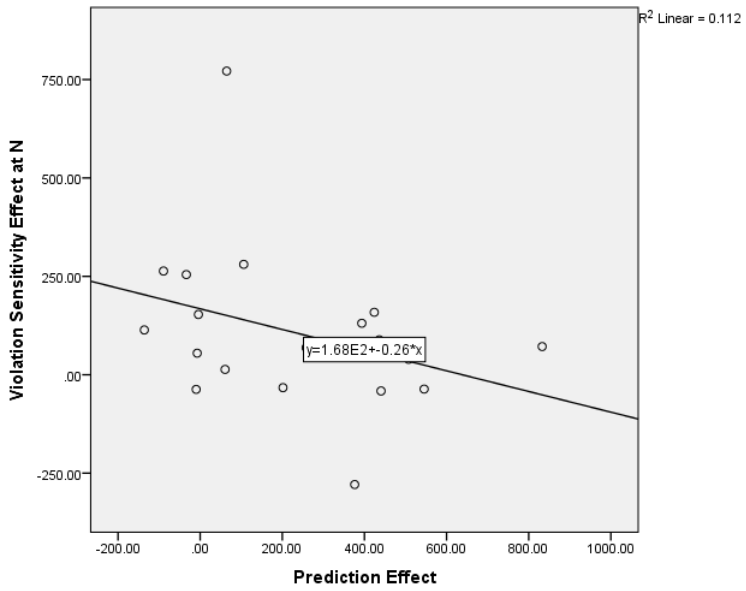


Figure 19. The relationship between the effect of violation sensitivity and prediction effect for advanced learners at N region

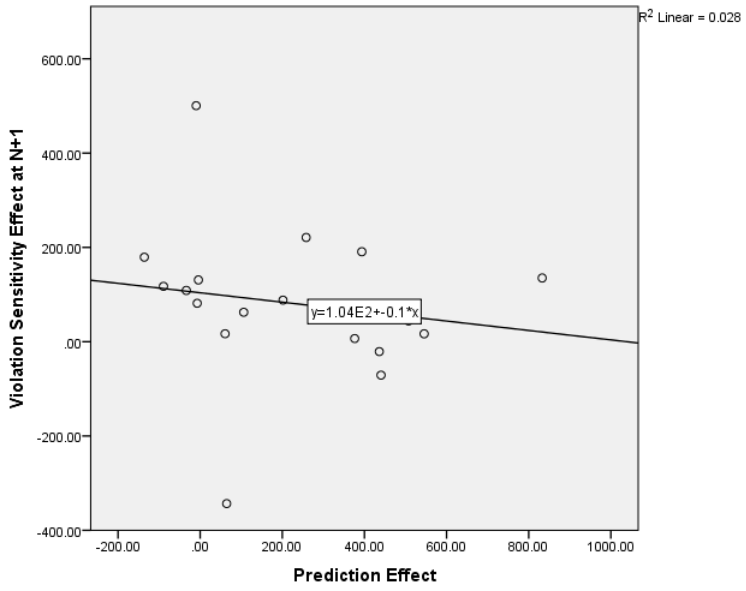


Figure 20. The relationship between the effect of violation sensitivity and prediction effect for advanced learners at N+1 region

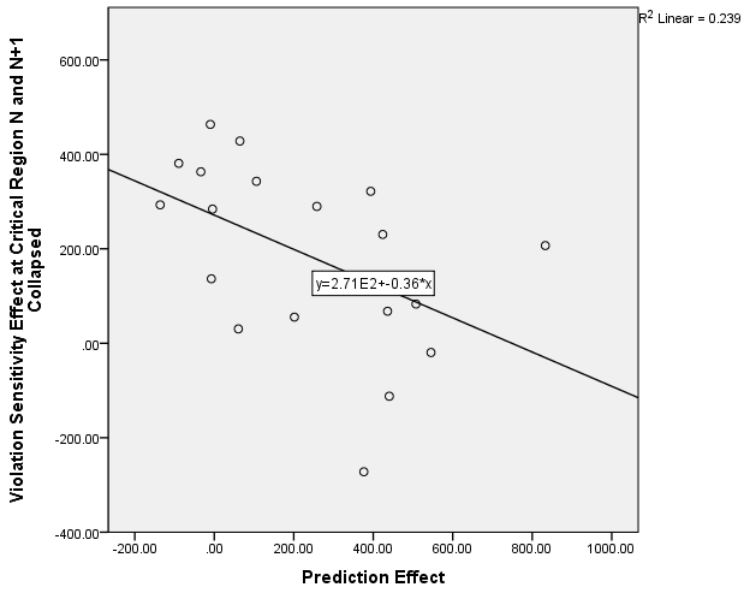


Figure 21. The relationship between the effect of violation sensitivity and prediction effect for advanced learners at collapsed N and N+1 regions

Intermediate. In the N and N+1 region there was no correlation (N: r = -.003, p = .987; N+1: r = -.129, p =.411) nor when the N and N+1 region were collapsed together (r = - 071, p = .651) between the effect of violation sensitivity and predictive sensitivity (see Figures 22, 23, and 24).

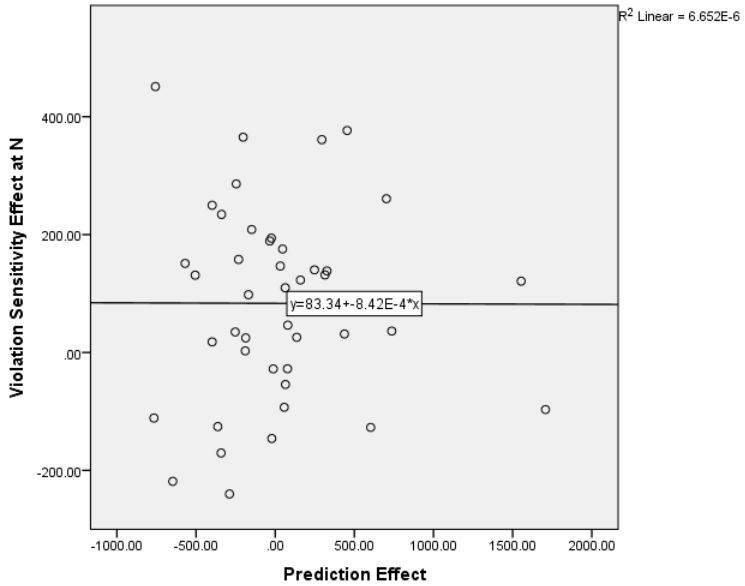


Figure 22. The relationship between the effect of violation sensitivity and prediction effect for intermediate learners at N region

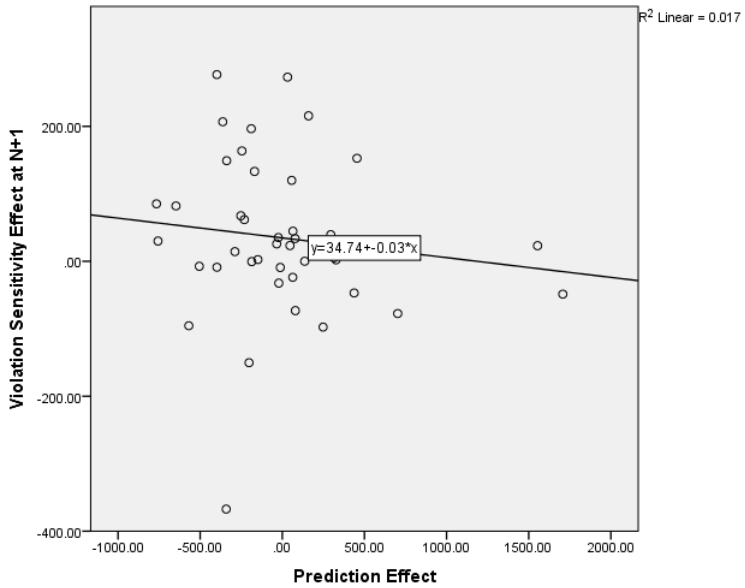


Figure 23. The relationship between the effect of violation sensitivity and prediction effect for intermediate learners at N+1 region

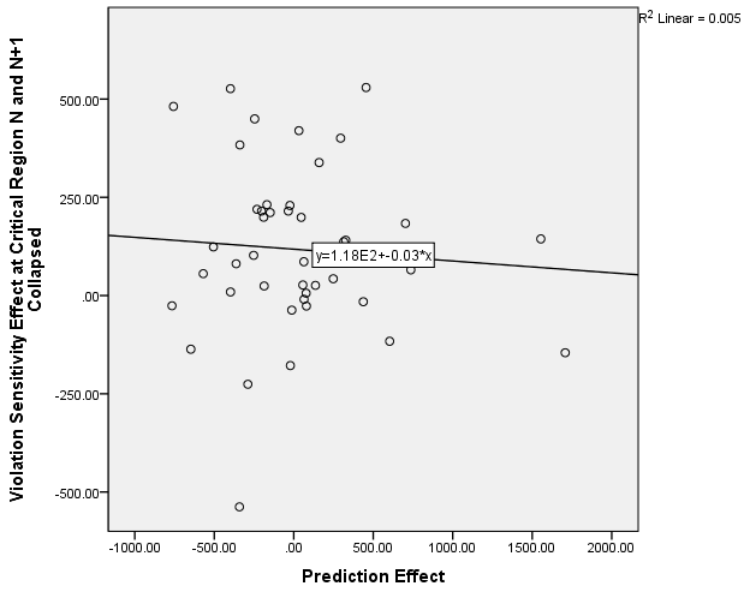


Figure 24. The relationship between the effect of violation sensitivity and prediction effect for intermediate learners at collapsed N and N+1 region

To further examine the effect of the relationship between the prediction effect and the violation sensitivity effect the participants were separated into groups of predictors and non-predictors and the data were refit using GLMs. To determine the members of the predictor group the difference was calculated between the response times in the uninformative condition and the informative conditions. Participants who had an average numerical positive response time difference were considered predictors and those with a negative or zero average response time difference were considered non-predictors. This was done for each proficiency group (see Table 27).

Table 27
Classification of participants as predictors and non-predictors

		Count	Mean RT (numerical difference between Informative and Uninformative conditions)	*SD*
Native	Non-predictors	10	-81.26	69.50
	Predictors	22	151.23	132.11

Advanced	Non-predictors	6	-46.77	54.18
	Predictors	13	357.43	218.74
Intermediate	Non-predictors	23	-308.32	221.32
	Predictors	20	404.82	474.34

The critical regions of N and N+1 were collapsed together for this additional analysis. There was no main effect for predictor group for natives [$F(1, 30) = .81$, $p = .375$], advanced [$F(1, 16) = .56$, $p = .064$] or intermediate [$F(1, 40)] = .378$, $p = .542$]. However, qualitative assessment of the scatterplots suggest that the relationship between the predictors and non-predictors in the native and advanced group perform similarly, but not in the intermediate group. In this group, the slopes of the regression lines suggest an interaction between the prediction effect and violation sensitivity effect between the predictor and non-predictor groups. In fact, the intermediate predictors appear to behave similarly to the advanced learners and native group, whereas the intermediate non-predictors behave in an opposite fashion (see Figure 25).

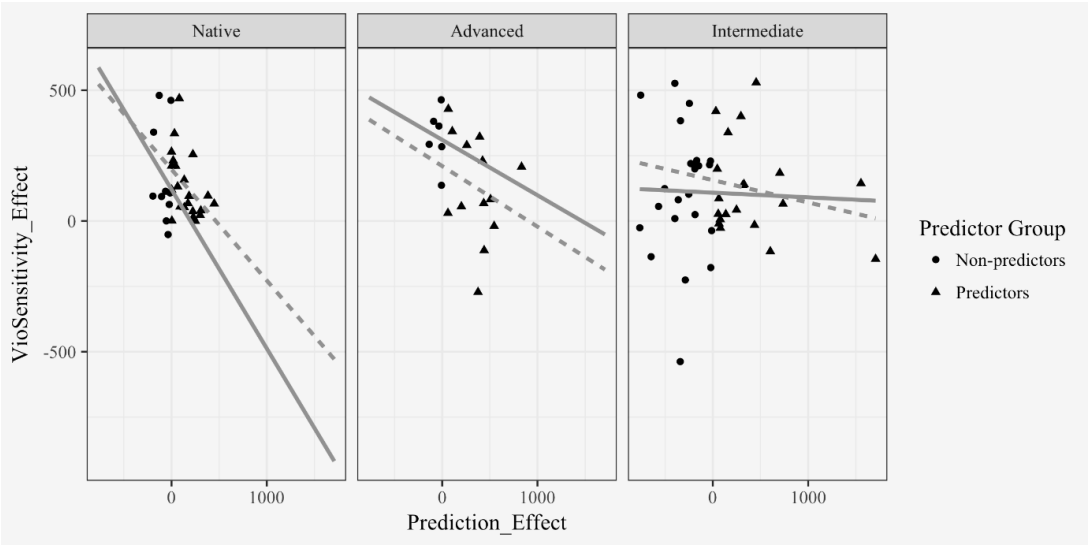


Figure 25. The relationship between the effect of violation sensitivity and prediction effect by predictor group and by proficiency group.

Summary. The above findings suggest that there is a correlation in performance between the prediction task (picture-selection task) and the self-paced reading task. However, this correlation is only found for the natives and the advanced learners, but in different regions (for the natives in the N+1 region and for the advanced only when N and N+1 were collapsed together). Qualitatively the slopes of the regression lines are very similar between the natives and the advanced learners, but again the intermediates show a different trend. One interesting finding is that when the groups were split into predictor or non-predictor groups, the intermediate predictors showed a regression line that began to resemble the regression lines of the advanced and natives. This suggests that ability to utilize predictive cues leads to behavior patterns that are more native-like. The fact that the correlations detected showed a negative relationship is a bit more difficult to interpret and possible explanations will be offered in the discussion section.

4.4.6 Metalinguistic Task

To address the final research question (6) regarding the relationship between L2 learner metalinguistic knowledge of number agreement between determiners and nouns and their performance on the sentence processing, below I summarize the results of the metalinguistic questionnaire and then interpret the results in light of processing performance.

4.4.6.1 Scoring and descriptives

Immediately after the follow-up grammar test which focused exclusively on number agreement between the determiner and the noun (gender was held constant – all masculine), the participants were presented a metalinguistic task in which they were prompted to verbally express in English how they had chosen their answers. They had one minute to provide an explanation and all responses were audio-recorded. Their responses were transcribed and coded into the following categories according to the recurring explanations offered: "Explicit mention of number agreement", "Explicit mention of gender agreement (in addition to number agreement)", "General structure", "Looked at endings", and "Grammatically correct". All advanced learners and 87% of the intermediate learners were able to verbalize with precision the morphosyntactic operation of number agreement between the Spanish determiner and noun, confirming that they possessed an accurate metalinguistic understanding of this structure. In fact, one advanced learner and two intermediate learners stated in their comments that it was "easy" to match the correct number-marked determiner to the noun. Total responses and sample tokens are summarized in Table 28. Take note that the data from one advanced learner and five intermediate learners are missing due to a failure to leave a response in the appropriate time frame.

Table 28

Learners' responses to the metalinguistic task

		Explicit mention of number agreement		Explicit mention of gender agreement (in addition to number agreement)		General structure		Looked at endings		Grammatically correct	
	Total	*N*	%	*N*	%	*N*	%	*N*	%	n	%
Advanced	18	18	100	2	11	0	0	0	0	0	0
Intermediate	38	33	87	12	32	2	5	2	5	1	2.6
Sample Responses		*"I was looking at number agreement. So, if it was singular I picked the singular form of the determiner rather than the plural form of the determiner." #213 (intermediate)*		*"I just had to match number and gender of the article or "this" "that" word with the, umm, word that it went with. So, "este dormitorio" not "aquellos dormitorio" that kind of thing. <pause> Well actually since I've got 25 seconds left on the clock, that is one of the things that bugged me actually when I was reading the sentences before. It kept putting the wrong gender or the wrong, actually more the wrong number, uh demonstrative word or article with the words. And, it just bugged me as I was reading the sentences." #227 (advanced)*		*"I just looked at verb and noun. I looked at the noun and the title for it like "a", "the" "these" made sure those were in agreement. So, subject, pronoun, antecedent, agreement." #250 (intermediate)*		*"I paid attention to the ending of the words and just matched them up to the preceding adjective." #208 (intermediate)*		*"I learned it because I was in Spanish class and they taught me how to do proper grammar." #251 (intermediate)*	

4.4.6.2 Inferential statistics

Unfortunately due a lack of variability in responses, a ceiling effect impedes the ability to evaluate the effect of metalinguistic knowledge on the sentence processing task. From the responses offered, it is evident that nearly all participants had a clear understanding of how determiner-noun number agreement is formed in Spanish, however to know if this knowledge benefited them in real time processing or not it would be necessary to have a more diverse group with participants who do not have a robust understanding of this linguistic phenomenon at the time of testing.

Chapter V: Discussion and Conclusions

This dissertation set out to investigate whether L2 processing difficulties are the result of inefficiencies in integrating (bottom-up processing) or anticipating (top-down processing) linguistic information and whether such effects can be characterized by individual capacity limitations and language knowledge. To this end, native Spanish-speakers and English learners of Spanish (advanced and intermediate) completed two sentence processing tasks, a picture-selection task and a self-paced reading, designed to tap into anticipatory and integrative processes respectively; and several tasks that measured individual cognitive abilities, such as working memory and lexical automaticity, and language knowledge tasks such as proficiency assessments, vocabulary size measures, verbal fluency tests, and metalinguistic probes.

The discussion of the findings is organized in the following way. First, I address each specific research question, the results, and their interpretation in light of the proposed hypotheses. This will be followed by a more in-depth discussion of the theoretical implications of these findings. Afterwards, the limitations of this study will be discussed and future directions will be explored. Finally, a brief summary of the overall study, its findings, and contributions will be offered as a conclusion.

5.1 Discussion of Research Questions

5.1.1 Research Questions 1 and 2

The first two research questions of this study asked whether intermediate and advanced L2 learners of Spanish are sensitive to number violations between demonstrative-noun and definite article-noun constructions during reading of L2 Spanish and if sensitivity was dependent on or predicted by learner's individual

working memory capacity, lexical automaticity, verbal fluency, vocabulary size, and proficiency.

As observed in the previous chapter, the native speaker group was sensitive to violations and demonstrated a reading slow down at the critical (N) and spill over (N+1) regions. This expected finding established the baseline for comparison for the learner groups. Both the advanced group and the intermediate group were also sensitive to the violation of number agreement between the determiner and the noun. However, sensitivity for the intermediate group was limited to the critical region only. These findings confirm that all participants were successful at establishing a number agreement relationship between the noun and its dependents inside the noun phrase (e.g., determiners and nouns). When this agreement relationship was not borne out due to a number mismatch all participants were sensitive to this violation and demonstrated a reading slow-down in the critical and/or spill-over regions.

One slight difference observed between the native performance and the learner performance was that the natives revealed more robust sensitivity in the spill-over region than in the critical region, whereas the advanced learners showed similar sensitivities in both regions, and the intermediate learners showed sensitivity in the critical region only. This quantitative difference can be explained by the faster reading times overall exhibited by the natives. This faster pace of reading facilitated faster tapping of the space bar to advance from one word region to the next, which most likely carried them into the next region before they had processed the violation, resulting in the slow-down appearing in the spill-over region rather than in the critical region. The learners were slower readers overall and had more time to react to the violation before they advanced on to the next region. This interpretation suggests that although the learners have developed sensitivities to the morphosyntactic violations,

they still differ from the natives regarding the time course thereof, possibly due to the additional cognitive burden of processing the L2, rather than a lack of grammatical knowledge per se (e.g., MacWhinney & Bates 1989; McDonald, 1987).

To examine the effects of crosslanguage similarity, the specific structures selected for this study were both inflected for number agreement but differed in their cross-language similarity and dissimilarity with regard to how these number features were mapped across semantic, syntactic, and phonological interfaces and assembled in the lexicon (as discussed in § 2.5.1, see examples 5-7). In this current study, I have defined and operationalized the morphological composition differences between the definite article and the demonstrative along the lines of Jackendoff's parallel structure (as discussed in Chapter 2). Within this framework, the lexicon is categorized according to regular productive rules and semi-productive words. For example, on one hand the English past tense can be formed by applying the productive rule of the regular past tense ending *–ed*, which is a lexical entry containing the phonological structure and the specification that it is a clitic affix to the lexical entry of the regular verb root, but on the other hand, irregular past-tense verbs such as [slept] have a lexical entry that corresponds to the full word. Such that walked is comprised by the unification of two lexical entries [walk] and [ed] via a productive rule and [slept] is a single lexical entry. Similarly in Spanish, I assume that the definite articles (at least in the masculine) are single lexical entries that correspond to the full phonological form [el] and [los] and that they are not composed by applying a productive rule of a plural clitic affix to a root (as argued by Harris, 1985). Whereas in the demonstrative a productive rule is applied to the root [est] to affix the clitic number markings of [e] or [os], or to the root [es] to affix [e] or [os]. These structures present crosslinguistic differences regarding the instantiation of number features. In Spanish, the plural

features of the noun always trigger agreement with the determiner, but not always in English. The challenge of the English learner of Spanish in the definite article condition ("el" and "los": the_s and the_{pl}) isn't just developing to two phonological realizations for [+Def] and [+Spec.] from one phonological realization, but rather the instantiation of additional features of gender and number. In the case of the demonstrative ("este" and "estos": this and these) the presence of a number feature in both languages reduces such difficulties. According to this reasoning, the expectation was that knowledge of the number-inflection on the English demonstrative would facilitate acquisition of the Spanish demonstrative because it doesn't require the instantiation of a new number feature and learners would be able to transfer their processing patterns from English to Spanish. Acquisition would require only developing the phonological form derived from the compositionality of a stem and a plural affix. This would be considered relatively easy as it follows the regular pattern of pluralization of nouns in English and doesn't require the instantiation of a new productive rule.

Consequently, if Ll similarity affects the cognitive resources available for processing, learners were expected to perform more efficiently with the construction that was more similar and less so with that which was less similar: the demonstrative would be more easily processed leading to more robust sensitivity when number agreement was violated than in the case of the definite article. Contrary to the L1 effects found in Tokowicz and MacWhinney (2005) and Tokowicz and Warren (2010), this prediction was not borne out. All learners were equally sensitive to number violations in both the definite article and demonstrative condition. One possible explanation is that although these two structures differ in regards to how they are stored and composed in the lexicon (i.e., Jackendoff, 2002), they are relatively

more similar than other structures with which crosslinguistic difference effects have been revealed (i.e., Tokowicz & MacWhinney, 2005, Tokowicz & Warren, 2010). The definite article and demonstrative constructions allowed for a contrast in how the number feature, already available in the L1 lexicon, may facilitate processing in the L2. In contrast, constructions dependent on gender, for example from previous studies, require that a new feature be instantiated in the L2 lexicon. In this case, greater crosslinguistic differences are expected than with number-inflected constructions for language pairings in which the L1 possesses number but not gender features. Accordingly, when the cross-language difference is relatively minor, the L1 effects may be limited to the earliest stages of second language acquisition when acquisition of these two structures is still in development explaining why a strong contrast was not found at the intermediate and advanced proficiency level. At this level of proficiency, these structures have been fully acquired and mapped in the lexicon and L1 facilitation effects have dissipated.

Alternatively, it is possible that the lack of crosslinguistic similarity effects is a consequence of how similarity is defined and operationalized. It is possible that the definition of similarity/dissimilarity outlined above with regard to the instantiation of the number feature and the application of a productive rule to a new set of cases may not be adequate or correlated with processing difficulty. The fact that Spanish definite articles are not formed productively may make them the more similar structure to English. It is possible, that the whole word storage in both languages may convey advantages to the Spanish definite article which are more important than the disadvantage of having to instantiate a new number feature. Additionally, an approach to L2 acquisition along the lines of the representational deficit hypothesis (Hawkins, 2009) may be more appropriate as it would predict the full transfer of the number

feature from the L1 to the L2 which could be easily extended to constructions beyond those that utilize the number feature in the L1. However, with the lack of effects found in the current study, one can only speculate as to their underlying differences and how they may correlate with processing difficulty. Methods will have to be developed that can tease these alternative propositions apart.

Nonetheless, it is important to keep in mind that number agreement was specifically selected for this study due to that fact that it ranks among the linguistic features that are most successfully learned in late L2 acquisition, especially among those who have some number agreement features in their L1 (e.g., Bruhn de Garavito & White, 2002; Dowens, Barber, Vergara, & Carreiras, 2009; McCarthy, 2008; Tokowicz & MacWhinney, 2005; White et al., 2004). The motivation was to demonstrate that if the processor can be shown to be fully functioning with these structures, then with structures that are more difficult to acquire such as gender (e.g., Alarcón, 2011; Bruhn de Garavito & White, 2003; Franceschina, 2005; Grüter et al., 2012; Montrul, Foote, & Perpiñán, 2008), the cause of inefficient processing can be pinpointed to the representational level of language knowledge and not to the parsing procedures internal to the processor. In consequence, further research will be needed to determine if crosslinguistic effects can be found with structures that share a greater degree of overlap and differ in very nominal ways as compared to those that show a greater degree of dissimilarity and whether these differences are only observable at the lower end of the proficiency spectrum, or if by redefining similarity we can better tap into the linguistic processes from which L1 effects arise.

Turning to the second research question, previous studies have found that a learner's language knowledge, modulated by experience with the L2, and individual cognitive abilities affect L2 sentence processing outcomes (as discussed extensively

in §2.3.2 - §2.3.4). These studies strongly align with the RAGE hypothesis that proposes that the interplay between cognitive resources, or the lack thereof, and grammatical knowledge, is the underlying factor which will determine processing efficiency.

With regard to the influence of these factors on the self-paced reading task, no effects were found other than proficiency. Presumably, higher vocabulary size would indicate a richer mental representation of the lexical items, which should facilitate processing when called upon. Lexical automaticity and working memory capacity would be expected to yield more efficient recall and manipulation of the mental representations for faster and more accurate processing of morphosyntax. Yet, no such effects were found. Take note that there is some preliminary evidence that working memory effects are only observed at the lowest levels of proficiency where due to the lack of grammatical knowledge greater demands are placed on working memory to compensate for this deficit (e.g., Marull, Sagarra, & Bel, 2015). As this study included only learners at the intermediate and advanced levels it is possible that is the reason for which no working memory effects were observed.

The lack of effects of these variables is puzzling, although, it is certain that some were correlated with proficiency and proficiency effects were found, they were not correlated similarly across all groups underscoring that these tasks tapped into dissociable skillsets. One likely explanation is that the findings, or lack thereof, result from the study's limitations stemming from feasibility and practical constraints. In the field of cognitive sciences, for example, typically one has several different tests for each cognitive construct of interest. To test working memory, one might include a digit span task, a listening span task, and a reading span task. The reason for doing this is that performance on any given individual difference measure can vary for a

number of reasons that may or may not have anything to do with the construct of interest. If one uses several tasks, one can measure the correlated variance across these tasks and use this as a predictor. The reason for which is that this correlated variance is likely to reflect the underlying cognitive construct of interest (e.g., working memory). Additionally, much larger population sizes, in the hundreds, are often required for effects to be found. Due to time restrictions and the fact that this study was mainly focused on lengthy sentence processing tasks, it would not have been feasible to include multiple tests for each construct nor to include hundreds of participants per group. The former would have exceeded the participants' attention and the latter, the financial and personnel resources available for this study. Thus, the lack of individual difference effects in this study may be an artifact of the study's design, rather than a true representation of the role these variables play in sentence processing. Future research will be charged with finding suitable solutions to these practical limitations as the fields of linguistics and cognitive sciences continue to merge.

In summary, the major findings that the learners were sensitive to number violations within the determiner phrase are in line with previous studies that have revealed that L2 learners can successfully detect morphosyntactic violations in real time when a certain level of proficiency has been reached (e.g., Alarcón, 2009; 2011; Keating, 2009; Osterhout et al., 2008; Rossi et al., 2006; Sabourin, 2003; Sabourin et al., 2006; Sagarra, 2007; Sagarra & Herschensohn, 2011; Tokowicz & MacWhinney, 2005). To tease apart the effects of integrative processes from predictive processes to infer which mechanism drives the sensitivities to violations in self-paced reading methodology, as these results can only reveal whether or not second language learners

are ultimately sensitive to number agreement violations, it is necessary to look at the findings of the second set of research questions regarding anticipatory mechanisms.

5.1.2. Research Questions 3 and 4

The second two research questions of this study asked whether intermediate and advanced L2 learners of Spanish are able to use number information from the demonstrative and the definite article to anticipate an upcoming target object to improve accuracy and response time on a picture disambiguation task and whether such ability was dependent or predicted by the learner's individual working memory capacity, lexical automaticity, verbal fluency, vocabulary size, and proficiency.

Recent L2 studies have identified inefficiencies in L2 morphosyntactic anticipation as the source of processing breakdown even when learners have extensive language exposure and high levels of proficiency (e.g., Dussias et al, 2013; Grüter et al. 2012, Hopp, 2013, 2014; Hopp, 2015a; Lew-Williams & Fernald, 2007, 2010). These findings motivated the hypothesis that L2 learners have reduced ability to generate expectations (Grüter & Rohde, 2013).

The observed results revealed that the native group was significantly faster to select the target image in the Informative condition than in the Uninformative condition. This confirms that the native group exploited the number marking on the determiners to compute forward agreement relations between the determiner and the noun to narrow down the set of potential nouns that could follow and thus facilitate comprehension and correct picture selection. Their performance set the baseline for comparison. The advanced learners patterned very similarly to the natives confirming that they, too, were able to generate expectations about the upcoming noun from the morphosyntactic number cue on the determiner. In contrast, the intermediate learners did not demonstrate any response time advantage in the Informative condition. This

finding suggests that the intermediate learners have not yet developed the ability to utilize morphosyntactic number markings in an anticipatory manner. This is a striking finding, considering that all other indicators (e.g., accuracy of picture-selection, follow-up grammar test, metalinguistic interview, etc.) revealed that the intermediate learners possessed strong metalinguistic knowledge of the morphosyntactic number marking on definite articles and demonstratives, had very high accuracy in the follow-up grammar task which focused specifically on these constructions, and were even able to employ such knowledge in real time to detect grammatical violations in the self-paced reading task.

Furthermore, these finding contrast with the similar study done by Lew-Williams (2009). In his study, he used a very closely related experiment (experiment 5) to this current study. L2 learners of limited proficiency completed a picture selection task with informative/uninformative cues of number marking on the determiner. In this task he finds that the learners with relatively limited proficiency were able to make use of number marking to predict the upcoming noun. These findings are in direct contrast with the current study. However, there seems to be a fairly straightforward explanation and that lies in the complexity of the prompt. In the Lew-Williams' experiment the prompt was quite simplistic with expressions such as "Mira el/los caballo/s" (Look at the$_{sing.}$/the$_{pl.}$horse/s). In the current study the prompts were much more complex and the number cue was preceded by a prepositional phrase and a subject which varied throughout the experiment. The more complex sentence was designed to be more representative of mature speech contexts as well as to abscond the target of the experiment. Thus, the current study is arguably more challenging and would increase the cognitive load of a participant more so than the simplistic prompts used in Lew-Williams. Thus, Lew-Williams' findings support rather than challenge

the current findings as they offer evidence that when cognitive resources are available to learners they are more likely to employ predictive processing mechanisms.

In sum, this study provides convincing evidence that L2 learners can successfully employ predictive mechanisms for the processing of morphosyntax in the L2. The strong claim of the RAGE hypothesis, that learners are systematically incapable of generating native-like expectations, is not supported by the findings of this study as it does not account for the specific processing situations (i.e., advanced proficiency) in which learners successfully employed anticipation.

The findings in this study are in line with the very recent findings of Hopp (2016), which examined how variability in lexical gender assignment moderates predictive gender agreement processing. His results revealed that intermediate L1 English late-learners of German can show predictive processing of gender agreement after training on lexical gender assignment, and that accuracy in gender assignment moderates predictive gender agreement. His findings underscore the interaction of lexical and syntactic features in L2 acquisition and processing and point to a target-like representation of the morphosyntactic feature in the lexicon as a prerequisite for it to be exploited in predictive processing. This target-like representation develops gradually with language experiences and is correlated with proficiency. The reason for which Hopp's intermediate participants were successful at exploiting the more difficult gender feature for predictive processing, whereas the intermediate participants in the current study were not successful with number may be due to methodological differences. First, Hopp's intermediate participants partook in a training activity designed to increase their attention and use of gender features. Second, participants' accuracy of lexical gender assignment in production was used as the selection criterion for the trials to be analyzed from the predictive task. In the

current study, no pre-training on the specific linguistic feature was included, more global measures of number agreement knowledge were used, and all correct trials were analyzed. Nonetheless, taken together my results add to previous findings (e.g., Grüter et al., 2012; Hopp, 2013) that suggest that lexical and syntactic variability in L2 morphosyntactic processing are correlated with proficiency and modulated by training and/or language experience.

Turning to the analyses of L1 effects in picture-selection task, no effect of construction type was found for the learners. This finding further supports the notion discussed above, that the linguistic constructions were mostly too similar for L1 effects to be evidenced at the intermediate or advanced proficiency level or that alternative ways of defining and operationalizing crosslinguistic similarity/dissimilarity need to be considered.

With regard to the influence of language knowledge and cognitive individual differences on the picture-selection task, as with the self-paced reading task, no effects were found other than proficiency. This surprising finding of a lack of individual difference effects further supports the notion that it is an artifact of the study's design, rather than a true representation of the role these variables play in sentence processing. It also is important to keep mind that this is not the first study to have found limited effects of individual differences. In fact, numerous studies have found no individual differences effects, especially working memory, when participants possessed high levels of proficiency (e.g., Havik et al., 2009; Sagarra, 2007, 2008; Sagarra & Herschensohn, 2010; Sagarra & Herschensohn, 2011, Sagarra & Herschenson, 2012; Service, Simola, Metsaenheimo, & Maury, 2002). Consequently, it is possible that the participants of this current study have reached a level of proficiency where the effects of these factors, especially working memory,

are no longer evinced. Determining the exact role these variables play in predictive processing are fodder for future research that can address the practical limitations of this current study.

5.1.3. Research Question 5

To address research question 5 regarding the relationship between anticipatory mechanisms and integrative mechanisms during processing of sentence comprehension, a prediction effect size from the picture-selection task and a violation effect size from the self-paced reading task were calculated for each participant and correlation analyses were run.

The findings revealed a weak negative correlation for the natives and the advanced learner groups. The greater the predictive effect size, the smaller the violation effect size. No correlation was found for the intermediate group, which is not surprising since they did not demonstrate the ability to utilize number markings in a predictive fashion. These findings establish that an individual's capacity for predictive abilities ties in with their integration abilities and are the first findings of this kind in L2 processing studies. All participants were sensitive to violations in the reading task, but not all participants were sensitive to the predictive cues (i.e., intermediate learners), which strongly suggests that integrative processes are sufficient for the detection of violations in self-paced reading. The bottom-up concatenation of linguistic elements, constructed in working memory, can cause a post-facto interruption to processing when they have mismatching morphosyntactic features but the loading of a prior lexical entry into working memory may not necessarily preactivate the features or characteristics of upcoming lexical entries. This latter top-down facet of language processing may be a characteristic of highly efficient language processing that corresponds to increased availability of cognitive

resources either through increased linguistic automaticity or proficiency or due to situational and contextual fluctuations. At maximum efficiency both of the processes occur simultaneously analogous to the dual-route models (Ferreira, 2003) discussed in §2.1.

Interestingly, the correlation between the predictive effect size and the violation effect size had a negative relationship. Although this may seem counterintuitive, it may indicate that when both integrative and predictive processes are efficiently employed, recovery from an unexpected violation is faster than when predictive mechanisms are less efficient. I speculate that the combined effect of efficient integration and anticipation provides a participant clear expectations regarding forthcoming linguistic information and when such expectations are not borne out he or she can easily recognize the cause of the processing disruption. Having such clear expectations can make it easier and faster to overcome a violation (shorter reading time delays). When the expectation is not as clear, there is an overreliance on backward-looking agreement checking. In this case, the combined effect of the detection of the violation and the identification of the source of the violation are costly with regard to temporal processing and thus, could explain the cause of the negative correlation. However, this is just speculative and other explanations for the negative correlation need to be explored.

This is a pivotal finding, because it allows us to begin to identify the individual contributions of the underlying processes responsible for sentence comprehension. It also furthers our understanding of the scope and limitations of different psycholinguistic methodologies and the interpretation of the findings. Future researchers will have to be very specific regarding the underlying language process that they are trying to measure and must be careful not to overgeneralize their findings

to global language processes if the tasks of their studies confound the bottom-up and top-down processes, among the many other processes that are surely to be disentangled in future studies.

In addition to these observations some other interesting findings were also revealed. Most notably, when participants were split into groups based on their ability to exploit predictive cues or not, the predictors in the intermediate group began to reveal qualitatively similar regression lines to the advanced and native groups suggesting that the employment of predictive processing is pivotal to advancing proficiency. Although this difference did not reach significance, upon visual examination, one can observe that this difference is quite robust and is sufficiently eye-catching to warrant further investigation (see Figure 24). Take note that the predictive effect is not always observable in both natives and advanced learners supporting the perspective that even healthy native speakers, who are in the prime age span, do not always efficiently employ anticipatory mechanisms. This finding is in line with capacity models that posit that in contexts of high cognitive demand, speakers may forgo the most accurate, but more cognitively demanding route of full parsing. Arguably, completing computer-administered sentence comprehension tasks, after numerous cognitive tasks is fatiguing and monotonous. It is logical that some participants would reduce their cognitive strain by adopting a "good enough" processing strategy. This finding lends further evidence that anticipatory mechanisms are not required for the detection of morphosyntactic violations during reading comprehension, but may enhance such processing.

5.1.4. Research Question 6

The final research question of this study asked whether there was a relationship between L2 learner metalinguistic knowledge of number agreement in the determiner

phrase and their online sensitivities to this phenomenon for the detection of violations and the anticipation of target objects.

To examine the role of a learner's conscious understanding, or metalinguistic knowledge, of a grammatical rule, learners completed a qualitative task which probed them to discuss their understanding of how definite articles and demonstratives function grammatically within a Spanish sentence. They had one minute to provide an oral free response regarding these constructions. All advanced learners and 87% of the intermediate learners were able to verbalize with precision the how the morphosyntactic operation of number agreement functioned between the Spanish determiner and noun. This confirmed that they possessed an accurate metalinguistic understanding of this structure and several participants made it a point to say that this was "easy". This is not surprising because previous studies have shown that, especially in a classroom setting, explicit knowledge of the L2 develops first. What is unclear is the relationship between explicit knowledge and implicit knowledge of the L2 system and whether explicit knowledge becomes automated or integrated as implicit knowledge (Jiang, 2007).

Unfortunately, due to the lack of variability in the learners' responses, the resulting performance at ceiling impeded the ability to evaluate the effect of this factor on the other tasks. Therefore, what can be said about the role of this knowledge on online performance is extremely limited. From these data it is impossible to determine if what one knows, consciously, has any bearing on one's efficiency of language processing (for an in-depth debate on the topic, see Ullman 2004, 2005).

Above, I have discussed the empirical findings reported in Chapter 4 with the objective of addressing the research questions that motivated and guided the present investigation. I argued that intermediate and advanced learners of L2 Spanish are

native-like in their ability to detect morphosyntactic number violations in reading, and at advanced proficiency are able to use morphosyntactic number marking on the determiners to anticipate, or facilitate the integration of the number marking on the noun. These results provide strong evidence that L2 learners can make morphosyntactic predictions when proficiency is high and when the linguistic construction has been fully acquired. I have further argued that predictive mechanisms are not necessary to detect violations in self-paced reading tasks, but contribute to more efficient processing. A detailed analysis of the data indicated that the only factor of those evaluated that significantly influenced L2 sentence processing was proficiency, contrary to some of the more nuanced predictions of the RAGE hypothesis regarding the effects of resource limitations. In the next section, I address the most relevant theoretical and methodological contributions of this dissertation. Finally, to conclude I also discuss the limitations of this study and present several suggestions for future research in the area of adult second language acquisition.

5.2 Conclusions

5.2.1 Introduction

The purpose of this study was to test the RAGE hypothesis and to tease apart L2 predictive processes from integrative processes. Native speakers develop integrative and predictive mechanisms early on, but second language (L2) learners often fail to develop native-like processing. Current L2 studies point to morphosyntactic anticipation as the source of processing breakdown even when learners have extensive language exposure and high levels of proficiency (e.g., Dussias et al, 2013; Grüter et al., 2012, Hopp, 2013, 2014, 2015a; Lew-Williams & Fernald, 2007, 2010). However, there has not been a systematic analysis of the processor's subcomponents in the L2 literature. Instead researchers have preferred to approach processing in holistic terms.

Teasing apart these two processes contributes significantly to current debates on the locus of difficulty in L2 sentence processing and has the potential to advance knowledge and understanding of what non-native processing exactly entails.

5.2.2 Theoretical Framework

A limited number of morphosyntactic L2 predictive studies have been carried out to test the hypothesis that L2 learners have a Reduced Ability to Generate Expectations. These studies have found that even highly proficient L2 learners differ from native speakers on their ability to exploit morphosyntax to anticipate or preactivate features of upcoming constituents. Yet, some evidence has been observed that suggests that the ability to generate expectations may be modulated by general processing abilities such as lexical automaticity (Hopp, 2014), variability of lexical representations (Hopp, 2015a), the properties of the learner's L1, vocabulary size (Borovsky et al., 2012) and L2 proficiency (Dussias et al., 2013). The findings from this study are in line with the RAGE hypothesis which posits that the underlying grammatical representation in late second language grammars is intact, but as resources are exhausted first on integrative mechanisms, proactive processes such as prediction are impaired or severely limited. Thus, the more cognitive resources a learner brings to the table the more he or she has available after integrative processes to expend on the generation of expectations. Therefore, it appears that the ability to employ anticipatory mechanisms may be constrained by the cognitive demands of the task and liberated by language automaticity that develops with proficiency. Thus, an individual's L2 linguistic knowledge is the critical factor in freeing up resources which ultimately impact language processing outcomes. On the one hand, the learners demonstrated sensitivities to morphosyntactic violations in the self-paced reading task, but in the picture-selection task, only the advanced learners employed

anticipatory processing. This suggests that predictive processing requires more cognitive resources than integration, hence, the learners with lower proficiency were stretched to their cognitive limits and applied a "good enough" strategy. This was sufficient for them to complete the task they were conscious of very accurately (e.g., correct picture selection), but limited their ability to utilize the morphosyntactic markings on the determiner to initiate picture disambiguation preemptively. This observation offers further support for the RAGE hypothesis, yet, this support is constrained by the fact that, beyond proficiency, none of the individual differences considered were found to have any effect on sentence processing. If cognitive constraints were driving performance one would have expected individual capacity to modulate the outcomes. This finding suggests certain limitations to the scope of the cognitive resources in the ability to employ anticipatory strategies as they do not account for all findings. However, one must be cautious in interpreting the lack of individual capacity effects on sentences processing as strong evidence against the RAGE hypothesis, because these findings may have resulted from methodological limitations (as discussed above).

Returning to the broader question of why evidence of L2 anticipatory processing has not been robustly found in previous studies, I argue that although outside of the domain of morphosyntax there is some limited evidence that learners are capable of utilizing linguistic information, such as lexical-semantic information, in anticipatory processing (Hopp, 2015a), the reason for which no such patterns have been found by learners within the domain of morphosyntax is attributable to previous studies' narrow focus on gender, verbal aspect, and case-marking (e.g., Grüter, Lew-Williams, & Fernald, 2012; Hopp, 2015a; Lew-Williams & Fernald, 2010). These structures contain morphosyntactic features notoriously difficult for L2 learners to acquire and

automatize at even very advanced proficiencies, especially when they are absent or differ greatly from L1 features. The source of their difficulty most likely lies in the interaction of the representational level of the lexicon with the parsing routines of the processor. When learners struggle to acquire an accurate grammatical representation of the construction, either because it requires the instantiation of a new feature or because it lacks interpretable features, the processor is less efficient in employing this knowledge in real time. The findings of this current study suggest that any L2 inability to predict, or preactivate features of upcoming constituent, stems from the acquisition difficulties of the linguistic phenomenon in question and not from an inefficient or incompetent processor that reduces the ability to generate expectations globally.

This current study has contributed to the field by identifying a linguistic phenomenon with which L2 learners were successful in exploiting morphosyntactic features to anticipate linguistic information. Both natives and advanced learners were able to exploit the number markings on the determiner - a morphosyntactic construction which is more easily acquired by learners than gender, case marking, or verbal aspect, due to some overlapping L1/L2 features - to accelerate disambiguation in the picture-selection task. The fact that the intermediate learners were not successful, combined with the observation that they were native-like in their detection of morphosyntactic violations in the self-paced reading task, supports the hypothesis that cognitive resources are dedicated first to integrative mechanisms. This is in line with the premise of the RAGE hypothesis, that resources exhausted in integrative processes impair or severely limit proactive processes such as prediction

Proficiency was clearly the strongest index by which successful predictive processing could be predicted. As proficiency increases, processing procedures

become automatized and more cognitive resources are made available. Both of these enable the processor to employ predictive mechanisms after employing integrative mechanisms for a more complete parse. The proficiency effect is in line with the findings by Dussias et al. (2013) that highly proficient English-Spanish speakers showed evidence of a gender anticipation effect in an eye-tracking study, but contrasts with the studies by Hopp (2014; 2015a) and Grüter et al. (2012) which found no evidence of anticipatory processing even by advanced proficiency participants (but see Hopp, 2016). These mixed findings can be reconciled by the fact that the linguistic phenomena examined in these studies included gender and case-marking in the L2 which was absent in the L1 of the participants. The mixed findings with gender may be a result of how proficiency was measured across the studies.

For example, Dussias et al. (2013), who had detected evidence of anticipatory processing of gender features by advanced learners, had grouped the learners into proficiency groups by taking the mean test score (41) on a 50 point modified DELE exam and performing a median split at that point. By not following pre-established cut-off points and adapting the group distribution to the specific participants in their study, they were able to establish groups that were indeed significantly different in proficiency and increase the internal validity of their study. This is very similar to the methods employed in the current study where the K-clustering statistical technique also provided statistically different proficiency groups.

In the studies by Hopp (2014; 2015a) and Grüter et al. (2012), certain variability in the proficiency measures may be the reason why they did not find proficiency effects while Dussias et al. (2013) and this current study did. In the Grüter et al. (2012) study, three measures of Spanish proficiency were completed by their participants: self-rating, a written cloze test; and the Versant Spanish Test (Pearson,

2009). Undeniably, the participants who were placed into the advanced proficiency group were highly proficient, but it is impossible to determine if they were equally proficient as the groups in the Dussias et al. (2013) and this current study. Keeping in mind that proficiency is a very nebulous term, it is possible that the language skills measured by one type of proficiency measure are not measured by another. As Dussias et al. (2013) and this current studied relied on a modified DELE exam, it is possible that this exam taps into skills which are more directly related to anticipatory mechanisms. Further confounding these comparisons are the results from Hopp (2014; 2015a) because the language pairs under examination were not L1 English-L2 Spanish and therefore, there may be certain language-specific effects modulating predictive processing. As proficiency measures have not been standardized within languages (take for example the modified DELE as compared to the Versant Spanish Test mentioned above) making generalizability of findings a problem, trying to compare proficiency measures across languages is nearly impossible. However, Hopp (2016) did find training effects on gender prediction by intermediate to advanced L2 German learners. When the training resulted in invariable representation of gender assignment in the lexicon, as measured by accurate production in an elicited production task, learners demonstrated predictive processing. The learners who continued to display variant knowledge of gender assignment in the lexicon did not reveal any anticipatory processing even for the items that they knew. He concluded that if

> [G]ender assignment is variable or non-target-like in the L2 lexicon, then L2 learners will encounter frequent mismatches between their (subjective) gender assignment and the actual gender of nouns in the input. Specifically, lexical variability paves the way to frequent prediction errors, since the noun predicted to occur by the listener based on her non-target gender assignment does not occur in the (target) input. As a consequence, the parser likely adjusts prediction strength according to error-based implicit learning, such that gender agreement

> will not be used predictively by L2 learners due to variable lexical gender assignment. (p. 6 - 7).

Taken together, these findings reveal that to more accurately measure proficiency effects on L2 predictive processing, measures which tap directly into the lexical representation of the construction are required in addition to more global proficiency measures.

Beyond proficiency effects, lexical automaticity effects were found by Hopp (2014; 2015a). He found that learner lexical automaticity modulated the ability of the learners to anticipate thematic roles based on case-markings. In this current study, no such effects were identified. The different findings may be due to the same methodological issues discussed above with regard to proficiency. Although the lexical automaticity task in the current study followed the same design as that used in Hopp (2014, 2015a), it has not been standardized across languages and may not have been as sensitive in Spanish as it was in German.

Regarding the effects of vocabulary size on the ability to generate linguistic expectations, as found by Borovsky et al. (2012), the findings of this current study are partially compatible. Within the advanced learner group vocabulary size and proficiency were highly correlated. Therefore, vocabulary size forms a pillar of the advanced learners' proficiency and may have contributed to their success in demonstrating native-like anticipatory processing in the picture selection task. However, in the intermediate learner group, there was no correlation between vocabulary size and proficiency, and no effects for vocabulary size were found for this group. This finding indicates that at a certain level of language experience, proficiency and vocabulary knowledge begin to correlate and it is at this stage of development that anticipatory processing begins to emerge.

In summary, the above findings demonstrate that learners can employ anticipatory mechanisms when proficiency is advanced (i.e., representations are stable in the lexicon) and when the linguistic construction under examination shares some similarities with the L1. The locus of the inefficiency in morphosyntactic predictive mechanism is external to the processor itself. This study has disentangled two important processing mechanisms, integration and anticipation, for the first time in L2 studies and has found strong evidence to suggest that these processes are highly correlated but that integration processes are recruited prior to anticipatory mechanisms.

Together these findings strongly suggest that native-like processing of morphosyntactic constructions which share some features with the L1 is possible at intermediate and advanced proficiency and that the mechanisms required for processing are dissociable and differentially affected by proficiency: anticipatory mechanisms develop later in proficiency than integrative mechanisms. Thus, it appears that the underlying causes of L2 divergent processing are external to the architecture of the L2 processor and can be localized in the interplay between proficiency and language experience.

5.2.2 Limitations

This dissertation presented a series of practical and theoretical shortcomings. One of the first methodological issues that became apparent during data analysis involved the unequal distribution of the participant groups. This was a direct result of choosing to group participants in accordance to the results of a k-cluster means statistical analyses rather than the more common use of pre-set cut-off scores on the adapted DELE proficiency test. This decision increased the internal validity of the participant

groups and allowed for a clearer picture to emerge regarding the development of sentence processing mechanisms in the L2.

A further limitation caused by sample size was the inability to isolate and identify the effects of individual differences on sentence processing. In the field of cognitive science, studies typically run hundreds of participants to find such effects, yet in the field of SLA group sizes are traditionally much smaller typically averaging between 20 and 50 participants. A related limitation is that each individual difference was only measured with a single task. Again, in the field of cognitive science, multiple tasks are employed to identify the effect of a single construct. When including both linguistic and cognitive tasks, certain practical constraints, such as time and participant fatigue, limit the amount of additional tasks that can be included. As the two fields of cognitive science and SLA begin to build bridges, the practical implications and constraints of including large participants and multiple individual differences tasks in language studies will have to be addressed and creative solutions will need to be developed to resolve these practical limitations.

Another limitation to the theoretical and methodological design of this study is that little is known about the nature of predictive processing with regard to the influence of the reliability of the cue, the immediacy of the predictive cue, the types of linguistic outcomes predicted, or the length of the temporal buffer required for the generation of expectations. In fact, time course of the predictive mechanism is one of the more contested issues in predictive research.

Several reviewers of previous versions of this manuscript have pointed out that a better method to tease apart integrative processes from anticipatory processes is a visual-world eye-tracking paradigm, in that eye movements are sufficiently fast to reflect predictive processing even during a brief amount of time, such as the duration

of the determiner. This implies that the methodology employed in this current study conflates predictive and integrative processes because the determiner is sufficiently short in duration that it is unlikely that participants selected the target image prior to having heard at least some of the phonological features pf noun, which makes it difficult to determine whether the effect of the informative cue reflects predictive or integrative processes (or both).

However, I would counter that there is evidence of the effectiveness of this methodology. Take for example the studies by Lew-Williams and Fernald (2007, 2009, 2010) and Grüter et al. (2012), who carried out a series of experiments that used a visual world paradigm and eye-tracking methodology to investigate whether L2 learners of Spanish would anticipate a referent in a two-picture visual display based on the gender cues of the gender-marked determiners (discussed in §2.3.1). Although earlier fixations on the target image were found in the Informative condition, this anticipatory glance was initiated after phonological content of the disambiguating word was presented. As a specific example in Lew-Williams and Fernald (2010), native adults began to launch eye-glances to the correct image in the Informative condition on average after 308 ms from the onset of the disambiguating noun (608 ms from the onset of the gender-marked article). In the Uninformative condition the average time to the first fixation on the target picture was 374 ms after onset of the disambiguating noun (674 ms from the onset of the gender-marked article). It is the time difference between the Uninformative and Informative condition that has been interpreted as evidence of anticipatory process, not the visual fixation on the target image prior to the onset of the disambiguating noun. Thus, the similar findings in this current study, although using a more rudimentary methodology, are equally

interpretable as evidence of anticipatory processing and validate picture-selection as an appropriate methodology for identifying anticipatory processing.

Against this backdrop, the notion that predictive processing only occurs if the upcoming constituent is activated in full form in mental representation prior to phonological or lexical content highlights the lack of consensus regarding the nature of prediction. It remains a question for future research whether pre-activation, priming, predictive coding, and/or Bayesian inference are the fundamental principles of prediction that apply to all aspects of language. Throughout this dissertation, I have been careful to acknowledge this lack of consensus by using a broad application of the term "prediction" as it is beyond the scope of this study to tease apart the contribution of each one of the processes. I have qualified the use of prediction or anticipation with the notion that anticipatory processing may also encompass preactivation of linguistic features which facilitates and enhances integration, that is, predictive processing of grammatical number agreement is the construction of a forward dependency relation between the number-inflected determiner and the noun (los_{pl}→$payasos_{pl}$). The number marking on the determiner is not sufficient to generate an anticipatory representation of the full noun form, but it may be sufficient to preactivate the expected number feature, so that when the number marking on the noun is encountered it is more rapidly integrated. This preactivation provides a head start on processing, which is noticeable when the number marking is informative, hence the faster response times in the Informative condition that in the Uninformative condition. How each of these predictive processes functionally contribute to different aspects of language processing, from speech perception to language acquisition, and by which cognitive and neural mechanisms this is accomplished must be taken into consideration in future research on L2 predictive processes.

Lastly, since the findings reveal that learners are able to detect violations in experiments employed in this study, but intermediate L2ers show significant delays, the metalinguistic awareness analysis has to be enhanced in order to depict the full nature of their explicit knowledge of number agreement in Spanish. In other words, a protocol which allows for a natural thinking process to occur, without time limitations (as in the current study) is required. Following this protocol the prompt for response would be contextualized to the participant. Then, a more detailed analysis of their response discourse could be carried out to determine the difficulty or challenge they have in understanding number agreement through morphosyntax. For example, pauses, quoting the grammatical rule, silence, etc. would offer significant clues as to why the participant could not detect the violation. What they say would offer evidence of their reasoning and should be understood and interpreted. An unfortunate limitation in this study is that, due to time constraints, participants had limited time to respond to the metalinguistic awareness prompt. These responses were analyzed quantitatively in relation to significant findings in the experimental tasks. However, a true qualitative analysis is lacking. As pointed out by Jefferson (1993), one utterance in which there is a learner telling you something is evidence of their thinking. Thus, in future research, more careful regard should be dedicated to a true qualitative analysis of the participants' metalinguistic awareness.

Despite these limitations, the data discussed in the present study were still able to capture differences between integrative and predictive processes and were able to locate processing inefficiency to linguistic knowledge external to the processor modulated by proficiency. In the following segment, I conclude this chapter by proposing suggestions to explore some of the findings obtained in this investigation in

more detail with the objective of improving our knowledge on L2 morphosyntactic integrative and predictive processing and development.

5.2.3 Future Research

The topics discussed throughout this dissertation open the possibility to future investigations regarding the application of integrative and predictive processing by L2 learners of different proficiencies. One of the most relevant contributions of the present work is the proposal that L2 anticipatory processing is highly dependent on the language experience of the participant and the L1/L2 similarity of the morphosyntactic features of the linguistic construction in question. In order to confirm the potential effects of these factors in the development and application of anticipatory mechanisms, the next logical step should involve testing various linguistic constructions, i.e. gender and number agreement, and different language pairings. To further tease apart the effect of the L1, for example, a study should include a group of learners of Spanish whose L1 does not mark plural morphologically in the noun phrase (e.g., Chinese, Japanese, Korean, Vietnamese), or include learners of Spanish whose language is more similar to Spanish than English in these aspects, (e.g., Brazilian Portuguese). Finally, the English-speaking learners of Spanish should also be tested with similar tasks in English, their L1, as another way of testing L1 transfer: to determine whether they use the same processing strategies in English and in Spanish. By implementing an analysis of more groups, more structures, and tests in the L1 and the L2 it would be possible to determine with more certainty the role of the L1 in the processing of the L2.

To test the role of anticipatory processing against the backdrop of the "critical period" and "capacity model" debate, future investigations should explore the effects of age of acquisition of Spanish and language use by including a heritage speaker

group, similar to the L2 learners in terms of proficiency and second language, not only in relation to processing patterns, but also in regard to other linguistic properties less similar across languages, such as verbal aspect, differential object marking, or gender assignment and agreement, and in regard to their individual differences (i.e., vocabulary size, verbal fluency, lexical automaticity and working memory). Additionally, it would be interesting to further examine proficiency effects – whether integrative abilities of number agreement are only evidenced beyond intermediate proficiency, as attested in the present study, or whether they begin to develop at the initial stages of L2 acquisition and whether they can be trained (i.e., Hopp, 2016). In a similar vein, near-natives should also be included to determine whether increased language automatization provides the cognitive resources to perform native-like anticipatory processing of linguistic constructions that require features not instantiated in the L1. Further information about the development of these processes in relation to language experience and age of acquisition would contribute to the development of an L2 acquisition model which fully accounts for all the findings in this study.

Similarly, the inclusion of supplementary measures that isolate the cognitive constructs that drive sentence processing and measures that tease apart the various mechanisms underlying anticipatory processing would shed some light on the potential factors that influence L2 learner linguistic performance.

Although the results obtained in this study have provided valuable information about how second language learners employ integrative and predictive parsing strategies to morphosyntactic constructions that share some linguistic features, namely number agreement, across English and Spanish, they have also raised a considerable number of questions regarding the effects of linguistic and extra-linguistic factors such as the ones presented in this section. While the scope of this dissertation is

limited with respect to the exploration of all the aforementioned variables, addressing them in future research would broaden our understanding of the subcomponents of the language processor and how they develop with language experience and are constrained by individual cognitive capacities.

5.3 Summary Remarks

The goal of this dissertation was to disentangle integrative from anticipatory mechanisms and to determine how language experience and cognitive individual differences modulate their efficiency. The findings of this study revealed that some learners successfully exploited number morphosyntax for predictive processing. However, this parsing routine appears to be recruited later in acquisition than integrative processes; all learners showed sensitivities to grammatical violations in the self-paced reading task, but only the advanced learners showed anticipation in the picture-selection task. Cognitive individual differences appeared to have a minimal effect on processing outcomes. These findings further our understanding of bottom-up and top-down processing abilities of second language learners and strongly suggest that once number feature mappings are target-like in the lexicon, predictive processing by number agreement is possible. Finally, I argue that L2 processing strategies are not inherently different from L1 strategies, but are dependent on L2 experience.

Moving beyond a holistic approach towards L2 processing offers significant theoretical implications for mapping the cognitive underpinnings of bilingualism. Through critical analyses of the sub-mechanisms driving language comprehension in relation to the abilities of the individual learner it is possible to determine the scope and nature of L2 processing inefficiencies

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Appendix A – Consent Forms

(English - paid)

CONSENT TO TAKE PART IN A RESEARCH STUDY

Title of Project: Language Experience Effects on Second Language Morpho-Syntactic Processing
Principal Investigator: Crystal Marull

This consent form is part of an informed consent process for a research study and it will provide information that will help you to decide whether you wish to volunteer for this research study. It will help you to understand what the study is about and what will happen in the course of the study.

If you have questions at any time during the research study, you should feel free to ask them and should expect to be given answers that you completely understand.

After all of your questions have been answered, if you still wish to take part in the study, you will be asked to sign this informed consent form.

The study principle investigator, Crystal Marull, or another member of the study team will also be asked to sign this informed consent. You will be given a copy of the signed consent form to keep.

You are not giving up any of your legal rights by volunteering for this research study or by signing this consent form.

Purpose of the study: The purpose of this research is to investigate role of cognitive abilities in second language processing by examining the language processing patterns of native Spanish speakers and learners of Spanish while reading and listening to Spanish sentences.

1. **Procedures to be followed:** You will be asked to complete a language background questionnaire, a proficiency test in Spanish (in a pre-session), a grammar test and two vocabulary tests, two short cognitive tests and two processing tasks (in an experimental session). For the processing tasks, you will be asked to read/hear sentences in Spanish and answer comprehension questions or to select one of two pictures.

2. **Discomforts and risks:** There are no risks in participating in this study.

3. **Benefits:** The benefits to you include learning more Spanish. The benefits to society include advancing our understanding of theories about how adults learn foreign languages.

4. **Duration/time of the procedures and study:** Approximately, between 1hr15min and 1hr35min.

5. **Statement of confidentiality:** Your participation in this research is confidential. The data will be stored and secured at the investigator's office in a password protected file and a locked file cabinet. In the event of publication of this research, no personally identifying information will be shared. The research team and the Institutional Review Board (a committee that reviews research studies in order to protect research participants) at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for at least three years.

6. **Right to ask questions:** Please contact Crystal Marull at (848) 932-9323 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. If you have any questions, concerns, problems about your rights as a research participant or would like to offer input, please contact you may contact the IRB Administrator at Rutgers University at:

   Institutional Review Board
   Rutgers University, the State University of New Jersey
   Liberty Plaza / Suite 3200

335 George Street, 3rd Floor
New Brunswick, NJ 08901
Phone: 732-235-9806
Email:

The ORSP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

7. **Payment for participation and alternative procedures that could be utilized:** Participants will receive 5 dollars for completing all tasks. Should you wish to discontinue your participation in this study, you will be compensated for the portion of the time that you spent participating in it.

8. **Voluntary participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and agree to the information outlined above, please sign your name and indicate the date below. You will be given a copy of this signed and dated consent form for your records.

_____ _____
Participant Signature Date

_____ _____
Person Obtaining Consent Date

(English – Extra Credit)

CONSENT TO TAKE PART IN A RESEARCH STUDY

Title of Project: Language Experience Effects on Second Language Morpho-Syntactic Processing
Principal Investigator: Crystal Marull

This consent form is part of an informed consent process for a research study and it will provide information that will help you to decide whether you wish to volunteer for this research study. It will help you to understand what the study is about and what will happen in the course of the study.

If you have questions at any time during the research study, you should feel free to ask them and should expect to be given answers that you completely understand.

After all of your questions have been answered, if you still wish to take part in the study, you will be asked to sign this informed consent form.

The study principle investigator, Crystal Marull, or another member of the study team will also be asked to sign this informed consent. You will be given a copy of the signed consent form to keep.

You are not giving up any of your legal rights by volunteering for this research study or by signing this consent form.

Purpose of the study: The purpose of this research is to investigate role of cognitive abilities in second language processing by examining the language processing patterns of native Spanish speakers and learners of Spanish while reading and listening to Spanish sentences.

9. **Procedures to be followed:** You will be asked to complete a language background questionnaire, a proficiency test in Spanish (in a pre-session), a grammar test and two vocabulary tests, two short cognitive tests and two processing tasks (in an experimental session). For the processing tasks, you will be asked to read/hear sentences in Spanish and answer comprehension questions or to select one of two pictures.

10. **Discomforts and risks:** There are no risks in participating in this study.

11. **Benefits:** The benefits to you include learning more Spanish. The benefits to society include advancing our understanding of theories about how adults learn foreign languages.

12. **Duration/time of the procedures and study:** Approximately, between 1hr15min and 1hr35min.

13. **Statement of confidentiality:** Your participation in this research is confidential. The data will be stored and secured at the investigator's office in a password protected file and a locked file cabinet. In the event of publication of this research, no personally identifying information will be shared. The research team and the Institutional Review Board (a committee that reviews research studies in order to protect research participants) at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for at least three years.

14. **Right to ask questions:** Please contact Crystal Marull at (848) 932-9323 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. If you have any questions, concerns, problems

about your rights as a research participant or would like to offer input, please contact you may contact the IRB Administrator at Rutgers University at:

Institutional Review Board
Rutgers University, the State University of New Jersey
Liberty Plaza / Suite 3200
335 George Street, 3rd Floor
New Brunswick, NJ 08901
Phone: 732-235-9806
Email: humansubjects@orsp.rutgers.edu

The ORSP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

15. **Payment for participation and alternative procedures that could be utilized:** Participants will receive course credit points (as determined by their professor) or extra credit points over the final grade of their Spanish course for completing all tasks. Should you wish to discontinue your participation in this study, you will be compensated for the portion of the time that you spent participating in it. For example, if you complete half of the tasks you receive half of the extra credit. If you do not wish to participate in the study or if you are not eligible to participate in the study (e.g., because you are not a native speaker of English), you will have an equal alternative to receive the credit points (as determined by your professor), for example, writing a 4500 word original composition in Spanish about the geography, economy, politics, and history of Spanish speaking country of your choice to be turned in to the researcher within the next two weeks.

16. **Voluntary participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and agree to the information outlined above, please sign your name and indicate the date below. You will be given a copy of this signed and dated consent form for your records.

_____	_____
Participant Signature	Date
_____	_____
Person Obtaining Consent	Date

RESERVED FOR IRB APPROVAL STAMP
DO NOT REMOVE

"This informed consent form was approved by the Rutgers University Institutional Review Board for the Protection of Human Subjects on September 8, 2015; approval of this form expires on March 19, 2016.

(Spanish – Paid)

IMPRESO DE CONSENTIMIENTO PARA LLEVAR A CABO INVESTIGACIÓN EN CIENCIAS SOCIALES

Título de Proyecto: Los efectos de experiencia lingüística en el procesamiento del morfosintaxis en segundas lenguas
Investigador Principal: Crystal Marull

Este formulario de consentimiento forma parte de un proceso de consentimiento informado para llevar a cabo una investigación en ciencias sociales y proporcionará información que le ayudará decidir si quiere participar voluntariamente en este estudio. Le explicará de qué se trata el estudio y en qué consistirá su participación.

Si Ud. Tiene cualquier pregunta en cualquier momento durante el estudio, no deba dudar hacerla y puede esperar una respuesta que entienda completamente.

Después de recibir las repuestas a todas sus preguntas, si aún desea participar en el estudio, tendrá que firmar el impreso de consentimiento.

La invesitigadora principal, Crystal Marull, u otro miembro del equipo de investigación también firmará el impreso de consentimiento. Le dará una a copia a usted para guardar.

Por participar en este estudio, o por firmar este impreso de consentimiento, no está renunciando a ningún derecho legal.

Propósito del estudio: El propósito de este proyecto de investigación es examinar el rol de las habilidades cognitivas en el procesamiento de español al leer y escuchar frases en español.

17. **Procedimiento del estudio:** Usted completará un cuestionario sobre sus hábitos lingüísticos, un test de gramática y dos de vocabulario, y dos pruebas cognitivas cortas y dos tareas de procesamiento de lenguaje, en los cuales leerá/escuchará frases en español y tendrá que responder a unas preguntas de comprensión o seleccionar una de dos imágenes.

18. **Molestias y riesgos:** La participación en este estudio no conlleva molestias ni riesgos.

19. **Beneficios:** Podría aprender sobre sus habilidades de memoria y su capacidad para procesar información lingüística. Los beneficios a la sociedad incluyen el avance del conocimiento sobre las teorías de cómo se aprende una lengua extranjera.

20. **Duración:** Tomará como hora y quince a una hora y treinta y cinco para completar las actividades mencionadas anteriormente
21. **Comunicado de confidencialidad:** Sus respuestas serán confidenciales. Sólo el personal de investigación aprobado tendrá acceso a los datos originales que lo identifican. Su nombre no se relacionará con sus respuestas. El equipo de investigación y el Panel de Revisión Institucional (un comité que analiza las propuestas de investigaciones para asegurar la protección de los participantes) de la universidad de Rutgers serán los únicos permitidos para revisar y copiar información relacionada con este proyecto de investigación, excepto lo requerido por ley. Si se publica este estudio, o si los resultados son presentados en una conferencia profesional, solo resultados por grupos serán divulgados.

22. **Derecho a hacer preguntas:** Puede hacer preguntas sobre este proyecto de investigación. Contacte a Crystal Marull a 011.848.932.9323 si tiene preguntas. También puede llamar a este número de teléfono si le preocupa algo sobre este proyecto de investigación, o si siente que ha sido dañado en este estudio. Si tiene preguntas sobre sus derechos como participante de este proyecto de investigación, o si tiene preocupaciones o preguntas generales sobre el proyecto de investigación, contacte:

    Institutional Review Board
    Rutgers University, the State University of New Jersey
    Liberty Plaza / Suite 3200
    335 George Street, 3rd Floor
    New Brunswick, NJ 08901
    Phone: 732-235-9806
    Email: humansubjects@orsp.rutgers.edu

    The ORSP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

23. **Remuneración:** Los participantes recibirán 50 pesos por participar activamente en las tareas del proyecto. Dicha remuneración será prorrateada si solo se completan las tareas parcialmente.

24. **Participación voluntaria:** Su participación es voluntaria, puede retirarse del estudio en cualquier momento sin informárselo al investigador principal, y puede declinar responder a preguntas específicas. Negarse a participar o retirarse del estudio no conllevará penalización o pérdida de beneficios que recibiría de otra manera.

Para participar en este estudio, debe tener al menos 18 años. Si está de acuerdo en participar en este estudio y en la información presentada en este documento, por favor escriba su nombre, firme, e indique la fecha de hoy.

_____ _____
Fima de Participante Fecha

_____ _____
Firma de Miembro del Equipo de Investigación Fecha

Appendix B– Background Questionnaires

(ENGLISH VERSION)
Language Background Questionnaire

Q1 Language Background Questionnaire ALL INFORMATION WILL REMAIN CONFIDENTIALPlease answer the following questions about your language habits.

Q3 Personal Information

Q2 1. Participant number:

Q4 2. Birth date (year only):

Q5 3. Place of birth:

Q6 4. Have you spent time in any other countries besides the one you were born in? (If yes, please list each country and the amount of time spent there.)(For example: I studied abroad for one semester in Valencia, Spain. Or, I was born in Argentina but my parents brought me to the US when I was 2 years old.

Q7 Information about your family

Q8 5. Country of origin of your family:

Q9 6. Languages spoken by your mother/guardian 1:

Q10 7. Languages spoken by your father/guardian 2:

Q11 8. Languages spoken by your grandparents:

Q12 Linguistic Competence Please fill out the information about all the languages you speak or understand. For language(s) that you learned from birth, please write "0" (zero) under "age of acquisition/first exposure". If you do not speak a second or third language please leave the response blank.

Q13 9. What is your "first" language? (Language 1)

Q14 10. Age of acquisition/first exposure (Language 1)

Q15 11. Any formal education in your first language? (Language 1)

❍ Yes (1)

❍ No (2)

Q16 11b. If you received formal education in your first language please describe in what context and for how long. (For example: I studied English in school from kindergarten through college.)

Q17 12. What is your "second" language? (Language 2)

Q18 13. Age of acquisition/first exposure (Language 2)

Q19 14. Any formal education in your second language? (Language 2)

❍ Yes (1)

❍ No (2)

Q20 14b. If you received formal education in your second language please describe in what context and for how many long.(For example: I studied Spanish in an after school flex program from 4th-6th grade

and then as a class subject 1 hour a day from 7th grade through 12th grade and I have continued at the college level.)

Q21 15. What is your "third" language? (Language 3)

Q22 16. Age of acquisition/first exposure (Language 3)

Q23 17. Any formal education in your third language? (Language 3)

- ❍ Yes (1)
- ❍ No (2)

Q24 17b. If you received formal education in your third language please describe in what context and for how long. (For example: I studied Portuguese for two semesters in college.)

Q25 Rate your ability to SPEAK in the following situations: Based on a 0-10 scale, where (0= not at all, 10= excellent).

Q27 18. Conversing with friends in ENGLISH: (Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q28 19. Conversing with friends in SPANISH:(Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q29 20. Talking on the phone in ENGLISH:(Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q30 21. Talking on the phone in SPANISH:(Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q31 22. Making a formal complaint in ENGLISH:(Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q32 23. Making a formal complaint in SPANISH:(Your speaking ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q33 Rate your ability to UNDERSTAND someone else speaking in the following situations: Based on a 0-10 scale, where (0= not at all, 10= excellent).

Q34 24. Movies/TV without subtitles in ENGLISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q35 25. Movies/TV without subtitles in SPANISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q36 26. Conversations with friends in ENGLISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q37 27. Conversations with friends in SPANISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q38 28. In a store/bank/restaurant in ENGLISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q39 29. In a store/bank/restaurant in SPANISH(Your comprehension ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q40 Rate your ability to WRITE in the following situations: Based on a 0-10 scale, where (0= not at all, 10= excellent).

Q41 30. Letter/e-mail to friends/family in ENGLISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q42 31. Letter/e-mail to friends/family in SPANISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q43 32. Letter/e-mail to a boss, a complaint in ENGLISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q44 33. Letter/e-mail to a boss, a complaint in SPANISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q45 34. Paper/project summary/composition in ENGLISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q46 35. Paper/project summary/composition in SPANISH(Your writing ability)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q47 Rate your ability to UNDERSTAND the following written materials: Based on a 0-10 scale, where (0= not at all, 10= excellent).

Q48 36. Newspapers/magazines/Internet in ENGLISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q49 37. Newspapers/magazines/Internet in SPANISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q50 38. Books/textbooks in ENGLISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q51 39. Books/textbooks in SPANISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q52 40. Letters/e-mail in ENGLISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q53 41. Letters/e-mail in SPANISH (Your ability to comprehend the written text)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q54 Language Preferences Choose which language you prefer to use with the following people or contexts.

Q55 42. With your parents:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 42. With your parents: Other Is Selected

Q70 If you answered "other" please specify

Q56 43. With your siblings:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 43. With your siblings: Other Is Selected

Q71 If you answered "other" please specify

Q57 44. With your partner:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 44. With your partner: Other Is Selected

Q72 If you answered "other" please specify

Q58 45. At work:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 45. At work: Other Is Selected

Q73 If you answered "other" please specify

Q59 46. At school/university:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 46. At school/university: Other Is Selected

Q74 If you answered "other" please specify

Q60 47. Reading

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 47. Reading Other Is Selected

Q75 If you answered "other" please specify

Q61 48. Watching TV

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 48. Watching TV Other Is Selected

Q76 If you answered "other" please specify

Q62 49. At shops/Banks:

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Both Spanish and English equally (if not 50/50 choose from the above options for the preferred language.) (3)
- ❍ Other (4)

Answer If 49. At shops/Banks: Other Is Selected

Q77 If you answered "other" please specify

(SPANISH VERSION)
Cuestionario sobre los Hábitos Lingüísticos

Q1 Cuestionario sobre los Hábitos Lingüísticos TODA INFORMACIÓN PROPORCIONADA ES CONFIDENCIAL Instrucciones: Por favor, conteste las siguientes preguntas sobre sus hábitos lingüísticos. En algunos casos se le pedirá que marque su respuesta, mientras que en otros casos deberá responder con una respuesta corta. Si hay alguna pregunta que no está relacionada con usted, le rogamos que la deje en blanco.

Q3 Información personal:

Q2 1. Participante #

Q4 2. Fecha de nacimiento:

Q5 3. Lugar de nacimiento:

Q6 4. ¿Usted siempre ha vivido allí? (Si no, describa los otros países de residencia y la duración de la estancia):

Q7 Información acerca de la familia:

Q9 6. Idiomas hablados por la madre / tutor:

Q10 7. Idiomas hablados por el padre / tutor:

Q11 8. Idiomas hablados entre los hermanos:

Q78 9. Idiomas hablados por los abuelos:

Q12 Competencia Lingüística Lenguas habladas o comprendidas. Para las lenguas aprendidas desde su nacimiento, escriba "0" (cero) debajo de "edad de aprendizaje/adquisición":

Q13 9. Cuál es tu primera lengua? (Lengua 1)

Q14 10. Edad de aprendizaje/adquisición (Lengua 1)

Q15 11. Recibió educación formal en ella?? (Lengua 1)

- ❍ Yes (1)
- ❍ No (2)

Answer If 11. Recibió educación formal en ella??(Lengua 1) Yes Is Selected

Q16 11b. Si recibió educación formal en su primera lengua, por favor describa en qué contexto y por cuánto tiempo. (e.g.: Estudié espanol en la primaria y secundaria y también en la universidad.)

Q17 12. Cuál es su segunda lengua? (Lengua 2)

Q18 13. Edad de aprendizaje/adquisición (Lengua 2)

Q19 14. Recibió educación formal en ella? (Lengua 2)

- ❍ Yes (1)
- ❍ No (2)

Answer If 11. Recibió educación formal en ella??(Lengua 1) Yes Is Selected

Q20 14b. Si recibió educación formal en su segunda lengua, por favor describa en qué contexto y por cuánto tiempo. (e.g.: Estudié inglés en la secundaria y también en la universidad.)

Q21 15. Cuál es su tercera lengua? (Lengua 3)

Q22 16. Edad de aprendizaje/adquisición? (Lengua 3)

Q23 17. Recibió educación formal en ella? (Lengua 3)

- ❍ Yes (1)
- ❍ No (2)

Answer If 17. Recibió educación formal en ella?(Lengua 3) Yes Is Selected

Q24 17b. Si recibió educación formal en tercera lengua, por favor describa en qué contexto y por cuánto tiempo. (e.g.: Estudié portugués por un semestre la universidad.)

Q25 Dominio Lingüístico Evalúe su habilidad para hablar en estas situaciones de 0-10 (0= nada, 10= excelente):

Q27 18. Hablar con amigos en ESPANOL: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q28 19. Hablar con amigos en INGLES: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q29 20. Hablar por teléfono en ESPANOL: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q30 21. Hablar por teléfono en INGLES: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q31 22. Poniendo una queja en ESPANOL: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q32 23. Poniendo una queja en INGLES: (hablar)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q33 Evalúe su habilidad para comprender a alguien en las siguientes situaciones:

Q34 24. Películas/ TV sin subtítulos en ESPANOL (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q35 25. Películas/ TV sin subtítulos en INGLES (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)

- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q36 26. Conversaciones con amigos en ESPANOL (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q37 27. Conversaciones con amigos en INGLES: (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q38 28. En una tienda / banco/ bar en ESPANOL (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q39 29. En una tienda / banco/ bar en INGLES: (comprensión)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q40 Evalúe su habilidad para escribir lo siguiente:

Q41 30. Carta/ E-mail amigos o familia en ESPANOL: (escritura)
0 (0)
1 (1)
2 (2)
3 (3)
4 (4)
5 (5)
6 (6)
7 (7)
8 (8)
9 (9)
10 (10)

Q42 31. Carta/ E-mail amigos o familia en INGLES: (escritura)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q43 32. Carta/ E-mail al jefe o una queja en ESPANOL: (escritura)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q44 33. Carta/ E-mail al jefe o una queja en INGLES: (escritura)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q45 34. Trabajo / Redacción para clase en ESPANOL: (escritura)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)

- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q46 35. Trabajo / Redacción para clase en INGLES: (escritura)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q47 Evalúe su habilidad para comprender estos materiales escritos:

Q48 36. Diarios/ Revistas / Internet en ESPANOL: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q49 37. Diarios/ Revistas / Internet en INGLES: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q50 38. Libros/Manuales en ESPANOL: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q51 39. Libros/Manuales en INGLES: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q52 40. Cartas/E-mails en ESPANOL: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q53 41. Cartas/E-mails en INGLES: (comprensión de textos escritos)

- ❍ 0 (0)
- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)

- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)

Q54 Preferencias Lingüísticas: Elija la lengua de preferencia en los siguientes contextos.

Q55 42. Con sus padres:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 42. With your parents: Other Is Selected

Q70 Si respondió "otra" explique por favor:

Q56 43. Con sus hermanos:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 43. With your siblings: Other Is Selected

Q71 Si respondió "otra" explique por favor:

Q57 44. Con su pareja:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 44. With your partner: Other Is Selected

Q72 Si respondió "otra" explique por favor:

Q58 45. En el trabajo:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 45. At work: Other Is Selected

Q73 Si respondió "otra" explique por favor:

Q59 46. En la escuela/universidad:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Other (4)

Answer If 46. At school/university: Other Is Selected

Q74 Si respondió "otra" explique por favor:

Q60 47. Leyendo:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 47. Reading Other Is Selected

Q75 Si respondió "otra" explique por favor:

Q61 48. Viendo la televisión:

- ❍ Inglés (1)
- ❍ Español (2)
- ❍ Ambas (si no 50/50 elija de las opciones arriba.) (3)
- ❍ Otra (4)

Answer If 48. Watching TV Other Is Selected

Q76 Si respondió "otra" explique por favor:

Q69 Gracias por su participación! Si tiene cualquier pregunta o comentario no dude en mandarme un e-mail: crystal.marull@rutgers.edu.

Appendix C – Spanish Proficiency Test (Modified DELE)

Q48 Examen de Proficiencia

Q47 Número de participante:

Q42 BLOQUE ASeleccione la opción (A, B, C, D) que mejor complete la oración. "Ø" significa que no es necesario poner nada en la frase para completarla.

Q1 1. _____edificio alto es la Torre Sears.

- ❍ A. Eso (1)
- ❍ B. La (2)
- ❍ C. Aquel (3)
- ❍ D. Ø (4)

Q3 2. Los novios pasaron unas vacaciones fantásticas _____ fueron a Hawai.

- ❍ A. cuando (1)
- ❍ B. que (2)
- ❍ C. donde (3)
- ❍ D. Ø (4)

Q3 3. –¿Van a invitar al profesor y a su esposa a la reunión? – Sí, vamos a invitar _____.

- ❍ A. ellos (1)
- ❍ B. sus (2)
- ❍ C. los (3)
- ❍ D. Ø (4)

Q4 4. Si no puedes usar tu bicicleta usa _____.

- ❍ A. nuestra (1)
- ❍ B. de él (2)
- ❍ C. la mía (3)
- ❍ D. Ø (4)

Q5 5. A Juana no _____ gustan las películas de ciencia ficción.

- ❍ A. le (1)
- ❍ B. se (2)
- ❍ C. la (3)
- ❍ D. Ø (4)

Q6 6. En nuestro barrio hay muchas casas bonitas, pero _____ Juan es la más bonita.

- ❍ A. su (1)
- ❍ B. de la (2)
- ❍ C. la de (3)
- ❍ D. Ø (4)

Q7 7. –¿Conoces _____ hombre de la camisa verde? – ¿Es muy guapo verdad?

- ❍ A. un (1)
- ❍ B. al (2)
- ❍ C. esto (3)
- ❍ D. Ø (4)

Q43 BLOQUE B

Q8 1. Por favor, _____ llegues a Madrid, me llamas.

- ❍ A. desde que (1)
- ❍ B. antes de (2)
- ❍ C. cuando (3)
- ❍ D. después de (4)

Q9 2. Hoy invito yo _____ todos al café, que es mi cumpleaños.

- ❍ A. para (1)
- ❍ B. de (2)
- ❍ C. a (3)
- ❍ D. sobre (4)

Q10 3. ¿_____ has pedido ya a tus padres?

- ❍ A. Se te (1)
- ❍ B. Se lo (2)
- ❍ C. Se les (3)
- ❍ D. Se le (4)

Q11 4. Manuel, como no _____ más fruta, no tendremos suficiente.

- ❍ A. compres (1)
- ❍ B. compras (2)
- ❍ C. compraras (3)
- ❍ D. comprarás (4)

Q12 5. ¿Que te vas a París? ¡Quién _____ tú!

- ❍ A. es (1)
- ❍ B. sea (2)
- ❍ C. sería (3)
- ❍ D. fuera (4)

Q13 6. Sinceramente, yo que tú _____ un mapa antes de viajar.

- ❍ A. compraré (1)
- ❍ B. compro (2)
- ❍ C. compraría (3)
- ❍ D. comprara (4)

Q14 7. Por favor, en cuanto _____ a Lucía, dile que me llame.

- ❍ A. verás (1)
- ❍ B. veas (2)
- ❍ C. ves (3)
- ❍ D. vieras (4)

Q44 BLOQUE C

Q15 1. Ellos estaban dispuestos a que _____ nosotros en el coche y ellos andando.

- ❍ A. íbamos (1)
- ❍ B. fuimos (2)
- ❍ C. iríamos (3)
- ❍ D. fuéramos (4)

Q16 2. _____ como se enteraron de lo sucedido fueron a visitar a la familia.

- ❍ A. Tan pronto (1)
- ❍ B. No bien (2)
- ❍ C. En cuanto (3)
- ❍ D. Nada más (4)

Q17 3. Elisa llegó a la estación cuando el tren _____ de salir, ¡qué rabia!

- ❍ A. acabó (1)
- ❍ B. acaba (2)
- ❍ C. acabaría (3)
- ❍ D. acababa (4)

Q18 4. En cuanto deje la maleta en la habitación del hotel _____ meterme en la piscina, ¡qué calor!

- ❍ A. creo (1)
- ❍ B. debo (2)
- ❍ C. pienso (3)
- ❍ D. siento (4)

Q20 5. Carolina y Luis se casaron muy jóvenes, _____ cumplieron los 20 años.

- ❍ A. al (1)
- ❍ B. apenas (2)
- ❍ C. de (3)
- ❍ D. pronto (4)

Q21 6. El perrito de María es muy gracioso, tan pronto salta _____ se tumba.

- ❍ A. que (1)
- ❍ B. de (2)
- ❍ C. y (3)
- ❍ D. como (4)

Q22 7. El jefe no se ha enfadado porque María _____ llegado tarde, sino porque no se había preparado bien.

- ❍ A. ha (1)
- ❍ B. haya (2)
- ❍ C. había (3)
- ❍ D. hubiera (4)

Q45 COMPRENSIÓN ESCRITA Lea el siguiente texto y seleccione la opción (A, B, C) que considere más adecuada para completar cada uno de los espacios en blanco de las opciones que siguen el texto.

Q24 Las bicicletas también son para el otoño El ciclismo está considerado por los especialistas como uno de los deportes más completos. Fortalece el cuerpo y también la mente, y a él puede __1__ cualquier persona porque no tiene __2__ de edad. La bicicleta es uno de los mejores deportes, sobre todo para la gente __3__ no puede hacer ejercicios de contacto con el suelo, como correr.

Q25 1.

- ❍ acceder (1)
- ❍ practicar (2)
- ❍ ejecutar (3)

Q27 2.

- ❍ límite (1)
- ❍ término (2)
- ❍ frontera (3)

Q28 3.

- ❍ quien (1)
- ❍ quienes (2)
- ❍ que (3)

Q29 __4__ estemos ante un deporte muy beneficioso, ya que no solo mejora nuestra condición física, sino que nos hace más resistentes; __5__ tiene unos efectos anímicos extraordinarios. Elimina el estrés y hace que __6__ más eufóricos y enérgicos, __7__ supone encontrarnos mejor. Por último, la práctica de este deporte facilita el contacto con la naturaleza.

Q30 4.

- ❍ De modo que (1)
- ❍ De ahí que (2)
- ❍ Así que (3)

Q31 5.

- ❍ pero (1)
- ❍ sino (2)
- ❍ también (3)

Q32 6.

- ❍ estamos (1)
- ❍ estemos (2)
- ❍ estaremos (3)

Q33 7.

- ❍ lo que (1)
- ❍ el cual (2)
- ❍ cuyo (3)

Q34 Para practicar este deporte, debemos __8__ en cuenta algunos aspectos. El tiempo es una de las dificultades con __9__ que se cuenta si se vive en la ciudad. Hay que intentar sacar tiempo de __10__

sea para poder practicar nuestro deporte preferido. En el caso de la bicicleta, lo ideal es salir todos los días aunque sólo __11__ un cuarto de hora, si bien se recomienda pedalear __12__ 40 y 45 minutos.

Q35 8.

- ❍ tener (1)
- ❍ considerar (2)
- ❍ darnos (3)

Q37 9.

- ❍ lo (1)
- ❍ las (2)
- ❍ la (3)

Q38 10.

- ❍ donde (1)
- ❍ como (2)
- ❍ cuando (3)

Q39 11.

- ❍ sería (1)
- ❍ es (2)
- ❍ sea (3)

Q40 12.

- ❍ entre (1)
- ❍ hacia (2)
- ❍ de (3)

Q41 ¡Muchísimas gracias por participar!

Appendix D – Vocabulary Size Test (LexTale-Esp)Test de Vocabulario Español

Q11 Test de Vocabulario Español

Q2 Escriba su número de participante:

Q3 En la página siguiente encontrarás 90 secuencias de letras que parecen “españolas”. Solo algunas de ellas son palabras de verdad. Por favor, señala las palabras que tú conoces (aquellas que estás convencido que son palabras españolas, incluso aunque no seas capaz de dar el significado preciso). Pero ten cuidado: Los errores se penalizan. Por eso, no tiene sentido tratar de incrementar tu puntuación marcando “palabras” que no has visto nunca. Todo lo que tienes que hacer es marcar las palabras que conoces.

Q10 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
1. terzo (1)		
2. pellizcar (2)		
3. pulmones (3)		
4. batillón (4)		
5. zapato (5)		
6. tergiversar (6)		
7. pésimo (7)		
8. cadeña (8)		
9. hacha (9)		
10. antar (10)		

Q16 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
11. cenefa (1)		
12. asesinato (2)		
13. helar (3)		
14. yunque (4)		
15. regar (5)		
16. abracer (6)		
17. floroso (7)		
18. arsa (8)		
19. brecedad (9)		
20. ávido (10)		

Q17 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
21. capillo (1)		
22. lacayo (2)		
23. lampera (3)		
24. látigo (4)		
25. bisagra (5)		
26. secuestro (6)		
27. acutación (7)		
28. merodear (8)		
29. decar (9)		
30. alardio (10)		

Q22 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
31. pandilla (1)		
32. fatacidad (2)		
33. pauca (3)		
34. aviso (4)		
35. rompido (5)		
36. loro (6)		
37. granuja (7)		
38. estornudar (8)		
39. torpe (9)		
40. alfombra (10)		

Q23 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
41. rebuscar (1)		
42. cadallo (2)		
43. canela (3)		
44. cuchara (4)		
45. jilguero (5)		
46. martillo (6)		
47. cartinar (7)		
48. ladrón (8)		
49. ganar (9)		
50. flamida (10)		

Q23 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
51. candado (1)		
52. camisa (2)		
53. vegada (3)		
54. fomentar (4)		
55. nevar (5)		
56. musgo (6)		
57. tacaño (7)		
58. plaudir (8)		
59. besar (9)		
60. matar (10)		

Q20 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
61.seda (1)		
62. flaco (2)		
63. esposante (3)		
64. orgulloso (4)		
65. bizcocho (5)		
66. hacido (6)		
67. cabello (7)		
68. alegre (8)		
69. engatusar (9)		
70. temblo (10)		

Q21 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
71. polvoriento (1)		
72. pemición (2)		
73. hervidor (3)		
74. cintro (4)		
75. yacer (5)		
76. atar (6)		
77. tiburón (7)		
78. frondoso (8)		
79. tropaje (9)		
80. hormiga (10)		

Q22 Marca las palabras que reconoces como palabras españolas. Si no es una palabra española marca NO.

	Marca uno	
	Sí (1)	No (2)
81. pozo (1)		
82. empirador (2)		
83. guante (3)		
84. escuto (4)		
85. laúd (5)		
86. barato (6)		
87. grodo (7)		
88. acantilado (8)		
89. prisa (9)		
90. clavel (10)		

Q6 Gracias por su participación

Appendix E – Stimuli: Follow-up Vocabulary Test

Stimuli	a	b	c	Correct_ Response
cojín	basket	small pillow	store	b
edificio	basket	small pillow	building	c
cartel	sign/poster	small pillow	building	a
negocio	sign/poster	business	building	b
perro	sign/poster	business	dog	c
chico	boy	business	dog	a
niño	nest	child (male)	dog	b
regalo	nest	child (male)	gift	c
cuchillo	knife	child (male)	gift	a
piso	knife	apartment	gift	b
camión	knife	apartment	truck	c
gato	cat	apartment	truck	a
frigorífico	cat	refrigerator	truck	b
periódico	cat	refrigerator	newspaper	c
folleto	flyer	refrigerator	newspaper	a
trabajador	flyer	worker	newspaper	b
mueble	flyer	worker	furniture	c
enfermero	nurse (male)	worker	furniture	a
camino	nurse (male)	path/trail	furniture	b
amigo	nurse (male)	path/trail	friend	c
avestruz	ostrich	path/trail	friend	a
joven	ostrich	youth	friend	b
cobertizo	ostrich	youth	shed	c
premio	prize	youth	shed	a
libro	prize	book	shed	b
cuadro	prize	book	painting	c

avión	plane	book	painting	a
puente	plane	bridge	painting	b
escritorio	plane	bridge	desk	c
maletín	briefcase	bridge	desk	a
vestido	briefcase	dress	desk	b
abrigo	briefcase	dress	coat	c
abanico	fan	dress	coat	a
bocadillo	fan	sandwhich	coat	b
bolígrafo	fan	sandwhich	pen	c
caballo	horse	sandwhich	pen	a
clavo	horse	nail	pen	b
crucifijo	horse	nail	crucifix	c
cuaderno	notebook	nail	crucifix	a
gusano	notebook	worm	crucifix	b
horno	notebook	worm	oven	c
hueso	bone	worm	oven	a
huevo	bone	egg	oven	b
molino	bone	egg	(wind)mill	c
murciélago	bat	egg	(wind)mill	a
muñeco	bat	doll (male)	(wind)mill	b
nido	bat	doll (male)	nest	c
pájaro	bird	doll (male)	nest	a
búho	bird	owl	nest	b
pañuelo	bird	owl	handkerchief	c
pollo	chicken	owl	handkerchief	a
reloj	chicken	watch	handkerchief	b
refresco	chicken	watch	soft-drink	c
relámpago	lightening	watch	soft-drink	a
tiburón	lightening	shark	soft-drink	b

león	lightening	shark	lion	c
trono	throne	shark	lion	a
billete	throne	ticket	lion	b
guante	throne	ticket	glove	c
juguete	toy	ticket	glove	a
títere	toy	puppet	glove	b
cajón	toy	puppet	drawer	c
colchón	mattress	puppet	drawer	a
cosía	visited	sewed	drawer	b
visitó	read	sewed	visited	c
leyó	read	sewed	visited	a
revisó	read	reviewed	visited	b
acariciaba	read	reviewed	pet	c
bañaba	bathed	reviewed	pet	a
despertó	bathed	woke	pet	b
preparó	bathed	woke	prepared	c
limpió	cleaned	woke	prepared	a
visitó	cleaned	visited	prepared	b
aparcó	cleaned	visited	parked	c
mostró	showed	visited	parked	a
cargó	showed	loaded	parked	b
leyó	showed	loaded	read	c
quemó	burned	loaded	read	a
observaba	burned	observed	read	b
arregló	burned	observed	fixed	c
transportó	transported	observed	fixed	a
cerró	transported	closed	fixed	b
invitó	transported	closed	invited	c
atacó	attacked	closed	invited	a

llevó	attacked	carried/brought	invited	b
pintó	attacked	carried/brought	painted	c
recibió	received	carried/brought	painted	a
escribía	received	wrote	painted	b
quiso	received	wrote	wanted	c
detectó	detected	wrote	wanted	a
entrevistó	detected	interviewed	wanted	b
diseñó	detected	interviewed	designed	c
eligió	chose	interviewed	designed	a
dejó	chose	left	designed	b
colgó	chose	left	hung	c
puso	put	left	hung	a
colocó	fixed	placed	hung	b
guardó	fixed	placed	put away	c
arregló	fixed	placed	put away	a
mandó	fixed	sent	put away	b
sacó	fixed	sent	took out	c
bajó	lowered	sent	took out	a
repasó	lowered	reviewed	took out	b
quitó	lowered	reviewed	removed	c
prendió	turned on	reviewed	removed	a
clasificaba	turned on	classified	removed	b
preparaba	turned on	classified	prepared	c
dibujó	drew	classified	prepared	a
espantó	drew	frightened	prepared	b
fabricó	drew	frightened	made	c
encontró	found	frightened	made	a
vigilaba	found	watched	made	b
atrapó	found	watched	trapped	c

teñía	dyed	watched	trapped	a
compró	dyed	bought	trapped	b
contempló	dyed	bought	contemplated	c
olvidó	forgot	bought	contemplated	a
señaló	forgot	pointed at	contemplated	b
siguió	forgot	pointed at	followed	c
enfrentó	confronted	pointed at	followed	a
decoraron	confronted	decorated	followed	b
perdió	confronted	decorated	lost	c
escondió	hid	decorated	lost	a
abrió	hid	opened	lost	b
ensució	hid	opened	dirtied	c

Appendix F – Stimuli: Follow-up Grammar Test

Stimuli	a	b	CRESP
El jefe observaba a _____ trabajador en el techo.	ese	esos	a
El guardabosque cerró _____ camino a la montaña.	el	los	a
El estudiante visitó ___ piso detrás de la universidad.	el	los	a
El dueño pintó ____ cobertizo detrás de la casa.	el	los	a
El piloto transportó a ____ enfermero en su helicóptero.	ese	esos	a
El mes pasado el arquitecto diseñó ___ puentes sobre el río.	este	estos	b
El león atacó a ____ avestruces a la orilla del lago.	este	estos	b
La duquesa quiso ___ cuadros para el salón.	este	estos	b
El inspector revisó ___ negocios en la plaza.	el	los	b
El empleado cargó ____ frigoríficos a la furgoneta.	el	los	b

Appendix G: Prompt for Metalinguistic Awareness Task

"Ahora que ha completado la primera parte de gramática, por favor tome un minuto para explicar cómo decidió cuales eran las respuestas correctas para completar las frases. PULSA LA BARRA ESPACIADORA PARA GRABAR TU EXPLICACION."

("Now that you have completed the first grammar section, please take a moment and explain how you chose the correct answers to complete the sentences. PRESS THE SPACE BAR TO RECORD YOUR ANSWER").

Appendix H – Stimuli: Working Memory Test

Trial #	Stimuli	Correct Response
1	2 J	2J
2	C 6	6C
3	F 8	8F
4	4 G 1	14G
5	J 7 O	7JO
6	9 S 4	49S
7	5 W 3 L	35LW
8	A 8 C 1	18AC
9	2 Y 8 E	28EY

10	P 4 H 6 K	46HKP
11	9 B 7 H 2	279BH
12	3 I 1 Q M	13IMQ
13	4 N 9 B 5 R	459BNR
14	T 8 V 6 C 1	168CTV
15	3 Y 2	237DKY

	D 7 K	
16	F 8 L 2 O 5 V	258FLOV
17	6 N 7 H 3 D 4	3467DHN
18	9 R 4 Q 1 M 8	1489MQR
19	X 5 A 8 S 4 K	2458AKSX

	2	
20	W	1379HPQW
	1	
	H	
	9	
	P	
	7	
	Q	
	3	
21	5	3569CNRX
	X	
	9	
	N	
	3	
	R	
	6	
	C	

Appendix I – Stimuli: Lexical Automaticity Task

Davies, M. (2006). A frequency dictionary of Spanish: Core vocabulary for learners. Routledge.

Order	Pseudo	Word	syll_cnt	rank_freq	POS
1	clacera	Trasero	3	4,962	adj
2	acirchado	Asombrado	4	4,541	adj
3	arrargada	Aplastado	4	4,976	adj
4	hicado	Nítido	3	4,908	adj
5	caciste	Carente	3	4,907	adj
6	carribera	Callejero	4	4,889	adj
7	durado	Sumido	3	4,876	adj
8	mopiraco	Soberano	4	4,782	adj
9	añan	Afín	2	4,726	adj
10	guedo	Hueco	2	4,714	adj
11	plaso	Llano	2	4,694	adj
12	mueposo	Piadoso	3	4,671	adj
13	larbiznimo	Larguísimo	4	4,608	adj
14	dalloco	Sabroso	3	4,605	adj
15	dinniente	Sonriente	3	4,579	adj
16	sobispio	Soberbio	3	4,576	adj
17	mamabera	Pasajero	4	4,570	adj
18	tensato	Bendito	3	4,560	adj
19	silloco	Dichoso	3	4,497	adj
20	pramikador	Trabajador	4	4,489	adj
21	soncaneciente	Perteneciente	5	4,467	adj
22	isplibisto	Imprevisto	4	4,436	adj
23	deroz	Veloz	2	4,429	adj

24	sutnestre	Silvestre	3	4,418	adj
25	zuvida	Jugada	3	4,998	sus
26	pemustra	Penumbra	3	4,997	sus
27	cengo	Cerco	2	4,996	sus
28	dal	Cal	1	4,997	sus
29	ciesca	Cuenca	2	4,975	sus
30	desconza	Descarga	3	4,971	sus
31	fitra	Libra	2	4,964	sus
32	desfraugie	Despliegue	3	4,963	sus
33	desparfinia	Desperdicio	4	4,957	sus
34	tadrallenamo	Bachillerato	5	4,950	sus
35	napima	Navaja	3	4,947	sus
36	befido	Tejado	3	4,944	sus
37	advokado	Almohada	4	4,939	sus
38	pacime	Paraje	3	4,935	sus
39	docino	Sótano	3	4,930	sus
40	erra	Olla	2	4,927	sus
41	faula	Fiera	2	4,923	sus
42	repibo	Rebaño	3	4,919	sus
43	embanjadura	Envergadura	5	4,916	sus
44	objito	Olfato	3	4,913	sus
45	sorano	Molino	3	4,893	sus
46	aveto	Acera	3	4,886	sus
47	neullero	Guerrero	3	4,885	sus
48	bodo	Lomo	2	4,868	sus
49	irrosbir	Irrumpir	3	4,994	vrb
50	sosfrizar	Disfrazar	3	4,979	vrb
51	deriir	Decaer	3	4,974	vrb
52	pasgilar	Perfilar	3	4,969	vrb

53	prodizar	Propagar	3	4,958	vrb
54	encitrar	Entablar	3	4,952	vrb
55	resvantir	Desmentir	3	4,925	vrb
56	vercor	Verter	2	4,924	vrb
57	onstriar	Instruir	2	4,918	vrb
58	tercear	Bordear	3	4,915	vrb
59	acupar	Alojar	3	4,896	vrb
60	insubler	Incurrir	3	4,867	vrb
61	inflipear	Estropear	4	4,851	vrb
62	vermar	Vengar	2	4,849	vrb
63	insader	Incidir	3	4,841	vrb
64	admimendar	Encomendar	4	4,828	vrb
65	mortatar	Percatar	3	4,826	vrb
66	avinar	Acatar	3	4,820	vrb
67	devisar	Rebasar	3	4,813	vrb
68	mochibenir	Sobrevenir	4	4,811	vrb
69	resicir	Renacer	3	4,805	vrb
70	ensuadar	Engordar	3	4,796	vrb
71	soscuchir	Discurrir	3	4,791	vrb
72	trecantir	Presentir	3	4,783	vrb

Appendix J – Prompts for Semantic Verbal Fluency Task

Trial	Prompt
Practice	Animals
*1	Fruits
*2	Professions

*Order of presentation was counterbalanced.

Appendix K – Stimuli sentences for the Self-Paced Reading and Picture Selection Tasks

number	condition	agreement	Sentence
NUM01_1	demonstrative	agreement	Por la tarde la criada cosía este cojín en la sala.
NUM01_2	demonstrative	violation	Por la tarde la criada cosía este cojines en la sala.
NUM01_3	definite article	agreement	Por la tarde la criada cosía el cojín en la sala.
NUM01_4	definite article	violation	Por la tarde la criada cosía el cojines en la sala.
NUM02_1	demonstrative	agreement	Ayer el turista visitó estos edificios del centro de la ciudad.
NUM02_2	demonstrative	violation	Ayer el turista visitó estos edificio del centro de la ciudad.
NUM02_3	definite article	agreement	Ayer el turista visitó los edificios del centro de la ciudad.
NUM02_4	definite article	violation	Ayer el turista visitó los edificio del centro de la ciudad.
NUM03_1	demonstrative	agreement	Lentamente la vieja leyó ese cartel fuera del cine.
NUM03_2	demonstrative	violation	Lentamente la vieja leyó ese carteles fuera del cine.
NUM03_3	definite article	agreement	Lentamente la vieja leyó el cartel fuera del cine.
NUM03_4	definite article	violation	Lentamente la vieja leyó el carteles fuera del cine.
NUM04_1	demonstrative	agreement	Por la mañana el inspector revisó esos negocios en la plaza.
NUM04_2	demonstrative	violation	Por la mañana el inspector revisó esos negocio en la plaza.
NUM04_3	definite article	agreement	Por la mañana el inspector revisó los negocios en la plaza.

NUM04_4	definite article	violation	Por la mañana el inspector revisó los negocio en la plaza.
NUM05_1	demonstrative	agreement	Felizmente el chico acariciaba este perro en el jardín.
NUM05_2	demonstrative	violation	Felizmente el chico acariciaba este perros en el jardín.
NUM05_3	definite article	agreement	Felizmente el chico acariciaba el perro en el jardín.
NUM05_4	definite article	violation	Felizmente el chico acariciaba el perros en el jardín.
NUM06_1	demonstrative	agreement	Por la noche la prima bañaba a estos chicos en la bañera.
NUM06_2	demonstrative	violation	Por la noche la prima bañaba a estos chico en la bañera.
NUM06_3	definite article	agreement	Por la noche la prima bañaba a los chicos en la bañera.
NUM06_4	definite article	violation	Por la noche la prima bañaba a los chico en la bañera.
NUM07_1	demonstrative	agreement	Muy temprano la tía despertó ese loro en su cuarto.
NUM07_2	demonstrative	violation	Muy temprano la tía despertó ese loros en su cuarto.
NUM07_3	definite article	agreement	Muy temprano la tía despertó el loro en su cuarto.
NUM07_4	definite article	violation	Muy temprano la tía despertó el loros en su cuarto.
NUM08_1	demonstrative	agreement	Ayer el voluntario preparó esos regalos en la iglesia.
NUM08_2	demonstrative	violation	Ayer el voluntario preparó esos regalo en la iglesia.
NUM08_3	definite article	agreement	Ayer el voluntario preparó los regalos en la iglesia.
NUM08_4	definite article	violation	Ayer el voluntario preparó los regalo en la iglesia.
NUM09_1	demonstrative	agreement	Rápidamente el mesero limpió este cuchillo de la mesa.

NUM09_2	demonstrative	violation	Rápidamente el mesero limpió este cuchillos de la mesa.
NUM09_3	definite article	agreement	Rápidamente el mesero limpió el cuchillo de la mesa.
NUM09_4	definite article	violation	Rápidamente el mesero limpió el cuchillos de la mesa.
NUM10_1	demonstrative	agreement	Por la mañana el estudiante visitó estos pisos detrás de la universidad.
NUM10_2	demonstrative	violation	Por la mañana el estudiante visitó estos piso detrás de la universidad.
NUM10_3	definite article	agreement	Por la mañana el estudiante visitó los pisos detrás de la universidad.
NUM10_4	definite article	violation	Por la mañana el estudiante visitó los piso detrás de la universidad.
NUM11_1	demonstrative	agreement	Difícilmente el conductor aparcó ese camión en el aparcamiento.
NUM11_2	demonstrative	violation	Difícilmente el conductor aparcó ese camiones en el aparcamiento.
NUM11_3	definite article	agreement	Difícilmente el conductor aparcó el camión en el aparcamiento.
NUM11_4	definite article	violation	Difícilmente el conductor aparcó el camiones en el aparcamiento.
NUM12_1	demonstrative	agreement	Ayer el veterinario mostró esos gatos en la consulta.
NUM12_2	demonstrative	violation	Ayer el veterinario mostró esos gato en la consulta.
NUM12_3	definite article	agreement	Ayer el veterinario mostró los gatos en la consulta.
NUM12_4	definite article	violation	Ayer el veterinario mostró los gato en la consulta.
NUM13_1	demonstrative	agreement	Laboriosamente el empleado cargó este frigorífico a la furgoneta.
NUM13_2	demonstrative	violation	Laboriosamente el empleado cargó este frigoríficos a la furgoneta.
NUM13_3	definite article	agreement	Laboriosamente el empleado cargó el frigorífico a la furgoneta.

NUM13_4	definite article	violation	Laboriosamente el empleado cargó el frigoríficos a la furgoneta.
NUM14_1	demonstrative	agreement	Por la mañana el abuelo leyó estos periódicos en el sofá.
NUM14_2	demonstrative	violation	Por la mañana el abuelo leyó estos periódico en el sofá.
NUM14_3	definite article	agreement	Por la mañana el abuelo leyó los periódicos en el sofá.
NUM14_4	definite article	violation	Por la mañana el abuelo leyó los periódico en el sofá.
NUM15_1	demonstrative	agreement	Secretamente el espía quemó ese folleto con un encendedor.
NUM15_2	demonstrative	violation	Secretamente el espía quemó ese folletos con un encendedor.
NUM15_3	definite article	agreement	Secretamente el espía quemó el folleto con un encendedor.
NUM15_4	definite article	violation	Secretamente el espía quemó el folletos con un encendedor.
NUM16_1	demonstrative	agreement	Contentamente el jefe observaba a esos trabajadores en el techo.
NUM16_2	demonstrative	violation	Contentamente el jefe observaba a esos trabajador en el techo.
NUM16_3	definite article	agreement	Contentamente el jefe observaba a los trabajadores en el techo.
NUM16_4	definite article	violation	Contentamente el jefe observaba a los trabajador en el techo.
NUM17_1	demonstrative	agreement	Cuidadosamente el carpintero arregló este mueble en su taller.
NUM17_2	demonstrative	violation	Cuidadosamente el carpintero arregló este muebles en su taller.
NUM17_3	definite article	agreement	Cuidadosamente el carpintero arregló el mueble en su taller.
NUM17_4	definite article	violation	Cuidadosamente el carpintero arregló el muebles en su taller.
NUM18_1	demonstrative	agreement	Orgullosamente el piloto transportó a estos enfermeros en su helicóptero.

NUM18_2	demonstrative	violation	Orgullosamente el piloto transportó a estos enfermero en su helicóptero.
NUM18_3	definite article	agreement	Orgullosamente el piloto transportó a los enfermeros en su helicóptero.
NUM18_4	definite article	violation	Orgullosamente el piloto transportó a los enfermero en su helicóptero.
NUM19_1	demonstrative	agreement	Hoy el guardabosque cerró ese camino a la montaña.
NUM19_2	demonstrative	violation	Hoy el guardabosque cerró ese caminos a la montaña.
NUM19_3	definite article	agreement	Hoy el guardabosque cerró el camino a la montaña.
NUM19_4	definite article	violation	Hoy el guardabosque cerró el caminos a la montaña.
NUM20_1	demonstrative	agreement	Anteayer un alumno invitó a esos amigos a una fiesta.
NUM20_2	demonstrative	violation	Anteayer un alumno invitó a esos amigo a una fiesta.
NUM20_3	definite article	agreement	Anteayer un alumno invitó a los amigos a una fiesta.
NUM20_4	definite article	violation	Anteayer un alumno invitó a los amigo a una fiesta.
NUM21_1	demonstrative	agreement	Esta mañana el león atacó este avestruz a la orilla del lago.
NUM21_2	demonstrative	violation	Esta mañana el león atacó este avestruces a la orilla del lago.
NUM21_3	definite article	agreement	Esta mañana el león atacó el avestruz a la orilla del lago.
NUM21_4	definite article	violation	Esta mañana el león atacó el avestruces a la orilla del lago.
NUM22_1	demonstrative	agreement	Ayer el biólogo llevó a estos jóvenes al museo.
NUM22_2	demonstrative	violation	Ayer el biólogo llevó a estos joven al museo.
NUM22_3	definite article	agreement	Ayer el biólogo llevó a los jóvenes al museo.

NUM22_4	definite article	violation	Ayer el biólogo llevó a los joven al museo.
NUM23_1	demonstrative	agreement	Nuevamente el dueño pintó ese cobertizo detrás de la casa.
NUM23_2	demonstrative	violation	Nuevamente el dueño pintó ese cobertizos detrás de la casa.
NUM23_3	definite article	agreement	Nuevamente el dueño pintó el cobertizo detrás de la casa.
NUM23_4	definite article	violation	Nuevamente el dueño pintó el cobertizos detrás de la casa.
NUM24_1	demonstrative	agreement	El año pasado el atleta recibió esos premios en las olimpiadas.
NUM24_2	demonstrative	violation	El año pasado el atleta recibió esos premio en las olimpiadas.
NUM24_3	definite article	agreement	El año pasado el atleta recibió los premios en las olimpiadas.
NUM24_4	definite article	violation	El año pasado el atleta recibió los premio en las olimpiadas.
NUM25_1	demonstrative	agreement	Concentradamente el autor escribía este libro en su oficina.
NUM25_2	demonstrative	violation	Concentradamente el autor escribía este libros en su oficina.
NUM25_3	definite article	agreement	Concentradamente el autor escribía el libro en su oficina.
NUM25_4	definite article	violation	Concentradamente el autor escribía el libros en su oficina.
NUM26_1	demonstrative	agreement	Naturalmente la duquesa quiso estos cuadros para el salón.
NUM26_2	demonstrative	violation	Naturalmente la duquesa quiso estos cuadro para el salón.
NUM26_3	definite article	agreement	Naturalmente la duquesa quiso los cuadros para el salón.
NUM26_4	definite article	violation	Naturalmente la duquesa quiso los cuadro para el salón.
NUM27_1	demonstrative	agreement	De repente el soldado detectó ese avión en el radar.

NUM27_2	demonstrative	violation	De repente el soldado detectó ese aviones en el radar.
NUM27_3	definite article	agreement	De repente el soldado detectó el avión en el radar.
NUM27_4	definite article	violation	De repente el soldado detectó el aviones en el radar.
NUM28_1	demonstrative	agreement	Por la tarde el periodista entrevistó a esos payasos en el circo.
NUM28_2	demonstrative	violation	Por la tarde el periodista entrevistó a esos payaso en el circo.
NUM28_3	definite article	agreement	Por la tarde el periodista entrevistó a los payasos en el circo.
NUM28_4	definite article	violation	Por la tarde el periodista entrevistó a los payaso en el circo.
NUM29_1	demonstrative	agreement	El mes pasado al arquitecto diseñó este puente sobre el río.
NUM29_2	demonstrative	violation	El mes pasado al arquitecto diseñó este puentes sobre el río.
NUM29_3	definite article	agreement	El mes pasado al arquitecto diseñó el puente sobre el río.
NUM29_4	definite article	violation	El mes pasado al arquitecto diseñó el puentes sobre el río.
NUM30_1	demonstrative	agreement	Impacientemente la secretaria eligió estos escritorios para la sala de reuniones.
NUM30_2	demonstrative	violation	Impacientemente la secretaria eligió estos escritorio para la sala de reuniones.
NUM30_3	definite article	agreement	Impacientemente la secretaria eligió los escritorios para la sala de reuniones.
NUM30_4	definite article	violation	Impacientemente la secretaria eligió los escritorio para la sala de reuniones.
NUM31_1	demonstrative	agreement	Distraídamente el abogado dejó ese maletín en la mesa.
NUM31_2	demonstrative	violation	Distraídamente el abogado dejó ese maletines en la mesa.
NUM31_3	definite article	agreement	Distraídamente el abogado dejó el maletín en la mesa.

NUM31_4	definite article	violation	Distraídamente el abogado dejó el maletines en la mesa.
NUM32_1	demonstrative	agreement	Esta mañana la dependienta colgó esos vestidos en la vitrina.
NUM32_2	demonstrative	violation	Esta mañana la dependienta colgó esos vestido en la vitrina.
NUM32_3	definite article	agreement	Esta mañana la dependienta colgó los vestidos en la vitrina.
NUM32_4	definite article	violation	Esta mañana la dependienta colgó los vestido en la vitrina.
NUM33_1	demonstrative	agreement	Por la tarde la chica puso este abrigo en el armario.
NUM33_2	demonstrative	violation	Por la tarde la chica puso este abrigos en el armario.
NUM33_3	definite article	agreement	Por la tarde la chica puso el abrigo en el armario.
NUM33_4	definite article	violation	Por la tarde la chica puso el abrigos en el armario.
NUM34_1	demonstrative	agreement	Ayer la bailarina colocó estos abanicos en la pared.
NUM34_2	demonstrative	violation	Ayer la bailarina colocó estos abanico en la pared.
NUM34_3	definite article	agreement	Ayer la bailarina colocó los abanicos en la pared.
NUM34_4	definite article	violation	Ayer la bailarina colocó los abanico en la pared.
NUM35_1	demonstrative	agreement	Lentamente el mecánico guardó ese bocadillo en una bolsa.
NUM35_2	demonstrative	violation	Lentamente el mecánico guardó ese bocadillos en una bolsa.
NUM35_3	definite article	agreement	Lentamente el mecánico guardó el bocadillo en una bolsa.
NUM35_4	definite article	violation	Lentamente el mecánico guardó el bocadillos en una bolsa.
NUM36_1	demonstrative	agreement	Por la mañana el contable arregló esos bolígrafos en la taza.

NUM36_2	demonstrative	violation	Por la mañana el contable arregló esos bolígrafo en la taza.
NUM36_3	definite article	agreement	Por la mañana el contable arregló los bolígrafos en la taza.
NUM36_4	definite article	violation	Por la mañana el contable arregló los bolígrafo en la taza.
NUM37_1	demonstrative	agreement	Felizmente el granjero mandó este caballo al corral grande.
NUM37_2	demonstrative	violation	Felizmente el granjero mandó este caballos al corral grande.
NUM37_3	definite article	agreement	Felizmente el granjero mandó el caballo al corral grande.
NUM37_4	definite article	violation	Felizmente el granjero mandó el caballos al corral grande.
NUM38_1	demonstrative	agreement	Por la noche el obrero sacó estos clavos de la puerta.
NUM38_2	demonstrative	violation	Por la noche el obrero sacó estos clavo de la puerta.
NUM38_3	definite article	agreement	Por la noche el obrero sacó los clavos de la puerta.
NUM38_4	definite article	violation	Por la noche el obrero sacó los clavo de la puerta.
NUM39_1	demonstrative	agreement	Muy temprano el cura bajó ese crucifijo de la escalera.
NUM39_2	demonstrative	violation	Muy temprano el cura bajó ese crucifijos de la escalera.
NUM39_3	definite article	agreement	Muy temprano el cura bajó el crucifijo de la escalera.
NUM39_4	definite article	violation	Muy temprano el cura bajó el crucifijos de la escalera.
NUM40_1	demonstrative	agreement	Ayer el productor repasó esos cuadernos en su despacho.
NUM40_2	demonstrative	violation	Ayer el productor repasó esos cuaderno en su despacho.
NUM40_3	definite article	agreement	Ayer el productor repasó los cuadernos en su despacho.

NUM40_4	definite article	violation	Ayer el productor repasó los cuaderno en su despacho.
NUM41_1	demonstrative	agreement	Rápidamente el cocinero quitó este gusano de la manzana.
NUM41_2	demonstrative	violation	Rápidamente el cocinero quitó este gusanos de la manzana.
NUM41_3	definite article	agreement	Rápidamente el cocinero quitó el gusano de la manzana.
NUM41_4	definite article	violation	Rápidamente el cocinero quitó el gusanos de la manzana.
NUM42_1	demonstrative	agreement	Por la mañana el panadero prendió estos hornos en la cocina.
NUM42_2	demonstrative	violation	Por la mañana el panadero prendió estos horno en la cocina.
NUM42_3	definite article	agreement	Por la mañana el panadero prendió los hornos en la cocina.
NUM42_4	definite article	violation	Por la mañana el panadero prendió los horno en la cocina.
NUM43_1	demonstrative	agreement	Difícilmente el arqueólogo clasificaba ese hueso en la caja.
NUM43_2	demonstrative	violation	Difícilmente el arqueólogo clasificaba ese huesos en la caja.
NUM43_3	definite article	agreement	Difícilmente el arqueólogo clasificaba el hueso en la caja.
NUM43_4	definite article	violation	Difícilmente el arqueólogo clasificaba el huesos en la caja.
NUM44_1	demonstrative	agreement	Ayer la suegra preparaba esos huevos para el desayuno.
NUM44_2	demonstrative	violation	Ayer la suegra preparaba esos huevo para el desayuno.
NUM44_3	definite article	agreement	Ayer la suegra preparaba los huevos para el desayuno.
NUM44_4	definite article	violation	Ayer la suegra preparaba los huevo para el desayuno.
NUM45_1	demonstrative	agreement	Laboriosamente el artista dibujó este molino en la colina.

NUM45_2	demonstrative	violation	Laboriosamente el artista dibujó este molinos en la colina.
NUM45_3	definite article	agreement	Laboriosamente el artista dibujó el molino en la colina.
NUM45_4	definite article	violation	Laboriosamente el artista dibujó el molinos en la colina.
NUM46_1	demonstrative	agreement	Por la mañana la monja espantó estos murciélagos en el ático.
NUM46_2	demonstrative	violation	Por la mañana la monja espantó estos murciélago en el ático.
NUM46_3	definite article	agreement	Por la mañana la monja espantó los murciélagos en el ático.
NUM46_4	definite article	violation	Por la mañana la monja espantó los murciélago en el ático.
NUM47_1	demonstrative	agreement	Secretamente el diseñador fabricó ese muñeco para su sobrina.
NUM47_2	demonstrative	violation	Secretamente el diseñador fabricó ese muñecos para su sobrina.
NUM47_3	definite article	agreement	Secretamente el diseñador fabricó el muñeco para su sobrina.
NUM47_4	definite article	violation	Secretamente el diseñador fabricó el muñecos para su sobrina.
NUM48_1	demonstrative	agreement	Contentamente el investigador encontró esos nidos en la roca.
NUM48_2	demonstrative	violation	Contentamente el investigador encontró esos nido en la roca.
NUM48_3	definite article	agreement	Contentamente el investigador encontró los nidos en la roca.
NUM48_4	definite article	violation	Contentamente el investigador encontró los nido en la roca.
NUM49_1	demonstrative	agreement	Cuidadosamente el zorro vigilaba este pájaro detrás del tronco.
NUM49_2	demonstrative	violation	Cuidadosamente el zorro vigilaba este pájaros detrás del tronco.
NUM49_3	definite article	agreement	Cuidadosamente el zorro vigilaba el pájaro detrás del tronco.

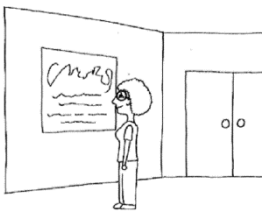
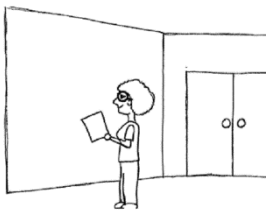
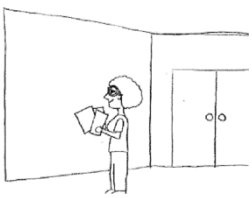
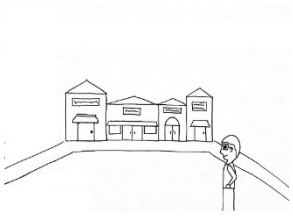
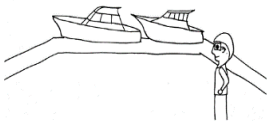
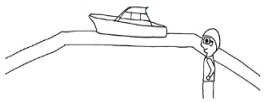
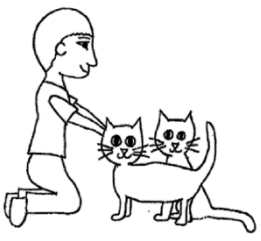
NUM49_4	definite article	violation	Cuidadosamente el zorro vigilaba el pájaros detrás del tronco.
NUM50_1	demonstrative	agreement	Orgullosamente el explorador atrapó estos búhos con la jaula.
NUM50_2	demonstrative	violation	Orgullosamente el explorador atrapó estos búho con la jaula.
NUM50_3	definite article	agreement	Orgullosamente el explorador atrapó los búhos con la jaula.
NUM50_4	definite article	violation	Orgullosamente el explorador atrapó los búho con la jaula.
NUM51_1	demonstrative	agreement	Hoy el sastre teñía ese pañuelo en el taller.
NUM51_2	demonstrative	violation	Hoy el sastre teñía ese pañuelos en el taller.
NUM51_3	definite article	agreement	Hoy el sastre teñía el pañuelo en el taller.
NUM51_4	definite article	violation	Hoy el sastre teñía el pañuelo en el taller.
NUM52_1	demonstrative	agreement	Anteayer el mayordomo compró esos pollos en el mercado.
NUM52_2	demonstrative	violation	Anteayer el mayordomo compró esos pollo en el mercado.
NUM52_3	definite article	agreement	Anteayer el mayordomo compró los pollos en el mercado.
NUM52_4	definite article	violation	Anteayer el mayordomo compró los pollo en el mercado.
NUM53_1	demonstrative	agreement	Esta mañana el físico contempló este reloj en la plaza.
NUM53_2	demonstrative	violation	Esta mañana el físico contempló este relojes en la plaza.
NUM53_3	definite article	agreement	Esta mañana el físico contempló el reloj en la plaza.
NUM53_4	definite article	violation	Esta mañana el físico contempló el relojes en la plaza.
NUM54_1	demonstrative	agreement	Ayer el cantante olvidó estos refrescos encima del piano.

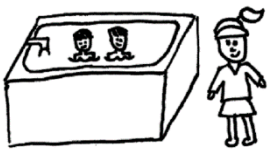
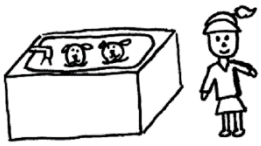
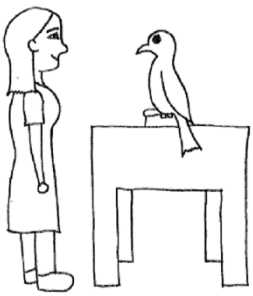
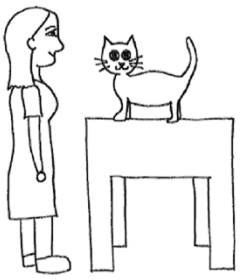
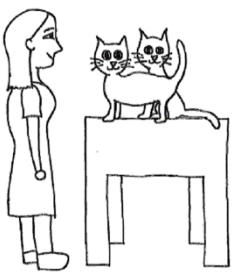
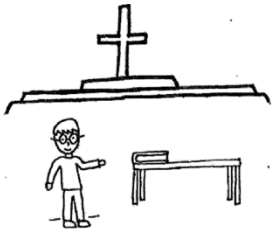
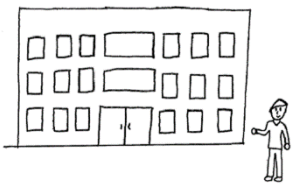
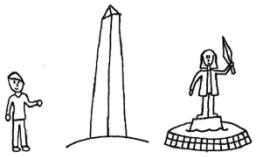
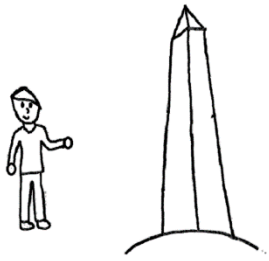
NUM54_2	demonstrative	violation	Ayer el cantante olvidó estos refresco encima del piano.
NUM54_3	definite article	agreement	Ayer el cantante olvidó los refrescos encima del piano.
NUM54_4	definite article	violation	Ayer el cantante olvidó los refresco encima del piano.
NUM55_1	demonstrative	agreement	Nuevamente el entrenador señaló ese relámpago en el cielo.
NUM55_2	demonstrative	violation	Nuevamente el entrenador señaló ese relámpagos en el cielo.
NUM55_3	definite article	agreement	Nuevamente el entrenador señaló el relámpago en el cielo.
NUM55_4	definite article	violation	Nuevamente el entrenador señaló el relámpagos en el cielo.
NUM56_1	demonstrative	agreement	El año pasado el capitán siguió esos tiburones cerca de la isla.
NUM56_2	demonstrative	violation	El año pasado el capitán siguió esos tiburón cerca de la isla.
NUM56_3	definite article	agreement	El año pasado el capitán siguió los tiburones cerca de la isla.
NUM56_4	definite article	violation	El año pasado el capitán siguió los tiburón cerca de la isla.
NUM57_1	demonstrative	agreement	Concentradamente el esclavo enfrentó este león en la plaza.
NUM57_2	demonstrative	violation	Concentradamente el esclavo enfrentó este leones en la plaza.
NUM57_3	definite article	agreement	Concentradamente el esclavo enfrentó el león en la plaza.
NUM57_4	definite article	violation	Concentradamente el esclavo enfrentó el leones en la plaza.
NUM58_1	demonstrative	agreement	Naturalmente los reyes decoraron estos tronos con muchas joyas.
NUM58_2	demonstrative	violation	Naturalmente los reyes decoraron estos trono con muchas joyas.
NUM58_3	definite article	agreement	Naturalmente los reyes decoraron los tronos con muchas joyas.

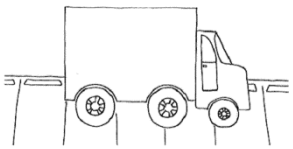
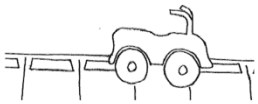
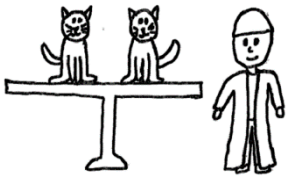
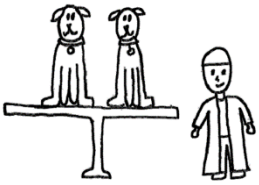
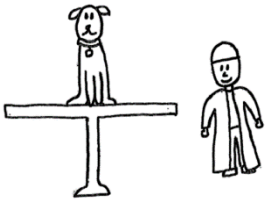
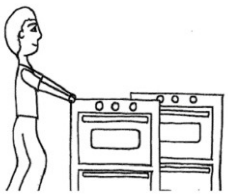
NUM58_4	definite article	violation	Naturalmente los reyes decoraron los trono con muchas joyas.
NUM59_1	demonstrative	agreement	De repente el actor encontró ese billete en la acera.
NUM59_2	demonstrative	violation	De repente el actor encontró ese billetes en la acera.
NUM59_3	definite article	agreement	De repente el actor encontró el billete en la acera.
NUM59_4	definite article	violation	De repente el actor encontró el billetes en la acera.
NUM60_1	demonstrative	agreement	Por la tarde la escritora perdió esos guantes en el tren.
NUM60_2	demonstrative	violation	Por la tarde la escritora perdió esos guante en el tren.
NUM60_3	definite article	agreement	Por la tarde la escritora perdió los guantes en el tren.
NUM60_4	definite article	violation	Por la tarde la escritora perdió los guante en el tren.
NUM61_1	demonstrative	agreement	El mes pasado el cartero escondió este juguete detrás del arbusto.
NUM61_2	demonstrative	violation	El mes pasado el cartero escondió este juguetes detrás del arbusto.
NUM61_3	definite article	agreement	El mes pasado el cartero escondió el juguete detrás del arbusto.
NUM61_4	definite article	violation	El mes pasado el cartero escondió el juguetes detrás del arbusto.
NUM62_1	demonstrative	agreement	Impacientemente el mago bajó estos títeres delante del telón.
NUM62_2	demonstrative	violation	Impacientemente el mago bajó estos títere delante del telón.
NUM62_3	definite article	agreement	Impacientemente el mago bajó los títeres delante del telón.
NUM62_4	definite article	violation	Impacientemente el mago bajó los títere delante del telón.
NUM63_1	demonstrative	agreement	Distraídamente el bombero abrió ese cajón debajo de la taquilla.

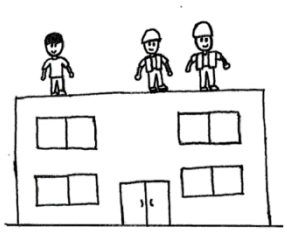
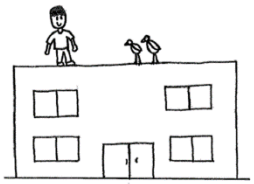
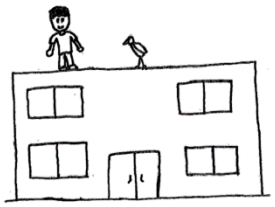
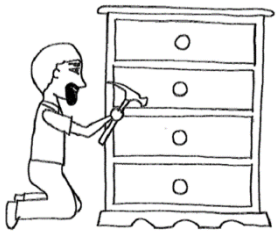
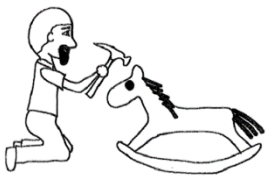
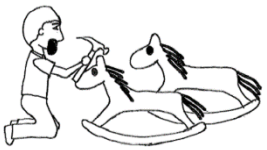
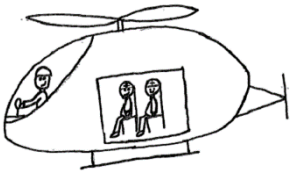
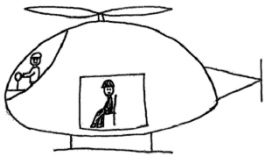
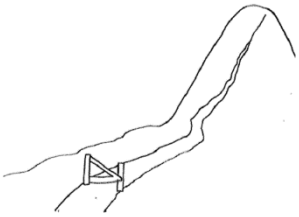
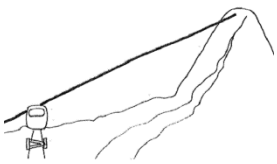
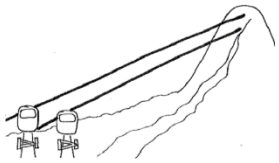
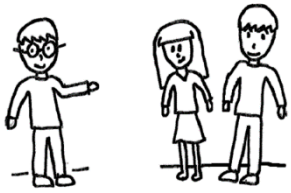
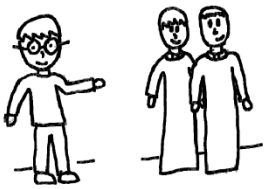
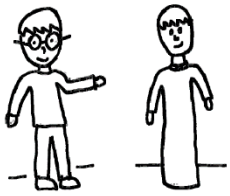
NUM63_2	demonstrative	violation	Distraídamente el bombero abrió ese cajones debajo de la taquilla.
NUM63_3	definite article	agreement	Distraídamente el bombero abrió el cajón debajo de la taquilla.
NUM63_4	definite article	violation	Distraídamente el bombero abrió el cajones debajo de la taquilla.
NUM64_1	demonstrative	agreement	Esta mañana el borracho ensució esos colchones con vino.
NUM64_2	demonstrative	violation	Esta mañana el borracho ensució esos colchó con vino.
NUM64_3	definite article	agreement	Esta mañana el borracho ensució los colchones con vino.
NUM64_4	definite article	violation	Esta mañana el borracho ensució los colchón con vino.

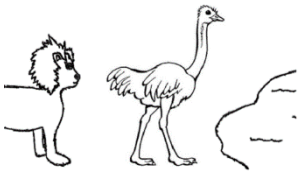
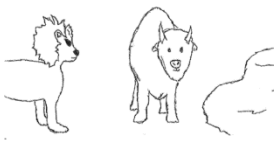
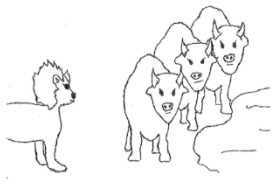
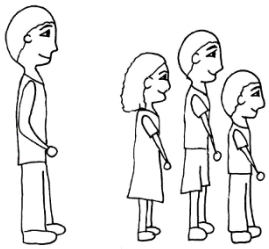
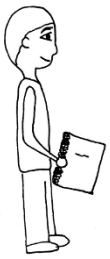
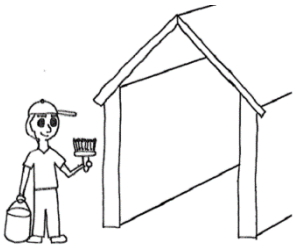
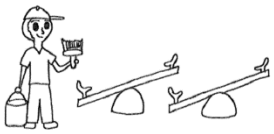
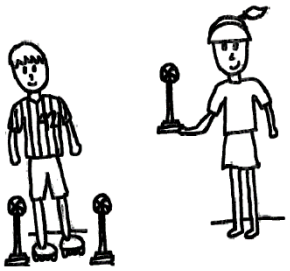
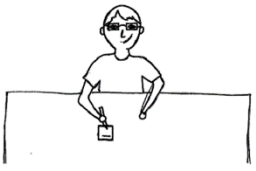
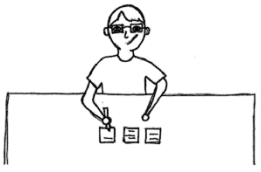
Appendix L – Visual stimuli for picture selection task

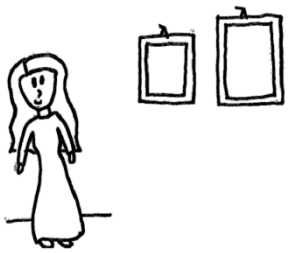
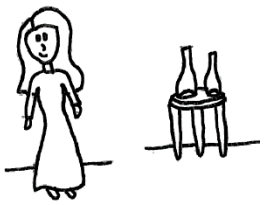
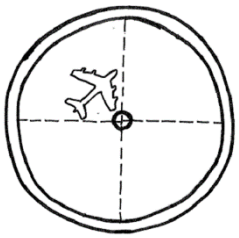
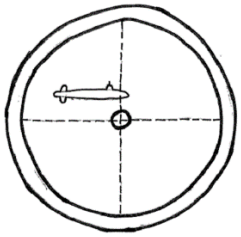
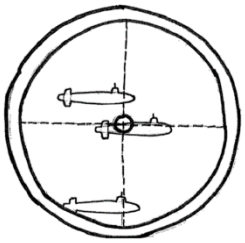
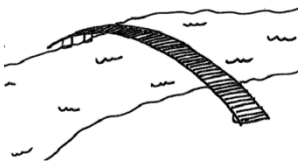
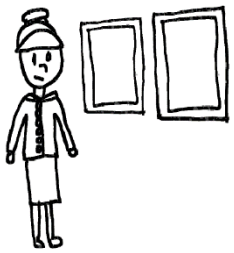
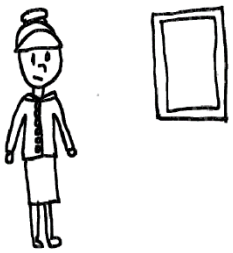
Number	**Master sentence**	**Target image**	**Uninformative Condition image**	**Informative Condition image**
NUM 01	Por la tarde la criada cosía este/el cojín en la sala.			
NUM 02	Ayer el turista visitó estos/los edificios del centro de la ciudad.			
NUM 03	Lentamente la vieja leyó ese/el cartel fuera del cine.			
NUM 04	Por la mañana el inspector revisó esos/los negocios en la plaza.			
NUM 05	Felizmente el chico acariciaba a este/el perro en el jardín.			

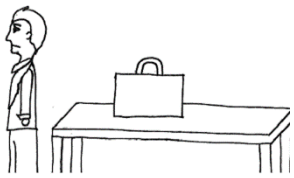
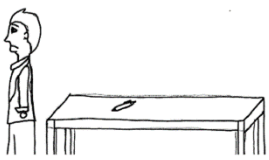
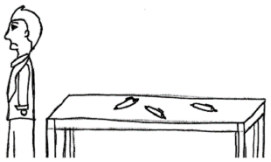
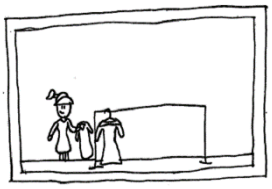
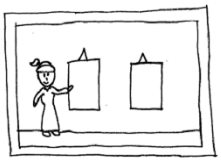
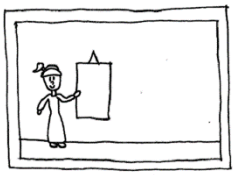
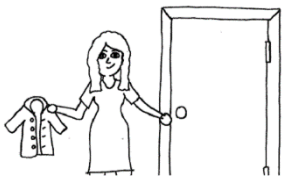
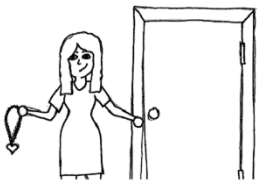
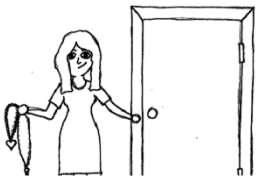
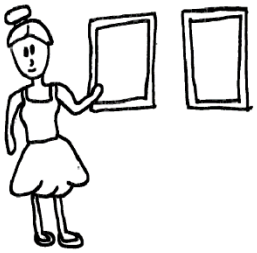
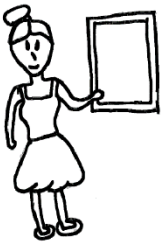
NUM 06	Por la noche la prima bañaba a estos/los chicos en la bañera.			
NUM 07	Muy temprano la tía despertó ese/el loro en su cuarto.			
NUM 08	Ayer el voluntario preparó esos/los regalos en la iglesia.			
NUM 09	Rápidamente el mesero limpió este/el cuchillo de la mesa.			
NUM 10	Por la mañana el estudiante visitó estos/los pisos detrás de la universidad.			

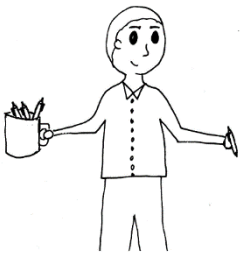
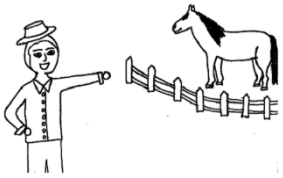
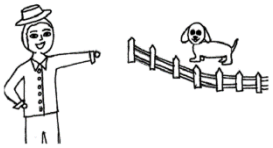
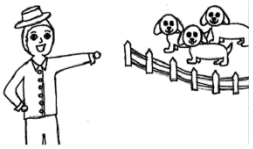
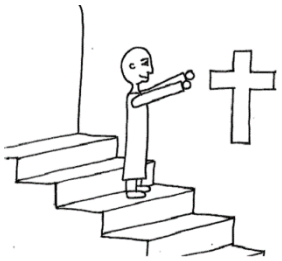
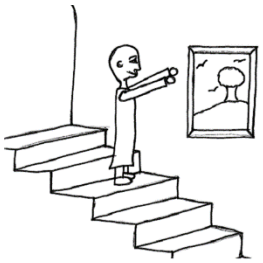
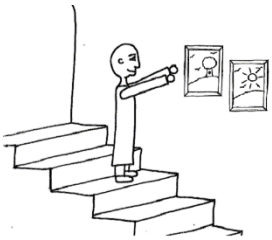
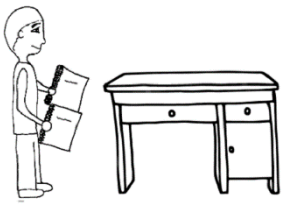
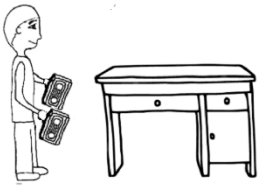
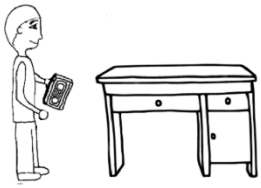
NUM 11	Difícilmente el conductor aparcó ese/el camión en el aparcamiento.			
NUM 12	Ayer el veterinario mostró esos/los gatos en la consulta.			
NUM 13	Laboriosamente el empleado cargó este/el frigorífico a la furgoneta.			
NUM 14	Por la mañana el abuelo leyó estos/los periódicos en el sofá.			
NUM 15	Secretamente el espía quemó ese/el folleto con un encendedor.			

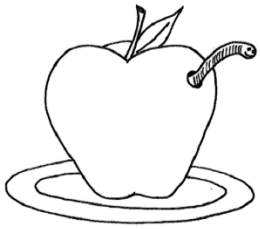
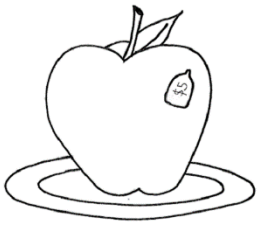
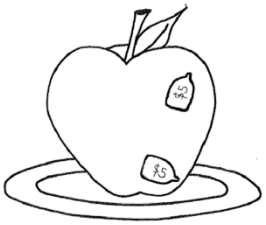
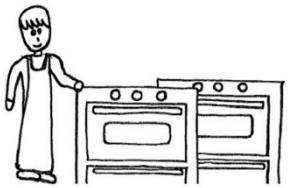
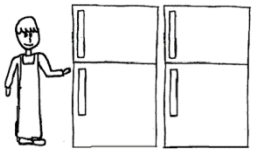
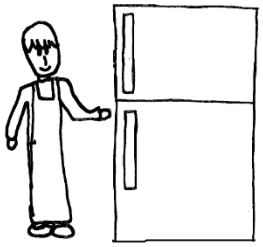
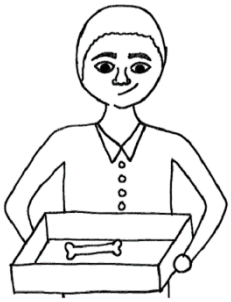
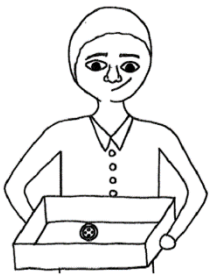
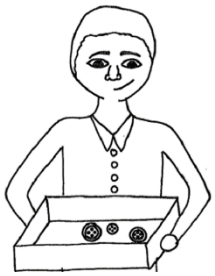
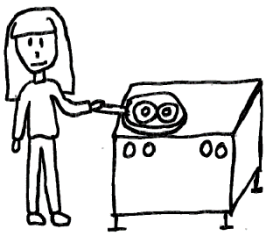
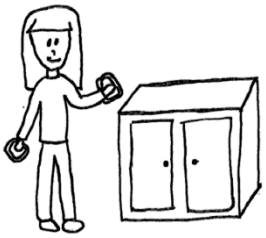
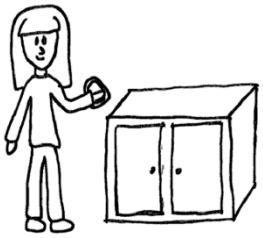
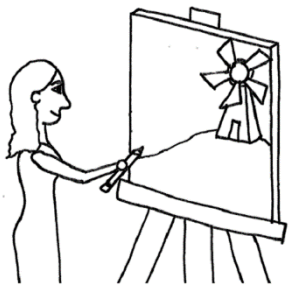
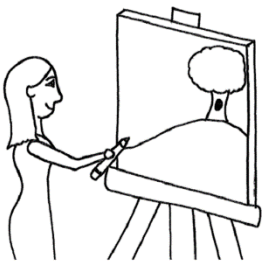
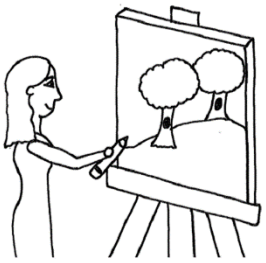
NUM 16	Contentamente el jefe observaba a esos/los trabajadores en el techo.			
NUM 17	Cuidadosamente el carpintero arregló este/el mueble en su taller.			
NUM 18	Orgullosamente el piloto transportó a estos/los enfermeros en su helicópteo.			
NUM 19	Hoy el guardabosque cerró ese/el camino a la montaña.			
NUM 20	Anteayer un alumno invitó a esos/los amigos a una fiesta.			

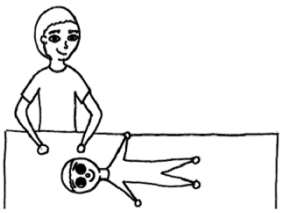
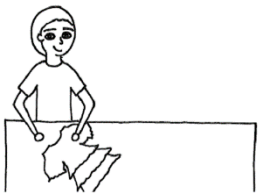
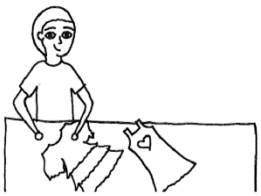
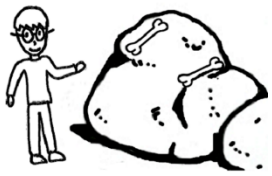
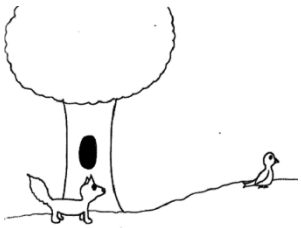
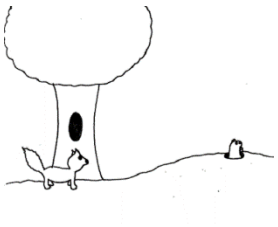
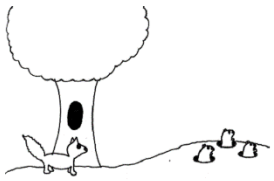
NUM 21	Esta mañana el león atacó este/el avestruz a la orilla del lago.			
NUM 22	Ayer el biólogo llevó a estos/los jóvenes al museo.			
NUM 23	Nuevamente el dueño pintó ese/el cobertizo detrás de la casa.			
NUM 24	El año pasado el atleta recibió esos/los premios en las olimpiadas.			
NUM 25	Concentradamente el autor escribía este/el libro en su oficina.			

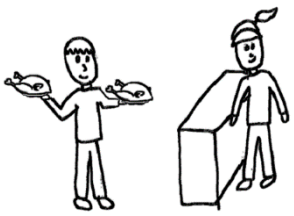
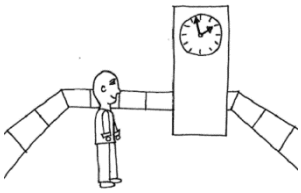
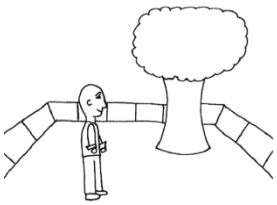
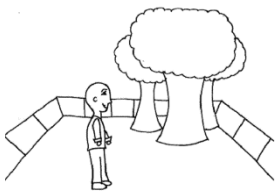
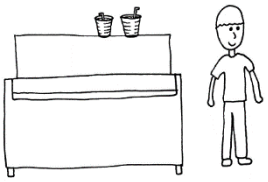
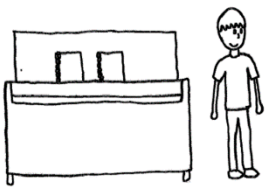
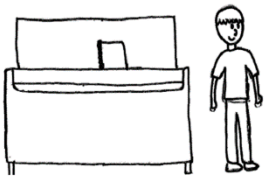
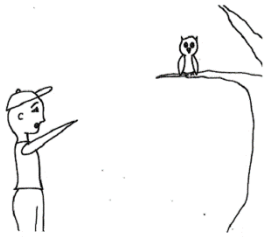
NUM 26	Naturalmente la duquesa quiso estos/los cuadros para el salón.			
NUM 27	De repente el soldado detectó ese/el avión en el radar.			
NUM 28	Por la tarde el periodista entrevistó a esos/los payasos en el circo.			
NUM 29	El mes pasado al arquitecto diseñó este/el puente sobre el río.			
NUM 30	Impacientemente la secretaria eligió estos/los escritorios para la sala de reuniones.			

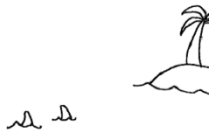
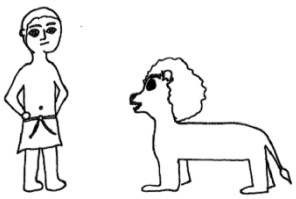
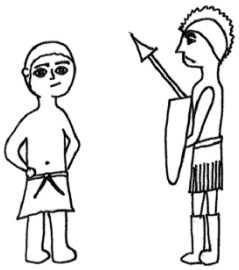
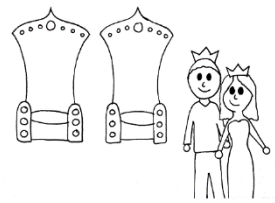
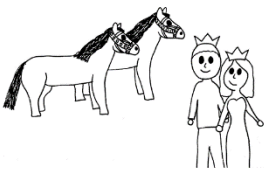
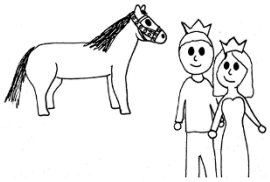
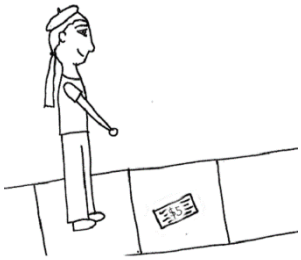
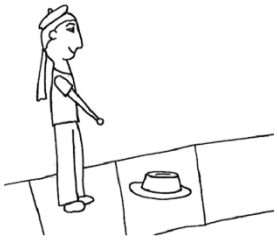
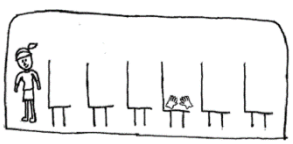
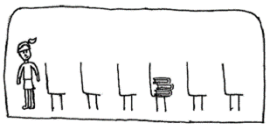
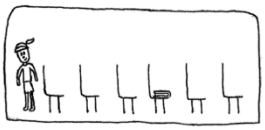
NUM 31	Distraídamente el abogado dejó ese/el maletín en la mesa.			
NUM 32	Esta mañana la dependienta colgó esos/los vestidos en la vitrina.			
NUM 33	Por la tarde la chica puso este/el abrigo en el armario.			
NUM 34	Ayer la bailarina colocó estos/los abanicos en la pared.			
NUM 35	Lentamente el mecánico guardó ese/el bocadillo en una bolsa.			

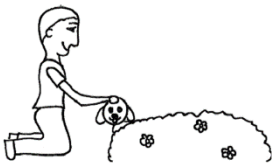
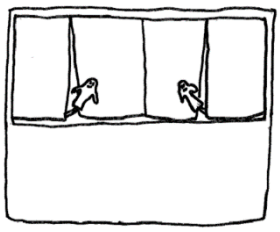
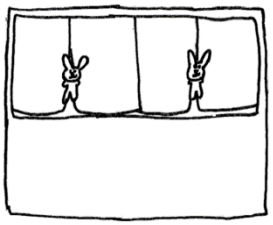
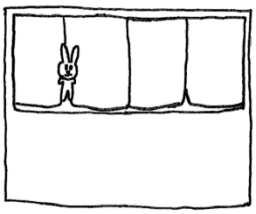
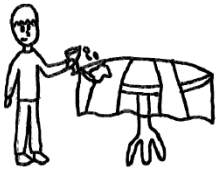
NUM 36	Por la mañana el contable arregló esos/los bolígrafos en la taza.			
NUM 37	Felizmente el granjero mandó este/el caballo al corral grande.			
NUM 38	Por la noche el obrero sacó estos/los clavos de la puerta.			
NUM 39	Muy temprano el cura bajó ese/el crucifijo de la escalera.			
NUM 40	Ayer el productor repasó esos/los cuadernos en su despacho.			

NUM 41	Rápidamente el cocinero quitó este/el gusano de la manzana.			
NUM 42	Por la mañana el panadero prendió estos/los hornos en la cocina.			
NUM 43	Difícilmente el arqueólogo clasificaba ese/el hueso en la caja.			
NUM 44	Ayer la suegra preparaba esos/los huevos para el desayuno.			
NUM 45	Laboriosamente el artista dibujó este/el molino en la colina.			

NUM 46	Por la mañana la monja espantó estos/los murciélagos en el ático.			
NUM 47	Secretamente el diseñador fabricó ese/el muñeco para su sobrina.			
NUM 48	Contentamente el investigador encontró esos/los nidos en la roca.			
NUM 49	Cuidadosamente el zorro vigilaba este/el pájaro detrás del tronco.			
NUM 50	Orgullosamente el explorador atrapó estos/los búhos con la jaula.			

NUM 51	Hoy el sastre teñía ese/el pañuelo en el taller.			
NUM 52	Anteayer el mayordomo compró esos/los pollos en el mercado.			
NUM 53	Esta mañana el físico contempló este/el reloj en la plaza.			
NUM 54	Ayer el cantante olvidó estos/los refrescos encima del piano.			
NUM 55	Nuevamente el entrenador señaló ese/el relámpago en el cielo.			

NUM 56	El año pasado el capitán siguió esos/los tiburones cerca de la isla.			
NUM 57	Concentradamente el esclavo enfrentó este/el león en la plaza.			
NUM 58	Naturalmente los reyes decoraron estos/los tronos con muchas joyas.			
NUM 59	De repente el actor encontró ese/el billete en la acera.			
NUM 60	Por la tarde la escritora perdió esos/los guantes en el tren.			

NUM 61	El mes pasado el cartero escondió este/el juguete detrás del arbusto.			
NUM 62	Impacientemente el mago bajó estos/los títeres delante del telón.			
NUM 63	Distraídamente el bombero abrió ese/el cajón debajo de la taquilla.			
NUM 64	Esta mañana el borracho ensució esos/los colchones con vino.			

Appendix M – Main effects and interaction in non-critical word regions of the self-paced reading task

Table 30

Main effects and interactions in non-critical word regions in the self-paced reading task.

	Main effects and Interactions	N-3	N-2	N-1	N+2	N+3
Natives	Construction_Type	[F(1,30)=1.636, *p*=.211]	[F(1,31)=.226, *p*=.638]	[F(1,31)=.097, *p*=.758]	[F(1,31)=.844, *p*=.365]	[F(1,31)=.239, *p*=.628]
	Agreement	[F(1,30)=.726, *p*=.401]	[F(1,31)=4.634, *p*=.039*[a]]	[F(1,31)=.000, *p*=.995]	[F(1,31)=.023, *p*=.881]	[F(1,31)=.533, *p*=.471]
	Construction_Type * Agreement	[F(1,30)=1.592, *p*=.217]	[F(1,31)=7.797, *p*=.009*[a]]	[F(1,31)=.337, *p*=.556]	[F(1,31)=.779, *p*=.384]	[F(1,31)=.755, *p*=.392]
Advanced Learners	Construction_Type	[F(1,18)=1.853, *p*=.190]	[F(1,18)=1.342, *p*=.262]	[F(1,18)=8.662, *p*=.009*[b]]	[F(1,18)=.829, *p*=.375]	[F(1,18)=2.394, *p*=.139]
	Agreement	[F(1,18)=4.280, *p*=.053]	[F(1,18)=3.028, *p*=.099]	[F(1,18)=3.071, *p*=.097]	[F(1,18)=3.156, *p*=.093]	[F(1,18)=.003, *p*=.959]
	Construction_Type * Agreement	[F(1,18).003, *p*=.954]	[F(1,18)=.101, *p*=.755]	[F(1,18)=.389, *p*=.541]	[F(1,18)=.000, *p*=.996]	[F(1,18)=.225, *p*=.641]
Intermediate Learners	Construction_Type	[F(1,42)=1.895, *p*=.176]	[F(1,42)=3.095, *p*=.086]	[F(1,42)=30.481, *p*=.000*[b]]	[F(1,42)=.086, *p*=.771]	[F(1,42)=5.327, *p*=.026]
	Agreement	[F(1,42)=2.782, *p*=.103]	[F(1,42)=1.391, *p*=.245]	[F(1,42)=3.238, *p*=.079]	[F(1,42)=2.390, *p*=.130]	[F(1,42)=.060, *p*=.808]
	Construction_Type * Agreement	[F(1,42)=.533, *p*=.469]	[F(1,42)=.084, *p*=.773]	[F(1,42)=2.634, *p*=.112]	[F(1,42)=3.620, *p*=.064]	[F(1,42)=.074, *p*=.788]

Note.

[a] Although there was a significant main effect for agreement and a significant interaction of Construction type and Agreement at N-2 for Natives at the N-1 region all reading times were the same which indicates that the unknown cause of differences at N-2 did not carry over to the next region and had no influence on processing at the critical regions of N and N+1. Theoretically there is no reason for any reading time difference in the N-2 region since the word being read was the same across all conditions and the critical manipulations had not yet occurred.

[b] Both learner groups should a significant reading time difference for construction type at the N-1 region. Learners read faster the shorter definite article than the demonstrative, however due to the lack of interaction with agreement at this region, sensitivity to violations in the critical regions was not affected by this difference.

Appendix N – Correlations between individual differences within groups and between group comparisons.

N.1 Correlations within groups

Table 29

Correlations between individual differences within the native group

		Proficiency	Vocabulary Size	Verbal Fluency	Lexical Automaticity	Working Memory
Proficiency	Pearson Correlation	1	.396*	.135	-.353	.217
	Sig. (2-tailed)		.034	.493	.065	.286
	N	29	29	28	28	26
Vocabulary Size	Pearson Correlation	.396*	1	.069	-.388*	.123
	Sig. (2-tailed)	.034		.721	.038	.542
	N	29	30	29	29	27
Verbal Fluency	Pearson Correlation	.135	.069	1	-.208	.278
	Sig. (2-tailed)	.493	.721		.261	.145
	N	28	29	31	31	29
Lexical Automaticity	Pearson Correlation	-.353	-.388*	-.208	1	-.231
	Sig. (2-tailed)	.065	.038	.261		.227
	N	28	29	31	31	29
Working Memory	Pearson Correlation	.217	.123	.278	-.231	1
	Sig. (2-tailed)	.286	.542	.145	.227	
	N	26	27	29	29	29

*Correlation is significant at the .05 level (2-tailed).

Table 30

Correlations between individual differences within the advanced learner group

		Proficiency	Vocabulary Size	Verbal Fluency	Lexical Automaticity	Working Memory
Proficiency	Pearson Correlation	1	.836**	.674**	-.555*	-.029
	Sig. (2-tailed)		.000	.002	.014	.906
	N	19	19	19	19	19
Vocabulary Size	Pearson Correlation	.836**	1	.599**	-.209	.123
	Sig. (2-tailed)	.000		.007	.391	.615
	N	19	19	19	19	19
Verbal Fluency	Pearson Correlation	.674**	.599**	1	-.188	.061
	Sig. (2-tailed)	.002	.007		.440	.805
	N	19	19	19	19	19
Lexical Automaticity	Pearson Correlation	-.555*	-.209	-.188	1	.091
	Sig. (2-tailed)	.014	.391	.440		.712
	N	19	19	19	19	19
Working Memory	Pearson Correlation	-.029	.123	.061	.091	1
	Sig. (2-tailed)	.906	.615	.805	.712	
	N	19	19	19	19	19

*Correlation is significant at the.05 level (2-tailed).

Table 31

Correlations between individual differences within the intermediate learner group

		Proficiency	Vocabulary Size	Verbal Fluency	Lexical Automaticity	Working Memory
Proficiency	Pearson Correlation	1	.215	.184	-.134	-.165
	Sig. (2-tailed)		.165	.263	.392	.298
	N	43	43	39	43	42
Vocabulary Size	Pearson Correlation	.215	1	.350*	-.093	-.029
	Sig. (2-tailed)	.165		.029	.551	.857
	N	43	43	39	43	42
Verbal Fluency	Pearson Correlation	.184	.350*	1	-.275	.039
	Sig. (2-tailed)	.263	.029		.090	.815
	N	39	39	39	39	38
Lexical Automaticity	Pearson Correlation	-.134	-.093	-.275	1	-.096
	Sig. (2-tailed)	.392	.551	.090		.546
	N	43	43	39	43	42
Working Memory	Pearson Correlation	-.165	-.029	.039	-.096	1
	Sig. (2-tailed)	.298	.857	.815	.546	
	N	42	42	38	42	42

*Correlation is significant at the 0.05 level (2-tailed).

N.2 Between group comparisons

Vocabulary size test. A one-way between subjects ANOVA revealed that there was a significant group effect on vocab size [$F(2, 89) = 116.983$, $p < .001$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the Native Group ($M = 46.17$, $SD = 8.51$) was significantly different than the Advanced Learner Group ($M = 33.11$, $SD = .112$), which in turn was significantly different from the Intermediate Learner Group ($M = .425$, $SD = .107$).

Lexical automaticity. A one-way between subjects ANOVA revealed that there was a significant group effect on lexical automaticity [$F(2, 90) = 12.101$, $p = .000$*]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the Native Group ($M = .319$, $SD = .083$) was significantly different than the Advanced Learner Group ($M = .435$, $SD = .112$) and the Intermediate Learner Group ($M = .425$, $SD = .107$). However, there was no significant difference between the two learner groups.

Verbal fluency. A one-way between subjects ANOVA revealed that there was a significant group effect on verbal fluency [$F(2, 86) = 51.630$, p = .000*]. Post hoc comparisons using the Tukey HSD test indicated that the Native Group ($M = 15.05$, $SD = 3.49$) produced significantly more exemplars than the Advanced Learner Group ($M = 12.18$, $SD = 3.43$), which in turn produced significantly more exemplars that the Intermediate Learner Group ($M = 7.49$, $SD = 2.65$).

Working memory test. A one-way between subjects ANOVA was conducted to compare the working memory capacity between groups: native, advanced learners, and intermediate learners. There was a significant group effect on working memory capacity [$F(2, 87) = 14.124$, $p = .000$*]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for the native Group ($M = 10.28$, $SD = 2.12$) was

significantly lower than the advanced Learner Group (M = 14.11, SD = 2.961) and the Intermediate Learner Group (M = 13.12, SD = 2.948). However, there was no significant difference between the two learner groups.