THE EFFECTS OF COGNITIVE ABILITIES AND VOCABULARY SIZE ON L2 SPANISH CLITIC PROCESSING

By

MARIA IDA FIONDA

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2014

© 2014 Maria Ida Fionda

To my parents: Franco Fionda and Cesira Bruno Fionda

ACKNOWLEDGMENTS

The idea for this project could not have been conceptualized, carried out and completed were it not for the invaluable assistance, support and dedication of several people. I would like to thank my advisor, Dr. Gillian Lord, for many tangible and intangible things. Dr. Lord's class on second language phonology sparked an interest in me many years ago, one that would materialize into this project. For although phonology is not directly related to my project, it is in that class where I first developed a fascination with the psycho-cognitive aspect of second language acquisition. Just as importantly, I'd like to sincerely acknowledge the many, many years of continued encouragement she has given me, allowing me to make the errors I needed in order to learn, but ensuring the project progressed as required. For the project itself, her insight on its structure and development, especially with regards to streamlining, has been invaluable. Beyond this project, her availability to assist students during times of need is truly unparalleled. I cannot recall one instance where I needed her assistance and she was not there. I am proud to have had her as my advisor throughout my graduate career.

Dr. Wind Cowles, my committee co-chair, has played a pivotal role in this undertaking. It was in her psycholinguistics course where the idea for this project began to develop. Since then she has given me invaluable advice on the design, and interpretation of challenging results, as well as graciously allowed me to use her laboratory and equipment for gathering data. Even more, she has helped me overcome the many challenges of being a first-timer in eye tracking research, in helping me to make sense of the data and statistics. Indeed, this dissertation could not have been completed without her. I sincerely thank her for believing in me and in the project from the very beginning.

Dr. Arnout Koornneef is a special member of my committee. Having come to the University of Florida on an exchange program from The Netherlands, he replaced Dr. Cowles for one semester as a professor and in the laboratory. When I approached Dr. Koornneef shortly after his arrival, he amiably agreed to help me, and proceeded to spend countless hours helping me through the many challenges of laboratory experimentation, setting up the experiment, and guiding me through trial runs, as well as further streamlining the project to ensure its timely completion. If that weren't enough to warrant him being made a special member of the committee, he also continued to help me after his return to The Netherlands, spending much time with me on Skype, teaching me to run ANOVAs. Months later, I continued to send him email questions regarding statistics and always received a prompt and informative reply. A heartfelt note of appreciation goes out to him, not only for all his help but also for showing true interest in my project.

I would like to thank Dr. Lori Altmann, first and foremost, for introducing me to working memory and its role in language processing in the capacity of guest lecturer in my psycholinguistics class. This was the element that tied the project together and made it what it has now become. I also thank her for her interest in working with me, her valued methodological input on various occasions, for the hours she spent with me running regression analyses, for offering and providing advice on statistical analyses, and for encouraging me to carry out this study.

I would also like to thank my final committee member, Dr. Jessi Aaron. Dr. Aaron's classes have provided me with much treasured speculation and inquiry into the nature of language emergence and representation in the brain from a cognitive and functional perspective—what has now become the theoretical background of my research.

In the many challenges I faced during this project, the most difficult was climbing the hurdles of statistical analyses. With virtually no experience, I did not begin to truly gain an understanding of statistics, and hence of my analyses and results, until I met Dr. Kyle Null at the University of Mississippi. I met Dr. Null as my statistics consultant but we quickly became friends. The countless hours he has spent explaining concepts, writing syntax and advising me on the most appropriate analyses for my project, at the office, in his home, and in restaurants, is something I am truly thankful for and will never forget.

Words cannot describe the appreciation I feel for the continued support of my family and friends. My parents, to whom I have dedicated this dissertation, have taught me, among many valuable life lessons, to work hard and never give up. This, along with their encouragement, I have taken with me wherever I've gone and in whatever I have faced, including the many challenges of this project. It is fitting that I finish this project in their home, in Montreal. And to my best friend Antonio Masello, and my dear friends, both in Montreal, Gainesville and in other parts of the world, you know who you are. For every word of understanding, reassurance and cheer, a heartfelt thank you!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

1	First person
3	Third person
ACC	Accusative
CI	Statistical confidence interval
CL	Clitic
CLLD	Clitic left dislocation
Comp.	Composite score
DAT	Dative
DSB	Digit span backward working memory test
DSF	Digit span forward working memory test
DSST	Digit symbol substitution test
DO	Digit ordering working memory test
EF	Executive function
ERP	Even-related potential
Fem.	Feminine
IA	Interest Area
IMPERS	Impersonal
IP	Input processing
IPS	Inhibition and processing speed factor
L1	First language
L2	Second language
LAN	Left lateralized anterior negativity
LTM	Long-term memory
LT-WM	Long-term working memory

M	Mathematical mean
Masc.	Masculine
ms	Milliseconds
NP	Noun phrase
Num.	Number
OR	Odds ratio
PI	Processing instruction
PCA	Principal component analysis
PL	Plural
PostAux	Postauxiliary clitic position condition
PostV	Postverbal clitic position condition
PP	Preposition phrase
PreV	Preverbal clitic position condition
PRON	Pronoun
REFL	Reflexive
RT	Reading time
SD	Statistical standard deviation
SG	Singular
SLA	Second language acquisition
SOV	Subject-object-verb word order
STM	Short-term memory
SVO	Subject-verb-object word order
UG	Universal Grammar
VP	Verb phrase
VS	Vocabulary size

WM	Working memory

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

THE EFFECTS OF COGNITIVE ABILITIES AND VOCABULARY SIZE ON L2
SPANISH CLITIC PROCESSING

By

Maria Ida Fionda

May 2014

Chair: Gillian Lord
Cochair: Wind Cowles
Major: Spanish

The present study sought to further our understanding of the role of individual differences in second language (L2) processing by looking at native English speakers' Spanish L2 online processing of verbal constructions containing clitic pronouns, and its relationship with individual abilities in two cognitive factors (working memory and executive function) and one linguistic factor (vocabulary size). It was predicted that higher abilities in these factors would lead to a greater likelihood of noticing non-target (ungrammatical) placement of the clitic with respect to the verb, and that enhanced abilities in these factors would prove especially beneficial when non-target placement is congruent with interfering schematic representations of the first language (L1).

Twenty-nine native English low-proficiency L2 learners of Spanish took part in the study. All were tested for working memory capacity, executive function abilities and Spanish vocabulary size. Two main experiments employed eye tracking methodology that assessed their online reading of two verbal constructions containing clitic pronouns (finite simple and complex past tenses). The results show that higher abilities of the two cognitive factors predicted a greater likelihood that non-target structures were detected.

In addition, they also revealed that learners with working memory and executive abilities were more likely to dedicate added processing effort to parsing target (grammatical) clitic verbal structures in the face of unreliable input caused by non-target sentences. Important differences were also found between the simple and finite verbal constructions, suggesting that ungrammatical clitic verbal structures congruent with interfering schematic representations of the L1 took longer to detect. No conclusive results emerged regarding the effects of vocabulary size.

These findings carry important implications for research in second language acquisition and L2 processing. First, they provide strong evidence that individual differences in cognitive abilities lead to significant processing differences among low-proficiency learners. Second, they show that when L2 learners do not mirror native speakers' processing patterns, rather than suggestive of inferior L2 knowledge during processing, this may be indicative of differences in how they invest their cognitive resources.

CHAPTER 1
INTRODUCTION

Studying how humans learn, understand and manipulate their native (L1), second (L2) and subsequent languages offers us a window into the sophisticated workings of the human brain. The field of second language acquisition (henceforth, SLA) encompasses research in adults' abilities and challenges in understanding and producing the various linguistic units of their L2. Anyone who has taken a foreign or second language class as an adult will recognize the challenge of understanding and producing a new language in real time. A major part of this challenge arises because processing an L2 forces the learner to deal with a large amount of input, both lexical and grammatical, in a limited timeframe. Decoding and forming an utterance is a complex task that requires much efficiency. The situation of the L1 learner/speaker and that of the L2 one are drastically different in many aspects, including but certainly not limited to: the nature of the linguistic input, an already existent L1 system, possible biological limitations due to age, and any number of individual factors. The effects of these differences show up in the large variance in L2 proficiency among learners who have had relatively the same exposure (Lightbown & Spada, 2013).

Studies of SLA are quite varied with respect to the angle from which they approach their research. Perspectives range from different theories of acquisition, mental capacity and representation, to social environments and type of input, learning processes, the effect of cross-linguistic influence and native language transfer, maturational constraints, and individual differences such as attitudes, aptitude, learning styles and cognitive abilities. This study focuses on the role of individual differences in cognitive abilities and vocabulary size in the online processing—specifically, reading comprehension—of an L2 by examining whether adult English native learners of Spanish with greater cognitive abilities are more likely to detect non-target word order in Spanish finite verb + clitic pronoun constructions. In the present study, the term 'non-target' refers to what is often called 'non-grammatical' in processing research. The two cognitive constructs examined in this investigation, along with vocabulary size, are introduced below, and then discussed in more detail in chapter 2.

Research in cognitive psychology and neuroscience has focused on two widely known cognitive systems: Working Memory (WM) and Executive Function (EF). The term Working Memory is used to refer to "the system needed to maintain information in the mind while performing complex tasks such as reasoning, comprehending and learning" (Baddeley, 2010, p. R136). Research in WM includes tasks in reasoning problems, and spatial and language processing. Equally important are studies of the nature of EF, which have found that it is responsible for the "shifting of mental sets, monitoring and updating of working memory representations, and inhibition of prepotent responses" (Miyake et al., 2000, p. 50); in other words, shifting between tasks and inhibiting material that interferes with the completion of a given task. Research in EF as it relates to language has focused on its effect on language disorders such as native language verbal fluency (e.g., Luo, Luk & Bialystok, 2010) and (bilingual) aphasia (e.g., Penn, Frankel, Watermeyer, & Russell, 2010). Finally, vocabulary size (henceforth, VS) has been studied with regards to its correlation to native language grammar development. Research in child language acquisition has found a strong relationship between vocabulary size and morphological and syntactic development (Bates, Devescovi & Wulfeck, 2001; Bates & Goodman, 1997), which suggests that vocabulary development promotes grammar. However, there is virtually no knowledge of whether this relationship exists in L2 acquisition and processing.

These three factors—WM, EF, VS—have been shown to be relevant to L1 acquisition and research has suggested that they play an important role in L2 acquisition as well. However, we still know very little about how they function with L2 grammar development and processing. As such, the present study aims to fill that gap by exploring their relationship with the processing of L2 morphosyntax. An eye tracking experiment was employed to observe whether increased capacities in the three aforementioned factors are able to predict learners' online detection of non-target structures in the L2. More specifically, the non-target structure consists of constructions produced by native English learners of Spanish: finite verb + clitic pronoun (Liceras, 1985). Studies of L2 processing are providing new information about how learners deal with the target language in real time. This information, in turn, allows researchers to further develop SLA theories.

In addition to exploring the role of cognitive abilities and VS in L2 processing, the present study adopts a cognitive linguistics theoretical framework. The main goal is not to investigate the validity of the theory, but rather to use it to inform and discuss the pertinent features of the learner's L2 system. Cognitive linguistics is a suitable framework in that it couples well with the cognitive factors whose role is analysed here. The cognitive linguistic approach to language is guided by three major hypotheses: i) language is not an autonomous cognitive faculty; ii) grammar is conceptualization; iii) knowledge of language emerges from language use (Croft & Cruse, 2004, p. 1). Because it espouses a non-modular approach to language representation in the mind, it works in unison with the notions of WM and EF in processing information and building a conceptual network.

In this introductory chapter, we examine the Spanish pronominal clitic system and compare it to English clitics, in order to understand the differences between the learners' L1 and L2 with respect to the finite verb + clitic construction. We then review the basic concepts of usage-based cognitive linguistics, in particular, cognitive grammar, the framework within which this study is carried out. The chapter ends with an account of clitics from a usage-based perspective. The second chapter begins with a review of previous research in the processing and acquisition of Spanish clitics. Next, because studies that employ online techniques provide added insight into SLA and complement investigations using offline experiments, L2 and bilingual online processing research is reviewed, followed by a discussion of WM, EF and VS and their relationship with language processing and development. The third chapter presents the research questions and methodology carried out for the present study. The final two chapters present the results and discussion of their interpretation, ending with concluding remarks and considerations for future research.

What Is a Clitic?

Theoretical linguists have long debated the nature of clitics, their exact properties, and even whether they should constitute a class or category proper. In fact, much of the research on clitics has tried to disentangle the issue of whether the element in question is a clitic or an affix, with linguists proposing different criteria for their identification. For our immediate purposes, we will use Zwicky's (1994) description of the general term as a working definition: clitics are generally described as linguistic elements that have the syntactic properties of words but also act like affixes in that they are phonologically dependent on an adjacent word. That is, a clitic is a form halfway between an affix and an autonomous word: affix-like in that it is normally unstressed and requires a host on which to "lean;" word-like in that it has no effect on the host's stressed syllable (Hopper & Traugott, 2003, pp. 5, 142). In many cases, clitics represent the weak forms of functional words, such as pronouns, determiners, auxiliaries, negation particles, and question particles (Gerlach, 2002). As an example in (1), the contracted form *n't* of the English negator *not* is often considered a clitic. Likewise, the Spanish dative and accusative pronouns are considered clitics in that they cannot, like their strong pronoun counterparts, stand alone, as is shown in (2) and (3).

(1) We couldn't do it.
'We could not do it'

(2) ¿A quién viste? A él
PRON who see? PRON him
'Who did you see? Him'

(3) ¿A quién viste? *Lo
PRON who see? *CL.3.SG.ACC
'Who did you see? Him'

However, the case of clitic properties and behaviour is far from clear and theoretical considerations of these particles are discussed in more detail later in this chapter. The study of clitics has been challenging for two main reasons: First, as noted above, it is difficult to determine exactly what a clitic is and what sets it apart from words on one end, and affixes on the other. Second, the grammatical elements commonly referred to as clitics across languages display a diversity of characteristics, which has led to the question of whether "clitic" should constitute a grammatical class at all.

This cross-linguistic mismatch has consequences for the L2 learner. Certainly, when we think of the learner's (lack of) success at efficiently processing a foreign grammar, the issue of transfer must be taken into account. The role of negative and positive transfer in SLA has been addressed by researchers both in and outside the Universal Grammar (UG) tradition. Outside the generative grammar framework, a considerable amount of work has been done in phonetics, cognate vocabulary, pragmatics and literacy. While there has been some skepticism about transfer in morphology and syntax, many theoretical linguists, particularly those working from within a UG paradigm, have recognized that there are cases of transfer in these linguistic subsystems as well, and that these are important in what they can reveal about the acquisition of L2 features (Odlin, 2003). A case in point is the instance of the Spanish clitic system and its difference when compared to English.

The Spanish Clitic Pronoun System

This section examines the Spanish pronominal clitic system and the information that it encodes, as well as the options for clitic placement within a clause. Table 1-1 shows the Spanish pronominal clitic and strong forms and their features (Harris, 1995, p.174)[1]. The clitics encode case, gender and number features, though, as is apparent in the table, there is a great amount of syncretism in the first and second person forms, and some in the dative and reflexive third person forms. In the case of the accusative pronouns, both number and gender are morphologically marked, whereas the dative clitics only show number marking. This lack of one form-one meaning mapping may present a challenge to L2 learners, as they must sift through confounding input in their attempt to assign a meaning to a reduced, unstressed form.

[1] Dialectal variation of clitic use is discussed separately below.

Like nearly all Romance clitic pronouns, Spanish clitics are syntactically distinguishable from full pronouns (Gerlach, 2002, p. 4): they may not be modified (4a), co-ordinated (4b), contrastively stressed (4c), and, as previously discussed, they may not appear in isolation (4d) or, in the case of finite verbs, in the same position as their full pronouns or NPs. In addition, clitics appearing in sequence observe a fixed order: dative-accusative (4e), and clitic clusters may not be separated (4f) (Zyzik, 2004).

(4)

a. Juan conoce sólo a él
Juan knows only PRON him
'Juan knows only him'

*Juan lo conoce sólo
*Juan CL.3.SG.ACC knows only
'Juan knows only him'

b. Juan conoce a él y a ella
Juan knows PRON him and PRON her
'Juan knows him and her'

*Juan lo y la conoce
*Juan CL.3.SG. ACC and CL.3.SG. ACC knows
'Juan knows him and her

c. Juan conoce a ÉL, no a vosotros
Juan knows PRON HIM, not PRON you.PL
'Juan knows him, not you'

*Juan lo conoce, no a vosotros
*Juan CL.3.SG. ACC knows, not PRON you.PL
'Juan knows him, not you'

d. ¿A quién conoce Juan? A él
PRON who knows Juan? PRON him
'Who does Juan know? Him'

*¿A quién conoce Juan? Lo
* PRON who knows Juan? CL.3.SG.ACC

e. Juan me la mandó
Juan CL.1.SG.DAT CL.3.SG.ACC sent

'Juan sent me it'

*Juan la me mandó
*Juan CL.3.SG.ACC CL.1.SG.DAT sent
'Juan sent me it'

f. Juan me la mandó
Juan CL.1.SG.DAT CL.3.SG.ACC sent
'Juan sent me it'

*Juan me mandó la
*Juan CL.1.SG.DAT sent CL.3.SG.ACC

Because the Spanish clitics are historically derived from Latin, their original forms being extinct, and because they display syntax unlike that of their corresponding strong pronoun forms or NPs, they may be classified under Zwicky's (1977) category of "special clitics," discussed in more detail below, distinguishable from the simple clitics we find in English. Native English L2 learners' processing of these morphemes is thus particularly interesting because these special clitics do not form part of the English language. Additionally, as discussed in the next section, certain clitics carry varied and complex functions such that there is not always a direct equivalent meaning in English to mirror a clitic construction in Spanish. This is especially true in the case of the dative clitics in Spanish.

The dative clitics

The Spanish dative clitics *le* and *les* are challenging to L2 learners because of the variety of functions of the dative case, from indirect object in ditransitive constructions (e.g., *Juan le dio el paquete* 'Juan gave him/her the package') to idiomatic phrases (e.g., *Le da igual* 'It's all the same to him/her') (Zyzik, 2004). While the purpose of this study is not to ascertain how L2 learners process/acquire the different functions of the dative case, a short review of what these are is necessary in order to gain a full appreciation of the amount of information encoded in the repertoire of Spanish dative constructions. L2 processing/acquisition must necessarily be viewed as a comprehensive practice, the managing of all features of a particular construction, including its morphology and syntax within the construction's context of use and the learner's experience with said construction.

Maldonado (2002) has proposed an underlying meaning in all dative constructions: that of a participant being affected; however, this affectedness may manifest itself in a variety of ways. Based on Maldonado's (2002) more extensive classification, Zyzik (2004) has categorized dative case constructions into five separate categories, as exemplified below: (5a) recipient, (5b) psychological experiencer, (5c) beneficiary, (5d) possessor, and (5e) superfluous dative.

(5)

a. Juan le entregó la tarea al profesor
Juan CL.3.SG.DAT turned in the homework to the professor
'Juan turned in the homework to the professor'

b. A Miguel le encantó la película
PRON Miguel CL.3.SG.DAT fascinated the movie
'Miguel loved the movie'

Juan le abrió la puerta
Juan CL.3.SG.DAT opened the door
'Juan opened the door for him/her

c. La tormenta le destruyó el jardín
The storm CL.3.SG.DAT destroyed the garden
'The storm destroyed his/her garden'

d. Este niño no me come nada
This child no CL.1.SG.DAT eat nothing
'This child won't eat anything (for me)'

To be sure, others have come up with different categories (see, for example, Butt & Benjamin, 2004). For the purposes of this study, however, these classifications will do, as the aim here is to have an understanding of the complexity of the system, and consequently, the challenges faced by the learners.

The multiple functions of *se*

In addition to the dative constructions presented above, the Spanish clitic pronoun *se* has also been subject of much research due to the many functions it may execute. Though the question of exactly how many senses of *se* exist is still open to debate, Zyzik (2006b) has outlined seven general functions of the morpheme, as shown in the examples below: (6a) decausative, (6b) passive, (6c) reflexive/reciprocal, (6d) impersonal, (6e) intransitive/dynamic, (6f) aspectual, (6g) inherent[2].

(6)

a. La ventana se rompió
The window CL.3 broke

b. La carta se escribió en 1992
The letter CL.3 written in 1992
'The letter was written in 1992'

c. Los chicos se miraron
The kids CL.3 looked
'The kids looked at each other'
'The kids looked at themselves'

d. La comida se come con un tenedor
The food CL.3 eat with a fork
'One eats food with a fork'

e. El coche se salió de la carretera
The car CL.3 left from the road
'The car went off the road'

[2] For a more extensive explanation of each of these categories, the reader is referred to Levin & Rappaport Hovav (1995), Nishida (1994), Suñer (1982), Turley (1999), Zyzik (2006b).

f. Se tomaron todo el vino
CL.3 drank all the wine
'They drank up all the wine'

g. Juan se queja de la tarea
Juan CL.3 complains about the homework

Furthermore, the dative *le* is manifested as *se* when it appears alongside a direct object clitic pronoun in double object clitic constructions, a phenomenon often referred to as the "Spurious *se*" (Perlmutter, 1971). Thus, constructions such as (7) are exemplary of, once again, the lack of one form-one function mapping.

(7) Juan se lo dio la semana pasada
Juan CL.3.SG.DAT CL.3.SG.ACC gave the week last
'Juan gave him/her it last week'

Spanish clitic placement

Spanish clitics observe clear placement usage depending on the construction, verb tense and verb type. In general, clitic placement revolves around one main property: finiteness of the host verb. Clitic pronouns precede finite verbs (as in 8), while they follow infinitive or non-finite verb forms (as in 9).

(8) Juan lo ve todos los días
Juan CL.3.SG.ACC sees all the days'
'Juan sees him everyday'

(9) Juan trabaja sin verlo todos los días
Juan works without to seeCL.3.SG.ACC all the days
'Juan works without seeing him everyday'

In more complex constructions there is more than one option (Montrul, 2010). For instance, in a sequence of a modal, causative or aspectual finite verb followed by a non-finite form, such as a gerund or infinitive, a clitic can appear either before the conjugated verb (as in 10a) or after the infinitive/gerund (as in 10b). It is not, however, placed in between the finite and the infinitive/gerund.

(10)

a. Juan lo quiere ver todos los días
Juan CL.3.SG.ACC wants to see all the days
'Juan wants to see him everyday'

b. Juan quiere verlo todos los días
Juan wants to see seeCL.3.SG.ACC all the days
'Juan wants to see him everyday'

In the case of commands, Spanish has two forms: formal and informal, each with the possibility of being affirmative or negative. Affirmative commands require that clitic pronouns be attached at the end of the conjugated verb, as seen in (11 [formal[3]]) and (12 [informal]). The situation with negative commands is the opposite: as with finite verbs in all cases of indicative and subjunctive moods, the clitic pronoun must be placed before the verb, shown in (13 [formal]) and (14 [informal]).

(11) Cómprelo
Buy CL.3.SG.ACC
'Buy it'

(12) Cómpralo
Buy CL.3.SG.ACC
'Buy it'

(13) No lo compre
No CL.3.SG.ACC buy
'Don't buy it'

(14) No lo compres
No CL.3.SG.ACC buy
'Don't buy it'

In double object clitic constructions, dative clitics always appear before accusative, as shown in example (7) above. Placement rules with respect to the verb stay the same as outlined above, with both clitics always appearing together. In

[3] In several Spanish-speaking countries, third person forms represent familiar, second person functions. The traditional term "formal" is adopted here only for convenience.

addition, in impersonal and ethical dative constructions involving a dative or accusative clitic, such as (15) and (16), *se* always precedes the dative clitic.

(15) Se le/la notaba pálida
CL.3.SG.IMPERS CL.3.SG.DAT/ACC noticed pale
'One could see she was pale'

(16) Se le rompió el plato
CL.3.SG.REFL CL.3.SG.DAT broke the plate
'The plate (up and) broke on him/her'[4]

Double object clitic constructions are without a doubt complex structures that challenge the linguist and foreign language learner alike, particularly if the construction does not exist in L1. Constructions such as (15) and (16) present the added task of expressing concepts whose exact equivalent form-function pairs are not easily found in English, along with the general clitic system of pronouns being new and being characterized by a structure that does not reflect that of the L1. Indeed, as we see in the following section, in some cases clitics may also appear in structures referred to as clitic doubling.

Spanish clitic doubling

Clitic doubling refers to both the noun phrase and its corresponding clitic pronoun appearing in the same sentence, as in example (17). With dative clitics and indirect objects, clitic doubling occurs in all varieties of Spanish to some extent. Such is not the case with accusative clitics and direct objects, which is ungrammatical in most Spanish varieties, as we see in (18). When the object is a strong pronoun, clitic doubling is always required, as shown in (19a) and (19b) (Montrul, 2010).

[4] This construction, traditionally referred to as the ethical dative and further analysed as a 'setting dative', functions as a "semi-active setting participant that operates as a location where affectedness takes place [and is] affected by the whole event as s/he is linked to some thematic participant" (Maldonado, 2002, p. 46). For a discussion on the function of the clitic *se* in the construction, the reader is referred to Maldonado (1993, 1999).

(17) Juan (le) mandó una carta a su hermana
Juan (CL.3.SG.DAT) sent a letter to his sister
'Juan sends a letter to his sister'

(18) Juan vio a su abuela
Juan saw PRON his grandmother
'Juan saw his grandmother'

*Juan la vio a su hermana
*Juan CL.3.SG.ACC saw PRON his sister

(19)

a. Juan lo vio a él
Juan CL.3.SG.ACC saw PRON him
'Juan saw him'

*Juan vio a él
*Juan saw PRON him

b. Juan le mandó una carta a ella
Juan CL.3.SG.DAT sent a letter to her
'Juan sent a letter to her'

*Juan mandó una carta a ella
'Juan sent a letter to her'

In more complex constructions involving topicalization, Montrul (2010) points out that clitic doubling is obligatory in both accusative and dative cases, and that objects are topicalized in what are called clitic left dislocation constructions (CLLD) (p. 171). These constructions are exemplified in (20a) and (20b):

(20)

a. Los libros los tiene Juan en la oficina
The books CL.3.PL.ACC has Juan in the office
'Juan has the books in the office'

b. A su hermana le mandó Juan una carta
To his sister CL.3.SG.DAT sent Juan a letter
'Juan sent a letter to his sister'

Whether optional or obligatory, constructions that display clitic doubling are novel for learners whose L1 does not contain such a structure. Insofar as conscious learning is concerned, learners are usually taught that clitic object pronouns behave in part like English direct and indirect object pronouns, in that they are used to replace the full NP. Having a construction contain both is usually seen as a redundancy.

Dialectal variation

If the task of processing and acquiring clitics were not complicated enough, the lack of their consistent use in the Spanish-speaking world poses an added challenge to learners, who may learn one "rule" from a textbook and be further exposed to another "rule" when traveling or studying abroad. This section reviews the most widely-known variation in clitic usage but is by no means exhaustive.

Leísmo. The use of the dative clitic pronoun *le* in reference to a human masculine direct object is called *leísmo* (example 21). This usage is common in central and northern Spain, and in most prestigious (standard) styles, i.e. publishing and the media. It is also found in certain parts of Latin America, though much less extensively than in Spain (Butt & Benjamin, 2004, pp. 161-164). *Le* is sometimes also used in place of the feminine accusative *la* when referring to an animate direct object. Furthermore, a more extreme and far less common *leísmo* is seen in the familiar speech of Madrid and Quito, Ecuador, with *le* being used as the direct object clitic pronoun for inanimate direct object nouns, both masculine and feminine (Butt & Benjamin, 2004, p. 162).

(21) Le ha visto ayer
CL.3.SG.DAT(ACC) have seen yesterday
'He/she saw him yesterday'

Loísmo. In many parts of Latin America, the accusative clitic *lo* is used in popular speech instead of the dative *le* for an indirect object, as is seen in (22). Butt and Benjamin (2004) report that the phenomenon occasionally occurs in some peninsular varieties as well (p. 162).

(22) ¿Quiere hablarlo?
Want to talkCL.3.SG.ACC(DAT)
'Do you want to talk to him?'

Laísmo. Similar to *loísmo*, described above, the *laísmo* phenomenon occurs when speakers use the accusative clitic *la* in place of the dative *le* for a feminine indirect object, as in (23). This occurs in Madrid and the provinces of central Spain (Butt & Benjamin, 2004, p. 162).

(23) Él la dijo la verdad.
He CL.3.PL.ACC(DAT) told the truth
'He told her the truth'

Accusative clitic doubling. We saw above that the co-occurrence of the accusative clitic and its corresponding direct object noun is not grammatical (example 18). It is worth mentioning that, while this is true in almost all of the Spanish-speaking world, in Argentina this form is acceptable (Montrul, 2010).

Having reviewed the complexity of the Spanish object clitic system, a look at the English clitic system serves to understand what the learners' L1 grammar contains. Knowledge of the English clitic system is important to ascertaining whether it may be of help, a hindrance, neither, or both to learners when they are faced with processing Spanish clitics.

English Clitics: A Diversified System

The clitic system of the English language is characterized mainly by reduced forms whose syntax reflects that of their corresponding full forms[5]. Unlike the case of the Spanish clitic pronouns, there is still debate as to whether some English grammatical elements considered clitics by some linguists are indeed such, or whether

[5] Some linguists consider the possessive marker *'s* a clitic and this element does not have a corresponding full form (e.g., Anderson, 2008).

they are more characteristic of affixes. Dixon (2007) proposes an account of over thirty-five grammatical elements of spoken educated British English that, according to him, may function either as free forms or as clitics. Many of the clitics Dixon addresses exist in American English as well. Discussing both pro- and enclitics, Dixon bases his analysis of these elements (and their combinality) on the fact that they are phonologically unstressed when in reduced form and they must therefore lean on a host. He categorizes the clitics according to their full form grammatical classes, including (among others): nominal determiners (e.g. [sm.'kɑɹz] 'some cars'), prepositions (e.g. [fɹ.'æplz] 'for apples'), conjunctions (e.g. ['æplz.ən.'o.ɹən.dʒɪz] 'apples and oranges'), possessive pronouns (e.g. [ðɚ.'mʌ.ðɹ] 'their mother'), auxiliary verbs (e.g. ['hid.'lɛft] 'he'd left, he had left'), the negator *n't* (e.g. ['hi.'ɪznt] 'he isn't, he is not'), the possessive marker *'s*, and subject pronouns (e.g. [ʃi.'wɛnt] 'she went') and object pronouns (e.g. ['θɹo.əm.ə.'wej] 'throw'em away, throw them away').

The English clitic system, then, is quite different from the Spanish one. Aside from *'s*, it consists of reduced forms whose full form counterparts are still commonly found in language use and carry a variety of different functions, unlike Spanish clitics. More importantly, aside from the negator *n't*, English clitics show the same syntax as their full forms[6]. This is perhaps the biggest difference between English and Spanish clitics as systems, and one of the main differences between English and Spanish object pronouns. Next we examine the English object pronoun forms and syntax so that they may subsequently be compared with the Spanish ones.

[6] For more on the case of *n't*, see Zwicky and Pullum (1983).

The English direct and indirect object pronouns are shown in Table 1- 2. As discussed in the previous section, the English object pronouns may cliticize by phonetic reduction and leaning onto the host verb. This process of cliticization, while not affecting the pronoun's placement, does carry some syntactic restrictions, as will be discussed shortly. In what concerns placement, the pronouns observe the same behaviour, whether in full or cliticized form: they are always placed after the verb, either alone or in a PP, regardless of the verb tense, mood, or whether the verbal construction includes a modal, as in examples (24a-d).

(24)

a. Juan sees him everyday

b. Juan works without seeing him everyday

c. Juan wants to see him everyday

d. Juan, buy it.

The reduced forms do, however, behave differently than the strong pronouns in some respects. Like the Spanish clitics, they may not be modified (25a), co-ordinated (25b), contrastively stressed (25c), and they may not appear in isolation (25d), while their full forms can. In the case of ditransitive verb constructions with both accusative and dative objects specified, American English prefers either the dative pronoun followed by the accusative full NP (25e) or the accusative pronoun followed by the dative NP in a prepositional construction (25f)[7].

(25)

a. Juan knows him
Juan ['no^{w}.zəm]

[7] British English, like Spanish, does allow both accusative and dative pronouns in a construction, as in *Juan gave her it* and *Juan gave it her*. See Gast (2007) and Gerwin (2013).

Juan knows only him
*Juan knows [onliəm]

b. Juan knows him and her
Juan ['no^{w}z.'hɪm.'ænd.'hɹ̩]

Juan knows him and her
*Juan ['no^{w}zəm.'ændɹ̩]

c. Juan knows HIM, not you
Juan [no^{w}z.'hɪm.nɑ.'ʔu]

Juan knows HIM, not you
*Juan ['no^{w}.zəm.nɑ.'ʔu]

d. Who does Juan know? Him
Who does Juan know? [hɪm]

Who does Juan know? Him
Who does Juan know? *[əm]

e. Juan gave her a dog.

f. Juan gave it to her.

In sum, while there are some basic similarities between the Spanish and English object pronouns, there certainly are more differences in terms of inventory and behaviour.

Direct and Indirect Object Pronouns: Spanish *vis-a-vis* English

One main difference between Spanish and English object pronouns is their place in finite verb constructions. As we have seen, the Spanish object pronouns are placed before the verb while the English ones appear after it. Another important difference between the two systems lies in the nature of the pronouns. While both the Spanish clitics and the English cliticized forms share one of the features that has been used to classify clitics—unstressed and requiring a host on which to lean—they are very different. In what would become the first of several analyses of clitics, Zwicky (1977) proposed a distinction between simple from "special" clitics, as was mentioned above.

In this analysis, simple clitics are characterized by their being unstressed words that have attached to a neighbouring word, as is the case of the English negator *n't* in *We couldn't do it*, while "special" clitics are different because their historical derivation from their corresponding full forms is not readily apparent, and they show special clitic syntax (Gerlach, 2002; Zwicky, 1977). That is, they are not obliged to appear in the same place as their full forms or as the arguments they replace.

Zwicky's distinction clearly outlines the differences between English and Spanish object pronouns. Spanish clitics fall under the "special" clitics definition; they are derived from Latin, they do not consist of reduced versions of their strong pronoun counterparts, and they display a different syntax than these. English object pronouns, on the other hand, occur either in their full forms, or in a reduced version of them that leans on the verb, and both forms appear in the same position (postverbal).

Furthermore, English third person object pronouns contain gender and animacy features in the singular form (*him, her, it*) but not in the plural (*them*), while the Spanish clitics mark gender and number features in both singular and plural forms. Additionally, English pronouns have the same forms for both accusative and dative case while the Spanish forms differ. Finally, the Spanish dative and *se* constructions reviewed above show the variety of functions that the clitics represent within these structures, many of which do not coincide with the English dative pronoun functions.

Although there are a number of differences between the Spanish and English object pronouns, the present study focuses on the difference in word order; more specifically, learners' individual abilities in detecting non-target L2 word order during online comprehension, when the word order matches that of the L1. Liceras' (1985) analysis of production data from native English L2 learners of Spanish contained sentences with clitic constructions such as *Yo pongolo* 'I put it,' with the accusative clitics pronoun appearing after the verb, as it does in English. The notion of cross-linguistic influence, more specifically in this case, transfer from the L1 in L2 processing, is a subfield of SLA in its own right and there has been some debate over whether transfer in morphology and syntax really does occur (Odlin, 2003). It is not the purpose of this study to enter in this debate. Rather, it is understood that the production of such sentences can be indicative of some influence, or interference, that is exercised by L1 syntax on L2. If learners produce such syntax in writing, it seems logical that under the time constraints of online processing, such influence would be even more apparent. The question is whether and how individual differences in cognitive abilities as well as L2 VS help to overcome the effects of L1 word order transfer.

Cognitive abilities must necessarily work with the linguistic system(s) in place during online processing in order to parse incoming information. In this sense, the level of establishment of the L2 system influences processing, which may tax the cognitive system to a greater or lesser degree. The present study adopts a usage-based cognitive linguistics theoretical framework of the linguistic systems at play during L2 processing. The next section introduces the main tenets of the theory, after which the chapter continues on to explore the particularities of the Spanish clitics in a linguistic system conceptualized in the framework adopted.

Cognitive Grammar and L2 Acquisition: Basic Concepts

An important question at the heart of this study is how cognitive linguistics can serve as a framework with which to examine SLA and processing of Spanish direct and indirect object clitic pronouns. Before we can answer this question, we must understand the underpinnings of the theory and how these attempt to explain language as a complex social tool and cognitive construct.

The theory of cognitive linguistics belongs to the functionalist tradition of linguistic theory (Langacker, 1999). The functionalist perspective of language is built upon the premise that first and second (and subsequent) language acquisition and mental representation are based on experience with the language, and that linguistic constructions are symbolic in nature, "their defining properties of morphological, syntactic, and lexical form being associated with particular semantic, pragmatic, and discourse functions" (Ellis & Robinson, 2008, p. 4). This usage-based approach to grammar views language as having a primarily social function (Beckner et al., 2009) and as having first emerged from intense social interaction. As such, the study of language (indeed, language itself) cannot be isolated from the social context in which it functions. With this in mind, the most basic tenet of cognitive and functional linguistics is that the innate structures and abilities involved in the capacity to learn a language are not unique to language, but rather represent more general human cognitive functions (Langacker, 1987, p. 13). That is, grammar is constructed and shaped through repeated exposure to and experience with the language, which comprise a variety of related factors, including: "environmental, biological, psychological, developmental, historical, [and] sociocultural" (Langacker, 1999, p. 14).

Thus, while the functionalist perspective of linguistics is rightfully concerned with analysing and viewing language structure and representation in accordance with its social function, Langacker notes that functional motivating factors cannot by themselves fully predict language structure; we must acknowledge its cognitive representation:

"major aspects of linguistic structure reside in individual minds" (p. 19). This critical observation obliges the linguist to explicitly describe such structures, be they L1 or L2 configurations. In his model, Cognitive Grammar[8], Langacker (2000) describes language as "a structured inventory of conventional linguistic units" (p. 8). These units span the phonological, morphological, lexical, and syntactic continuum. The usage event, where cognitive processes attempt to map a form onto a meaning, including all its semantic, pragmatic, and discourse information, is at the heart of linguistic organization because it is through each instance of language use that a given linguistic element can reappear, prompting sequential processing and category formation. In this way, interrelated patterns of experience, social interactions, and general cognitive processes and perception lead to the emergence of language structures. Researchers have emphasized the importance of the quality of input available to language learners, as it provides the building blocks for grammar formation (Ellis & Collins, 2009) and affords them the opportunity to process large amounts of information in a second language by means of general cognitive abilities. Repeated processing of the input through general cognitive processes, including sequential processing and automatization, is what leads to acquisition. These concepts and others are crucial to an understanding of how cognitive linguistics views language acquisition and use. As such, they are explored in greater detail in the coming sections.

[8] Cognitive linguistics, being an extensively developed theory, offers different takes on how the linguistic system is structured and how it functions. This discussion will center on Langacker's conceptualization, for the most part, with supporting ideas from other scholars in the field whose approach complement his. Given its focus on language structure in individual minds, Langacker's approach is best suited in a project such as this one, whose aim is to understand how L2 structures are parsed.

The Symbolic Unit

One of the fundamental concepts in cognitive linguistics and its view of grammar formation is that of the unit. A linguistic element has the status of a unit when the speaker is able to employ it in an automatic manner, with no need to focus on its individual components or their arrangement (Langacker, 1987, p. 57). With this definition, units may extend across the continuum of linguistic elements. The basic sounds of a language are units for the native or fluent speaker, as there is no conscious effort required for their articulation. The same occurs with suprasegmental units that include syllables, pitch, stress, etc. Likewise, words and familiar phrases may also constitute units. More important for cognitive grammar is the symbolic unit: the construct that represents both lexical and grammatical structure as one. In other words, it constitutes the symbolic association between a phonological unit and its semantic specifications, which themselves make up a semantic unit (i.e. an established concept).

Langacker's definition of grammar as a structured inventory of conventional linguistic units refers to the vast array of symbolic units that make up a speaker's linguistic inventory, and to the fact that they are interrelated at various levels of hierarchy, thereby forming a structured network. For example, the phonological units [k], [æ], [t] are elements of the higher-order phonological unit [[k]-[æ]-[t]]. At the same time, the semantic unit [CAT] consists of all the characteristics that make up its concept. Together, [[k] [æ] [t]] and [CAT] form the even higher-order symbolic unit [[CAT]/[[k]-[æ]-[t]]]. This may then be combined with the symbolic unit, plural morpheme [[s]/[PLURAL]] to form a new symbolic unit, and so on and so forth. Conceptually, [CAT] may also be related with other symbolic units such as [FUR], [PURR], etc., as well as their corresponding phonological units. The network, therefore, consists of "hierarchies that overlap and intersect on a massive scale" (Langacker, 1987, p. 73).

While a morpheme represents the simplest kind of symbolic unit—in which the phonological and semantic units that comprise it participate as "unanalyzable wholes in a symbolic relationship"—simple symbolic units then chain together to form larger symbolic structures, which themselves become units in their own right (Langacker, 1987, p. 58). The difference between symbolic units is found in their degree of specificity. Increasingly larger symbolic structures, and all smaller symbolic units, form a large inventory of conventional expressions, known as grammar.

Crucial processes for the (L1 or L2) speaker, then, are the abilities with which he/she manages linguistic constructions such that they eventually come to attain the status of units in their mental representation, for it is by means of these processes that a grammar system is built. Robinson and Ellis (2008) note that, "Second language learners start with much larger units than words in developing constructional knowledge, but input-driven processes likely contribute to their segmentation" (pp. 501-502). Evidence for acquisition of formulae by classroom learners is discussed in Ellis (1984), who found that the three learners analysed had acquired the particular formulae most often used in the classroom environment. Similarly, Weinert (1994) found that learners in a classroom setting were able to produce complex target-like negation in German through memorization of complex forms in confined linguistic contexts after only a few months of instruction. In the case of the object clitic pronoun constructions seen in this study, all learners were made explicitly aware of the pronouns and their English equivalents, as well as their pre-verbal placement constraint in finite verb constructions, when first being introduced to the topic in the textbook and classroom lessons. The amount of exposure to context-dependent input is what is crucial to the formation of the symbolic unit.

As is seen in more detail in the coming sections, frequently repeated input is what allows the language learner's cognitive processes to begin discerning patterns and organizing grammatical structure. However, while child language acquisition is characterized by a relative regularity in incremental grammar formation (Lightbown & Spada, 2013), such that we can speculate that most children exhibit the same complexity of mental representations at a given age, adult language acquisition exhibits "tremendous inter-learner variation" (Doughty, 2003). This fact forces us to examine how L2 learners differ when parsing target language constructions, both from native speakers of the language and among each other. Again, as cognitive linguistics views the grammar system not as an independent module but rather as a system that encodes all form-function information in a complex network, the learner is not simply establishing representations of form, but rather representations of form-functions based on each linguistic encounter. The sum of all linguistic encounters as well as individual differences in cognitive abilities work towards the formation of a more complex grammar system. The smaller symbolic units in this system are more specific and therefore definite in nature; however, the larger symbolic structures only emerge when learners begin to discern patterns through sequential processing and automatization of context-specific input.

Sequential Processing and Automatization

Language does not exist in a vacuum. Linguistic expressions are assembled in the usage event, the structure in which form and "detailed, context-dependent conceptualization" join to forge a symbolic relationship (Langacker, 1987, p. 66). The usage event, then, is the building block for grammar structure, in that it provides the speaker with all the relevant information needed to make sense, so to speak, of the form-function relationship in all its aspects: phonological, morphological, lexical, syntactical, pragmatic. In order for the speaker to form a mental grammar, however, a high frequency of usage events containing a given form-function relationship is necessary, so that general cognitive processes may begin to cue into recurring patterns. Linguistic collocations are the basis for the learner's perception of patterns in the grammar.

Collocations—co-occurring/sequential elements—are simply chunks that are parsed as bracketed units and considered interchangeable with other elements of the same function. Ellis (2003) discusses an example of L1 acquisition. In the longer collocation [*Teddy's*] [*Gone*], the shorter collocation [*Teddy's*] is processed as a chunk and is replaceable by similar chunks such as [*The ball's*], [*Thomas the Tank's*], bare nouns as in [*Salad*] or noun phrases as in [[*Funny*] [*Man*]]. Increased repetition and frequency of such low-scope patterns yields a more abstract pattern [*X*] [*Gone*]. This process is essentially a slot-and-frame pattern of processing and acquisition, in which slot *X* can be filled with a variety of linguistic elements, and takes place along the spectrum of complexity of linguistic elements: formulae (lexical chunks), limited scope patterns, as seen with [*Teddy's*] [*Gone*], and higher-order constructions. While there are some obvious differences between L1 and L2 acquisition (discussed below), Ellis (2003) notes, "unless there is evidence to the contrary, it is a reasonable default expectation that naturalistic SLA develops in broadly the same fashion as does L1" (p. 72). That is to say, when formulae, low-scope patterns and constructions occur with enough frequency, automatization and a subsequent level of abstraction take place.

Automatization occurs by means of its precursor, sequential processing: parsing information in an orderly manner. Sequential processing is evident in the learning of patterned phone numbers (e.g., 628-9743) and letter strings (e.g., telephone). Indeed, sequences, when repeated across learning experiences, have been shown to become better remembered (Ellis, 2003). Repetition and frequency, therefore, play a crucial role in this process because they are what drive automatization. Each instance of use of a specific collocation adds to its habituation, defined as "a decline in tendency to respond to stimuli that have become familiar due to repeated or persistent exposure" (Haiman, 1994, p. 7). Habit formation is not limited to numbers and letter alone. Automatization occurs at all levels of complexity. When the drive to work every day on the same road becomes familiar, the specific landmarks along stretches of road are no longer noticed as they were the very first time they were encountered, but rather chunked into units, or whole stretches of road. As Langacker (2000) notes, "Through repetition, even a highly complex event can coalesce into a well-rehearsed routine that is easily elicited and reliably executed (p. 3). In language, when frequency of use of a particular collocation is high enough, habituation leads to automatization.

Automatization, also known as "entrenchment" (Langacker, 2000), "routinization" or "chunking" (Haiman, 1994; Ellis, 2003), involves this kind of processing sequences as a whole unit, a "pre-packaged" assembly (Langacker, 2000, p. 3; Ellis, 2008a) and leads highly frequent linguistic expressions to eventually become symbolic units. Langacker (1987) notes, however, that the nonunit/unit status is not to be viewed as dichotomous, but rather as continuous. That is, a given linguistic expression may be found on a scale of entrenchment, with a higher or lower degree of entrenchment, the higher degree attained as a function of increased frequency of use, until it reaches the status of symbolic unit (p. 59).

If, then, grammar consists of a network of elements and units at various levels of entrenchment, we must explain how humans manage to say anything new, rather than behave as robots, essentially regurgitating pre-established linguistic constructions. The answer to this question must begin with Langacker's (1987) statement: "an exhaustive description of language cannot be achieved without a full description of human cognition" (p. 64). That is, understanding how human cognition in general functions in a creative manner will allow us to explain how speakers form new sentences. If novel expressions are viewed as a problem-solving activity, the burden is on the speaker to construct the appropriate usage event that fits the particular set of circumstances at hand. The speaker is charged with the task of recognizing the symbolic potential provided by conventional linguistic units and using it accordingly, either by employing specified symbolic units in a novel manner, or by assembling novel complex symbolic structures. Likewise, the listener is charged with understanding/interpreting all the information coded in the novel arrangement of symbolic units put forth by the speaker. What the listener interprets from the usage event then contributes to the emergence of new grammar structures.

In fact, grammar is believed to have emerged, and to continue to emerge, from the interaction between speaker and listener through a process called grammaticization (also called grammaticalization), whereby lexical items acquire a grammatical function or grammatical items develop new grammatical functions over time (Hopper & Traugott, 2003). Beckner et al. (2009) state: "As soon as humans were able to string two words together, the potential for the development of grammar exist[ed], with no further mechanisms other than sequential processing, categorization, conventionalization, and inference-making" (p. 8). An example of grammaticization is seen in the construction 'be going to/be gonna' (Hopper & Traugott, 2003, pp. 88-90).

The construction originally had a purposive directional function that indicated the purpose for an action in progress, as in *I'm going to buy the milk*, where the construction expressed the agent's progressive action with the goal of buying milk. Through processes of inference and reanalysis, the purposive function changed to futurity, where *be going to* was first reinterpreted as signaling the intention to carry out the action in question, and subsequently as the claim that it would be carried out at a future point in time. Thus, *I'm going to buy the milk* changed from being interpreted as [*I am going* [*to buy the milk*]] to [*I* [*am going to*] *buy the milk*]. The future *going to* further underwent a phonetic reduction to *gonna*, a typical characteristic of frequent constructions, while the directional *going to* of *I'm going to London* did not experience this functional and phonetic change. The grammaticization process reveals how syntax and semantics are inextricably linked, and thus grammar and lexis are inseparable (Ellis & Cadierno, 2009).

The emergence and evolution of grammar are topics that carry important implications for analysing how the brain parses linguistic units. Ellis (2003) states that, "we learn [...] chunks from the very beginnings of learning a second language" (p. 75). Each usage event contributes to reinforce the entrenchment of a given collocation or unit and adds to the semantic content paired with the form. In the second language speaker, this does not extend to processes of inference/reanalysis, phonetic reduction and the formation of new grammar; however, the basic cognitive constructs are at play from the early stages of processing and acquisition, and, together with motivational factors, work towards the formation of a grammar system. Importantly, these basic cognitive functions do not operate alone but rather may be aided or supported by other cognitive systems closely linked to them.

As was stated in the introduction to this chapter, and as is explored in more detail in the following chapter, research suggests that WM contributes to second language processing. Ellis (2003, p. 76) notes that the notion of automatization, commonly referred to as chunking in psychology literature, has been central in research on short-term memory since Miller (1956) first introduced the concept. While the traditional definition of short-term memory is more storage-oriented, focusing on separate stores through which information is transferred, WM is conceptualized as a more process-oriented construct, in which both temporary storage of task-relevant information and active processing occur (Shah & Miyake, 1999). The ability to automatize co-occurring elements into chunks is discussed in several WM cognitive models of information processing because longer chunks encode more information, thereby allowing a greater amount of information to be maintained active within WM capacity limits (Cowan, 1999). What's more, automatization occurs with elements active in the WM (Schneider, 1999), for which it seems logical to speculate that a higher WM span may provide an advantage for a greater number of co-occurring elements to be automatized.

The more usage events (and input) occur for the L2 learner, the more sequential processing and subsequent automatization work to add to and reshape the grammar. Automatization alone, however, is not enough to form more abstract grammar representations. The next section takes a closer look at how automatized co-occurring elements/chunks become organized in the speaker's network of symbolic units.

Schematization

We have seen thus far that, from the perspective of cognitive linguistics, acquisition and use of grammar take place by means of general cognitive abilities that work to parse frequently occurring collocations as whole units, and that grammatical constructions are viewed essentially as "chunks—neuromotor routines—with movable parts" (Bybee, 2008, p. 220). This non-modular view of language development begs the question of how the learner organizes into mental representations higher-order conceptual and linguistic information. An important cognitive phenomenon discussed in cognitive linguistics is that of abstraction, or schematization. This process involves reinforcing the common features that span multiple recurring linguistic units or constructions in usage events, such that a less specific, and hence more abstract, notion is formed. For example, each instance of occurrence of an apple carries its numerous specific features with it: shape, texture, colour, spots on the skin, direction and length of the stem, smell, etc. The process of abstraction "'filters out'" the features that do not reoccur (Langacker, 2000, p. 4), retaining only the common features among all experiences with an apple, such that a more coarse-grained notion is formed.

Abstraction of common facets leads to the formation of schemas (i.e. schematic linguistic units). Schemas can, of course, occur at various levels of hierarchy. For example, in the construction *He walked*, a very specific instantiation of a third person

[+masc] subject carrying out the action of putting one foot in front of the other continually in the past is presented to the speaker. With frequent such instantiations, *He walked* attains the status of a symbolic unit that contains all relevant form-function information for its future usage and is schematic at a fine-grained level of specificity. Although symbolic units essentially act as prepackaged, automatized constructions, multiple occurrences of constructions that contain repeated features do allow for abstraction of those features. Thus, *He walked*, *He talked*, *He shopped*, *He stopped*, *He wrapped* allow the speaker to schematize a less specific schema He + Verb-ed, or the even more abstract one Subject + Verb-past tense suffix. The higher the level of abstraction, the less specificity the schema contains of the properties of the multiple instantiations of the usage event. In other words, the higher the schema is on the hierarchical plane, the less defined are its features.

Schemas may exist for all linguistic and conceptual—phonological, semantic, symbolic—domains of their instantiations, as well as at several hierarchical planes. Take, for example, the schema for *away*. On the distance scale, it is high on the level of abstraction relative to the more precise specification *over 300 miles away*, which imposes a restriction on the values on the scale, thereby increasing its level of specificity. Still, while *over 300 miles away* is a more specific schema relative to the more abstract *away*, it is more abstract relative to *about 300 miles away*, whose schema contains an even higher level of specificity, and thereby lower level of abstraction. Abstracting course-grained features at various levels, as shown above, is an inherent cognitive ability that allows linguistic structures to be derived from primary data (Langacker, 1999, p. 25).

For the verbal constructions in this study, the notion of schematization is particularly noteworthy because the different possible positions for the object clitic pronouns with respect to the verb point to the existence of schemas for these constructions, at various levels of abstractness. The fact that the clitics appear before finite verbs yet may appear after non-finite ones confirms what may seem obvious: that the schema contains information about, among many other things, the placement of the clitic with respect to the verb. Thus, of the possible schemas at various hierarchies of abstractness for finite verb object clitic pronoun constructions, one may look something like: (dative clitic pronouns) + accusative pronoun + finite (di)transitive verb, and would include, though it has not been expressly written in the formula here, information regarding the referent(s) (i.e., gender, number, animacy [for some varieties of peninsular Spanish]), the corresponding clitic pronouns, the verb's semantic specifications, etc. As already discussed, this syntax does not match that of English object pronoun constructions, which poses an additional challenge for the L2 learner, in that s/he must inhibit potentially irrelevant schemas that may become activated while parsing in the L2. As one of the main roles of EF is inhibiting dominant responses, a high level of EF ability may aid in noticing clitic placement errors, even when the specific placement order does correspond (at least partially) to an existing schema in the learner's L1 representation.

Schematic representation of language, while vast and complex, is not disordered. Schemas at all levels of hierarchy (abstractness) are organized through the categorization process, which works to make them accessible in a cognitively efficient manner, for both comprehension and production.

Categorization

Through a process of categorization, linguistic units are arranged in a hierarchical schematic network containing all possible types: phonological, semantic, and symbolic. Categorization occurs as a way to organize stimuli in the brain. As Taylor (2008) notes, the emergence of cognitive linguistics was largely influenced by Eleanor Rosch's early work in prototype theory using colour categories (pp. 39-40). Rosch's findings showed that colour categories in cognition do not have clear-cut boundaries, but rather are represented in terms of a prototype of a given colour surrounded by others either closer to or further from this prototype, depending on their similarity to it.

Linguistic elements operate in the same way. They are not classified as belonging to a particular category or not, but rather are analysed for how well they represent a particular category. This concept in prototype theory has been called goodness-of-exemplar (Croft & Cruse, 2004). Thus, "categories have graded structures, with some members being better exemplars than others" (Ellis & Larsen-Freeman, 2009, p. 95). The prototype is simply the best example of a given category and less representative exemplars will be measured and classified against it. In other words, the prototype is the typical example of a given category. For instance, *carrot* would probably be classified as a prototype for the category VEGETABLE whereas *basil* may not be prototypical but still occupy a space somewhat near the prototype in the psychological space.

Having introduced, at this point, both the concept of schema and that of prototype, the question arises as to what exactly the difference between the two is, and what role each plays in categorization. From the definition and examples given above, we can deduce that a schema is an abstract characterization of whatever generalizations can be extracted from specific instances of items. Crucially, the schema must be fully compatible with all members of the category it defines. A prototype, on the other hand, is a typical instance of the category, and elements are categorized by comparison to their perceived similarity to it (Langacker, 1987, pp. 370-371). With regards to categorization, Langacker suggests that the two are not incompatible, and can, in fact, play complementary roles in creating and modifying the linguistic network.

The key lies in recognizing that, if a linguistic instantiation is judged as sufficiently similar to a prototype such that it can form part of the category delineated by the prototype, albeit at is outer edges, the perceived similarity must also have its own mental representation: "grasping the commonality of two structures requires abstraction" (Langacker, 1987, p. 373). Langacker suggests that this representation of the commonality perceived between the prototype and the linguistic instantiation is the schema (Langacker, 1987, pp. 372-373). Conceptually, then, the schema occupies a higher space in the conceptual area than the prototype in that it contains whatever generalizations allow us to judge the distance between an instantiation and a prototype as acceptable.

In this type of perceptual processing, "as more and more instances [of symbolic units] are processed, so the representations of these exemplars become sorted and positioned in psychological space so that similar items are close together and dissimilar ones are far apart" (Ellis, 2008b, p. 390). In language, categorization is the assessment of the features of a usage event in relation to linguistic units (Langacker, 2000). That is, the activation of a linguistic unit with some aspect of the usage event. If the categorization of a particular linguistic unit and a given usage event feature is frequent, the symbolic unit becomes conventionalized and is recognized as a prototypical exemplar. Less frequent categorization, or one in which the categorization is an extension of the prototype, is perceived as less well-formed. In other words, linguistic units are not merely categorized according to abstract representational features but also according to how those features are manifested in the usage event. Thus, linguistic units are categorized at all levels. Together, then, abstraction and categorization lead to the formation of interconnected categories that span the phonology, morphology, syntax, semantic, discourse and pragmatics continuum.

However, category membership is not a notion without its issues. Although diagnostic tests have been developed to identify whether, for example, a noun phrase is the subject of a verb, Taylor (2008) notes that in some cases an item does not pass all the tests, thereby making it a marginal member of a category. Such is the case with the categorization of *there* in *There's a man at the door* and *There's a man been shot*. Another gray area is the distinction between determinative possessives such as [*a man*]*'s skull* and descriptive possessives such as *a* [*man's skull*] (Taylor, 2008, p. 55). These kinds of elements fall in an indefinite area for native speakers in terms of categorization, and so it is feasible to posit that they pose challenges for L2 learners as well.

At the highest level of schematicity, Langacker (2010) identifies two fundamental grammatical categories, according to prototype: noun (physical object/thing) and verb (force-dynamic event/process), both highly abstract—semantically and phonologically. According to Langacker's model, those prototypes can be further abstracted into schemas representing basic cognitive abilities. The noun category (thing) is the product of grouping, or reification, for example *set*, *team*, *collection*, etc. A physical object is simply a splotch of substance whose prototype is characterized by very low-level, automatic reification: "[a]s used in Cognitive Grammar, the term 'entity' is maximally schematic, implying no specific properties or individual cognitive salience" (Langacker, 2010, p. 453). Focusing on the *thing* in a complex array of relationships allows for identification of the "splotch" as such.

Conversely, verbs reflect the cognitive system's focusing on the relationship between entities. The schematic definition of verbs, then, is a relationship that is being sequentially scanned through time. Verbs are particularly schematized as temporal relationships between entities. For example the verbs *walk*, *talk*, *finish* all represent various relationships between entities over time. *Walk* represents a temporal relationship between a person, a physical space in which a person moves, rate/manner of motion, one foot being placed in front of the other, etc. On the other hand, relationships between entities may also be atemporal if the relationship consists of a single state or is viewed as a summary of previous temporal relationships. In this way, adjectives, adverbs and adpositions, as well as participles and infinitives, are considered to be abstracted into atemporal relationships. Crucially, the lexicon and all grammatical categories are viewed as assemblies of symbolic structures at different levels of schematicity.

The high level of abstractness described above, although important in understanding how the theory views language representation in the brain for (multilingual) speakers of all languages, does not serve very well in the present task of honing in on the individual differences observed in L2 learners linguistic performance. In order to better understand why these individual differences arise, it is necessary to focus on, among other things, the cognitive processes by which language representation is formed, the cognitive abilities of the individual learner, and the differences in schemas at a more concrete level (as these may be the root of L1 transference), as well as the categorization of the Spanish clitic object pronouns in verbal constructions.

This categorization involves the assessment of several features: the anaphoric relationship with its antecedent to determine case, gender and number features in the specific usage event. Additionally, the verbal construction as a whole plays the crucial role, as the verb valence[9] sanctions the clitic (or full NP), and the clitic's pre-finite-verbal position forms an integral part of the linguistic structure. Lastly, because the usage event unites linguistic units with function/meaning, all semantic content is valuated as well and, together with all the aforementioned features, measured against the category's prototype. For the L2 learner, this translates into a complex task, especially in online processing, and can potentially tax the cognitive system. For this reason, greater WM capacity, EF abilities and VS may serve to enhance processing such that less well-formed exemplars are actually perceived as such.

We've seen thus far the cognitive processes of automatization, schematization and categorization. These and other concepts have been used in L2 processing and acquisition research, and have proven to be adequate frameworks for interpretations of results. The aim of the next section is to show how the concepts in this theoretical

[9] The concept of valence, originally developed by French linguist Lucien Tesnière (1959), is used in Cognitive Grammar to describe the relations among parts of a construction. With regards to verb valence, it is similar to the generative grammar concept of subcategorization, though it espouses a symbolic understanding of relationships. Valence is discussed in more detail below.

context can help interpret and explain the findings. Crucially, it reminds us that language does not exist in a vacuum, neither for the child nor for the adult language learner, and as such, the learners' linguistic behaviour must be viewed in light of language usage and exposure to said usage.

Cognitive Linguistics, Second Language Acquisition, and Processing

Researchers have emphasized the importance of the quality of input available to language learners, as it provides the building blocks for grammar formation (e.g., Ellis & Collins, 2009; Gass, 2003). Several factors that come into play in determining the cognitive formation of linguistic constructions. Studies have shown that input frequency is a crucial aspect of acquisition (e.g., Ellis & Larsen-Freeman, 2009; Gass & Mackey, 2002). Indeed, frequency effects have demonstrated that language learners are sensitive to input, which suggests that they register patterns of occurrence in processing (Ellis & Cadierno, 2009; Ellis & Collins, 2009).

Input frequency can affect various levels of the linguistic system. For example, type and token frequency differ in their ways of affecting the cognitive linguistic system. Type frequency refers to the number of times a particular form appears in the input while token frequency counts the different lexical items that can be substituted in a slot in a construction. The latter can occur at a word-level construction—for example, the English past tense -*ed* is highly frequent and accepts many verbs in the preceding slot—or at a syntactic-level construction that specifies the relation among words. Type frequency is important because it leads to automatization of forms and facilitates processing. Crucially, though, it is high token frequency that is responsible for the productivity and learning of phonological, morphological, and syntactic constructions because it reinforces categorization (Bybee, 2008; Ellis & Cadierno, 2009; Ellis & Collins, 2009; Ellis & Larsen-Freeman, 2009).

Although the process is carried out in essentially the same way for both the L1 and the L2, there are some crucial differences. Ellis (2008b) notes that children's categorization of phonemes depends on their L1 and therefore sound differences that cross a phonemic boundary will be discernable by speakers of a language in which that boundary is set as such, as opposed to speakers whose language does not contain a (phonemic) boundary between two sounds. He further specifies that very young children do not categorize individual speech sounds or phonemic segments, but rather that lexical items become more fully specified and undergo segmental restructuring in middle childhood (p. 392). Such is not the case with the L2. Ellis (2008b) explains that, due to the L2 learner's neocortex having been already tuned into the L1 and incremental learning being slowly committed to a certain configuration, the network is no longer able to return to its original plasticity (Ellis, 2008b, p. 393). Studies of adult sound perception have shown evidence for this: Adult native Japanese speakers were unable to distinguish /r/ and /l/, two separate phonemic categories in English, because they belong to the same category in Japanese (Iverson et al., 2003).

Recall that input frequency of token and type are important because frequency effects have indicated that language users are sensitive to highly occurring patterns. The same effects have also been found in the form of Zipfian distribution (Ellis & Cadierno, 2009; Ellis & Collins, 2009; Ellis & Larsen-Freeman, 2009). In natural language, Zipf's law explains how the highest frequency words disproportionately make up most of the linguistic tokens. When learning categories from exemplars, acquisition is characterized by a low-variance sample focused on prototypical exemplars, which allows learners to pinpoint what will comprise most of the category members. The category bounds are specified later, through experience with the multitude of exemplar types.

The ways in which frequency affects language can differ between the L1 and the L2 input. Bybee (2006) reviews three effects of frequency on L1: phonetic reduction, conservation, and autonomy. Phonetic reduction refers to the cases in which high-frequency words or phrases are pronounced with a shorter duration of phonetic segments due to the repetition of neuromotor routines. For example English *going to* pronounced [gənə], *I don't know* pronounced [arəno^{w}] or the deletion of the Spanish intervocalic fricative [ð], as in *hablado* ('spoken') pronounced informally as [aβlao]. Conservation concerns the morphosyntactic structure of high frequency forms that resist regularization, as opposed to their low-frequency counterparts. For example, where the English past tense of *weep* was *wept*, it is in the process of regularizing to *weeped*. The same cannot be said about *kept*, which conserved its irregular form due to its higher frequency (Bybee, 2006; Hopper & Traugott, 2003). Finally, autonomy, related to conservation, occurs with high-frequency morphologically complex forms that become autonomous from etymologically related forms. As an example, *went* used to be the past tense of the verb *wend*; however with increased frequency (and for reasons unknown), it became the past tense of *go* (Bybee, 2006).

Through phonetic reduction, frequency also leads to homophony and polysemy (Ellis, 2008a). For example, many frequently used words are homophones, such as *to*, *too*, *two*; *there*, *their*, *they're*; and *I*, *eye*. Because in these cases the linguistic system is forced to map various meanings onto one phonological form, these frequent words can become ambiguous out of context. Such is the case, with some of the clitic pronouns examined in this study: the feminine accusative singular and plural *la* and *las*, and the masculine accusative plural *los*. While these L1 frequency effects do not necessarily occur in the L2 input and output through the L2 learners' frequency of use, one in particular has serious effects for L2 acquisition. When forms are phonetically reduced due to frequency, or when their phonetic structure is altered by informal, rapid speech and frequent use, their boundaries with other surrounding morphemes are blurred, thereby making them more difficult to perceive. According to Ellis (2008a), "[c]litics, accentless words, or particles that depend accentually on an adjacent accented word and form a prosodic unit together with it, are the extreme examples of this blurring" (p. 236). For example, the /s/ of *he's* or the /v/ of *I've* cannot be pronounced in isolation; they are unstressed bound morphemes that represent cues that are difficult to perceive. This difficulty with perceiving cues occurs not only with bound morphemes but with grammatical function words as well, such as prepositions (e.g., *by*, *for*) because they are of low salience.

Low salience cues such as grammatical particles and inflections are learned with more difficulty by L2 learners (Ellis & Collins, 2009) precisely due to their relative weakness in the input. In addition, in many cases, the issue with low salience cues gets compounded with cue redundancy, which leads to "overshadowing" and "blocking" (Ellis, 2008a). Cue redundancy occurs when a cue other than the low salience bound morpheme or function word is present in the discourse and leads to the same outcome. This cue, usually lexical in nature, has a higher salience than the grammatical one.

Temporal adverbs clearly demonstrate this process. In utterances such as *Tomorrow I'll go to the movies* and *Yesterday she walked ten miles*, the temporal adverb is more salient and therefore likely to be processed first, rendering the morphological cue superfluous in terms of the information that it provides. In examples such as these, the more salient cue overshadows the less salient one. It is important to note that the learner's selective attention plays an important role in this process. When a cue is experienced along with another cue that is a known strong predictor of the outcome, the learner focuses her/his attention on the strong predictor, and the less salient cue is blocked from being perceived as predictive of the outcome. Redundant cues, which can also be the less salient morphemes such as the ones discussed above, tend to be acquired more difficultly (Ellis & Collins, 2009).

Certainly, the saliency of the Spanish clitic pronominal forms examined in this study is an issue that must be considered. While they cannot be said to be completely redundant, they represent a clearly stated antecedent that carries a much larger lexical weight than clitics do. Additionally, they are unstressed and phonologically lean on the host verb. Their absence, lack of gender and number agreement, or erroneous placement with respect to the verb can therefore be undetected, specifically if the meaning of the sentence is likely to be gleaned by the lexical elements. In this case, EF may play a role in the selection of input. As Robinson (2003) states,

> [...] selection is [...] a response to *control processes* such as attention allocation policy, scheduling and switching between concurrent task demands, and strategy monitoring. Selection of linguistic input is therefore just one aspect of action control, guided by the supervisory attentional system and executive control mechanisms. (p. 635)

EF, discussed in greater detail in the following chapter, may direct attention on the low-salience element, thereby inhibiting the tendency to overlook it. This may be particularly valuable at lower proficiency levels, where much of the input is not yet automatized. The more automatized the constructions that are being processed, the less input selection must occur, as fully automatized units are more easily accessible for processing (Ellis, 2003, p. 75).

Central to the discussion in the chapter thus far has been the notion of the symbolic unit, the construct that represents the union of a phonological unit and its semantic specifications. At a high level of schematicity, the Spanish object clitic pronouns could be categorized according to their abstract functions. As noted above, Maldonado (2002), for example, has proposed an underlying meaning for all dative constructions: that of a participant being affected. Notably, the linguistic form cannot be divorced from its function when examining its processing or acquisition, which is precisely why the notion of "clitic" becomes problematic when attempting to deal with the processing/acquisition of a grammatical class whose exact nature finds no consensus among researchers. The next section examines clitics in terms of theoretical analyses that have been carried out in an attempt to define and classify them.

Cognitive Linguistics and Clitics

Research in the nature of clitics has focused on different aspects of their behaviour and/or nature. Early studies consisted mainly of descriptive analyses aimed at determining their behaviour and categorizing them accordingly. In his body of research, Zwicky (1977, 1982, 1985, 1994) has put forth several analyses to determine the nature and typology of clitics. In one of his earlier works, a descriptive pre-theoretical study, Zwicky (1977) distinguished simple from "special" clitics, as briefly discussed above. In this analysis, simple clitics are characterized by their being unstressed words that have attached to a neighbouring word, as is the case of the

English reduced form of the auxiliary *had* in *He'd left* (*He had left*), while "special" clitics are different because their historical derivation from their corresponding full forms is not readily apparent, and they show special clitic syntax (Gerlach, 2002; Zwicky, 1977). That is, they are not obliged to appear in the same place as their full forms or as the arguments they replace. As an example, (26) shows the Spanish direct object clitic (pronoun) *lo* in preverbal position (26a), where its corresponding NP would appear in postverbal position (26b). Additionally, as is the case with all Spanish clitic pronouns, the historical derivation of *lo* from Latin is no longer apparent in modern Spanish.

(26)

a. Juan lo ve todos los días
Juan CL.3.SG. ACC sees all the days
'Juan sees him everyday'

b. Juan ve a su hermano todos los días
Juan sees PRON his brother all the days
'Juan sees his brother everyday'

Beyond descriptive studies, the most cited theoretical examinations of clitics have been carried out from the perspective of generative grammar. This theory differs from the cognitive linguistics perspective described above, in that its basic assumption is that grammar representation in the mind is separate from the lexicon, and is innate in humans. While this study does not adopt a generative grammar perspective, briefly reviewing the main foci of clitic research serves to show that a usage-based theory lends itself to a more flexible explanation of these elements. The attempt in studies of clitics from a generative grammar perspective has been to find universal rules governing cliticization, that is, the positioning and attachment of a clitic to its host (Klavans, 1985), as well as clitic sequence ordering (Perlmutter, 1971) and whether clitics are generated lexically (their ordering being non-syntactic) or syntactically in the deep structure

(Noyer, 2001). In a parallel vein, other investigations have attempted to determining the grammatical nature of unclear cases, i.e. clitics whose behaviour is not clearly determinable (e.g., Anderson, 2005; Bermúdez-Otero & Payne, 2011; Carstairs, 1981; Muysken, 1981; Zwicky & Pullum, 1983). These studies have led to the impression that clitics are, indeed, problematic as a grammatical "class."

Zwicky (1994) addressed this very question by proposing a new meaning of the term "clitic." Because many of the forms referred to as clitics across languages do not share any common features, Zwicky (1994) suggests that "clitic" is more of an umbrella term used to encompass a variety of phenomena that display marked properties. His starting point was precisely the fact that the peculiarities that characterize these forms encompass phonological, morphological and syntactic domains. As previously stated, clitics' phonological peculiarities include the fact that they are generally unstressed and thus cannot appear on their own, their morphological characteristics include the order in which they combine with each other, and their syntactic distinctiveness includes their position in a clause (e.g., Wackerngel's position[10]), clitic climbing[11], and clitic doubling[12].

In this new account, Zwicky (1994) reviews morphemes that span the spectrum from grammatical category lexemes (e.g. the determiner *more* or the possessive preposition *of*), to morphologically bound phrasal affixes (e.g. the plural marker *'s*). Grammatical category lexemes are marked because, although they are lexemes, they

[10] Jacob Wackernagel was the first to propose a universal position for enclitics—those clitics occurring after their host morphemes—in Proto-Indo-European languages. His conclusion from observing data from Greek and a number of other Indo-European languages was that (en)clitics appear in second position in the phrase or sentence (Anderson, 1993).

[11] In generative grammar theory, clitic climbing occurs when a clitic pronoun appears before a non-finite verb position. See example (10a).

[12] Clitic doubling occurs when both the clitic and its referent NP are manifested in the clause. See example (18).

lack concrete lexical meanings. Rather, they display affix-like behaviour in that they express grammatical categories such as case or tense, for which they are often referred to as functional words, or closed category words. At the opposite end are phrasal affixes. These elements that behave like inflectional features and are also morphologically special in that "they are located in an extra, outer layer, of inflection in morphology," (Zwicky, 1994, p. xix) as we saw in the case of the possessive *'s*. Along the spectrum, then, clitic morphemes display lexeme-like properties on one end and affix-like properties on the other.

This concept of a spectrum on which different types of clitics may fall depending on the features they display is reminiscent of the concept of grammaticization, discussed above, where we saw that lexical items acquire a grammatical function or grammatical items develop new grammatical functions over time (Hopper & Traugott, 2003), as was the case with *be going to*/*be gonna*. Thus, similar to the spectrum described by Zwicky, on one end of the grammaticization scale resides a lexical element, while on the other end is its fully grammaticized form. The notion of clitic formation through grammaticization is ideal, not only because it demonstrates the path of evolution of the element in question, but also because, in doing so, it does away with the fixed, static features and properties put forth in the generative grammar theoretical proposals in the studies mentioned above and opens the way to a more integrated explanation of clitic phenomena.

In a usage-based account of clitics, grammaticization explains how they are historically generated. Grammaticization is characterized by a cline, where the element in question evolves from less grammatical to more grammatical in nature. The cline of grammaticization of affixes discussed by Hopper and Traugott (2003) is: lexical item in a specific syntactic context > clitic > affix. In this path, the clitic represents a point between two extreme poles, a gradient where the lexical properties fade while those of the affix emerge. In this perspective of gradual change, the emerging elements, while displaying more grammatical properties, may still retain some of the more lexical properties of their previous forms, for the categories are not discrete. It is precisely this coalescence at the edge of each category that explains why clitics display such differing features both within and across languages. As they exist at different positions on the path, so they reflect those characteristics particular to their place on the path.

This being said, as Hopper and Traugott (2003) note, "not every instance of grammaticalization involves morphologization [i.e., the development of clitics into inflections]. For example, modal auxiliaries in English are grammaticized out of earlier full verbs, but they have not (yet) become affixes" (p. 141). The same holds for the Spanish object clitics examined in this study. They may or may not become affixes; however, we must always bear in mind that they are on a path whose evolution is specific to the constructions within which they occur: "It is the frequent syntactic collocation of a particular word class, [...], with a particular type of clitic, [...], that leads to morphologization," (Hopper & Traugott, 2003, p. 142) just as the frequent syntactic collocation of specific verbs and the full pronominal forms led to their cliticization[13].

What this evolution signals is that, while the features of the clitic seem quite fixed synchronically, they are also flexible enough to allow for diachronic grammatical

[13] Here "cliticization" refers to the process by which a lexical element becomes a clitic. This definition (Hopper & Traugott, 2003) is different, although related, to Klavans' (1985) definition used above, the position where a clitic can occur in a tree structure, and how a clitic attaches to a host.

change. This possibility must be in some way encoded in the schema, even if just through a lack of rigidity in phonetic form or word order. In fact, in Cognitive Grammar clitics do not constitute a unitary class because they represent a plethora of different grammatical information, much like inflected forms, depending on the clitic and the language. Rather, they are analysed in context, in the constructions in which they appear. For this study then, the constructions analysed are those involving: 1) third person accusative clitic pronoun + simple finite verb; 2) third person dative clitic (recipient or beneficiary) + simple finite verb; 3) third person accusative clitic pronoun + complex (auxiliary) finite verb; 4) third person dative clitic + complex finite verb. The verbs involved in these constructions are, of course, transitive or ditransitive. While traditional grammatical terminology of transitivity will serve our purposes here, before examining the schema for each construction, a brief explanation of the concept of valence in Cognitive Grammar is warranted, as it serves to better understand what features constitute the schemas for these constructions.

Valence is a symbolic concept that captures the notion of syntactic relations among all elements in a structure. In this view, a predicate has a semantic substructure that requires an argument. For example, in the sentence 'Tom walks,' the predicate 'walks' presupposes the concept of a walker in its substructure. Langacker uses the term "elaboration" for an argument filling the role of a predicate (Langacker, 1987, p. 304; Croft & Cruse, 2004, p. 281). Thus, *Tom* elaborates *walks*. Importantly, a unit in a given structure may function both as a predicate and an argument, as in the sentence *Tom wants to hear the music*, where *to hear* elaborates the substructure of *wants* and *the music* elaborates the substructure of *to hear*. In this way, valence is said to be relative, in the sense that the status of predicate and argument depend which semantic structures are compared (Croft & Cruse, 2004). In addition, valence is also said to be gradient in Langacker's Cognitive Grammar. An example of this is the phrase *in the kitchen* in the sentence *Tom hears the music in the kitchen*. Traditionally referred to as an adjunct, in Cognitive Grammar it is viewed as another valence relationship in which it functions as the predicate. In this interpretation *hears* elaborates a substructure of *in the kitchen*, though certainly not to the same degree as the valence relationships that characterize what are in traditional grammar called complements. It is in this sense that valence is said to be gradient.

In this particular study, the valence relationship that is most pertinent, though certainly not the only one that plays a role, is the one that characterizes the object clitic construction. In what is traditionally called a direct object construction, the accusative (pro)noun is explained in Cognitive Grammar as being the prototypical instance (i.e., the prototype of the category) of the tail—the final participant—of an action chain (Langacker, 2008, p. 391). The dative (pro)noun is conceptualized as an experiencer of the action chain, or, as Maldonado (2002) proposed, that of a participant experiencing an effect. In the accusative clitic construction, therefore, the verb is elaborated by the direct object, the tail, while in the dative construction, it is elaborated by the indirect object, the experiencer[14]. Crucially, in this study, the object constructions analysed do not contain the full NPs but rather their corresponding clitic pronouns.

[14] The verb is also elaborated by the subject (i.e., the doer of the action); however, this valence relationship and all others among the elements in the sentences, while playing an important role in processing language, are not analysed in this study.

In light of this, it is equally important to know how pronominal anaphora is understood in Cognitive Grammar, as anaphora is an integral part of Spanish clitic constructions. At the root of the anaphora is the reference point relationship, which consists of a dynamic mental scanning in which a first entity, called the reference point, is invoked to establish mental contact with a second entity, the target. This occurs within a conceptual dominion of a number of possible targets, such that once focus shifts to the target, the activation of the reference point fades into the background (Langacker, 2008, pp. 82-85). Thus, in the sequence of sentences *Look at that dog over there; his tail is very long*, the *dog* is the reference point and *tail* is the target.

Pronominal anaphora is said to function in the same manner. It is a type of reference point phenomenon in that the antecedent nominal is the reference point and the pronoun is target. Examples (26a,b) show how this works. Here, the man's daughter (*niña*) is the reference point and the accusative clitic pronoun *la* is the target. In this relationship, the pronoun has the special property that identifies it as the reference point itself, such that the reference point and target are coreferential (Langacker, 2008, p. 509). It is the reference point's prominence[15] within this portion of its dominion that allows it to impose itself as the target. That is, *niña* is sufficiently prominent in its dominion that it is interpreted as the target clitic pronoun.

(26)

a. El señor perdió a su niña durante la fiesta.
The man lost PRON his daughter during the party
'The man lost his daughter during the party'

b. La mamá la buscó por una hora.
The mother CL.3.SG. ACC looked for for one hour

[15] The concepts of topic and subject in discourse play an important role in pronominal anaphora and the reference point's prominence. For further reading, see Langacker (2008, pp. 512-517).

'The mother looked for her for one hour'

The anaphoric relationship, valence relations and all other features contribute to the schemas for the object clitic verbal constructions examined in this study. We will recall that schemas represent the abstracted features of frequent collocations. In processing, schemas are accessed by "aris[ing] within expressions, as recurring aspects of the processing activity that constitutes them" (Langacker, 2008, p. 219). This crucial definition enables us to conceptualize the complex task that processing these Spanish clitic constructions as an L2 learner entails. Categorization (schematization) must involve the assessment of the anaphoric relationship with its antecedent to determine identity (i.e. the target). At the same time, the valence relationship is also assessed to determine case, gender and number features in the specific usage event. Crucially, the verb tense is measured to determine word order evaluation, this being an integral part of the schema. All these features, along with the semantic content, must be verified and measured against the prototype to determine category membership.

It should come as no surprise by now that L2 learners struggle with achieving native-like competence in target-language processing, especially at lower proficiency levels, where schemas may still be in various levels of formation and not as easily accessible as the L1 schemas. It is, without a doubt, quite the taxing task for the cognitive system. Importantly, these general cognitive processes and input frequency should not be overlooked in studies of (second) language processing, acquisition and representation, for they are the driving force behind language development.

Thus far, this chapter has explored the theoretical underpinnings of cognitive linguistics, more specifically, Cognitive Grammar, as a usage-based theory that views grammar as a conventional system of symbols anchored in the usage-event. We have seen how the cognitive processes of sequential processing, automatization, schematization and categorization work to form an interconnected web symbolic units at various levels of abstraction. In addition, we've reviewed the Spanish and English clitics, and their behaviours, as well as theoretical considerations of clitics as a grammatical class. The following chapter explores the research on Spanish L2 clitic acquisition and processing, in a review of what has been found thus far so as to understand how the present study, situated within in a cognitive linguistics framework complemented by cognitive psychology constructs (WM, EF) and VS, can add to the body of knowledge on L2 processing of Spanish clitics.

Table 1-1. The Spanish Clitic System

		1st person		2nd person		3rd person			
Case	Num.	Masc/Fem		Masc/Fem		Masc		Fem	
		CL	Strong	CL	Strong	CL	Strong	CL	Strong
ACC	SG	me	a mí	te	a tí	lo	a él	la	a ella
	PL	nos	a nosotros	os	a vosotros	los	a ellos	las	a ellas
DAT	SG	me	a mí	te	a tí	le	a él	le	a ella
	PL	nos	a nosotros	os	a vosotros	les	a ellos	les	a ellas
REFL	SG	me	a mí	te	a tí	se	a si mismo	se	a si misma
	PL	nos	a nosotros mismos	os	a vosotros mismos	se	a si mismos	se	a si mismas

Table 1-2. English Object Pronominal System

		1st person	2nd person	3rd person		
Case	Number	Masc/Fem	Masc/Fem	Masc	Fem	Inanimate
ACC	SG	me	you	him	her	it
	PL	us	you	them	them	them
DAT	SG	me	you	him	her	it
	PL	us	you	them	them	them
REFL	SG	myself	yourself	himself	herself	itself
	PL	ourselves	yourselves	themselves	themselves	themselves

CHAPTER 2
L2 CLITIC ACQUISITION AND PROCESSING

In this chapter, we begin by examining the literature on acquisition and processing studies of L2 Spanish clitic pronouns, where we will see that learners both produce non-target verb + clitic word order and show the ability to acquire the target order. Thus, the question becomes what individual differences might aid learners in said acquisition. The chapter then proceeds with a look at some studies of L2 online processing, particularly those that employ eye-tracking methodology, and their contributions to the field of SLA. We end with a review of the three factors of individual differences whose role is examined in the present study: WM, EF and VS.

Research in Spanish Clitic Acquisition and Processing

Investigation in the acquisition of L2 Spanish clitics assumes different approaches, thereby focusing on different aspects of their acquisition, such as the nature of instruction and input (e.g., VanPatten & Cadierno, 1993; VanPatten & Sanz, 1995; Salaberry, 1997; Camps, 1998; Rell, 2005), interlanguage representation (e.g., Liceras, 1985; Duffield, Prévost & White, 1997; Duffield, Montrul, Bruhn de Garavito, & White, 1998; Duffield & White, 1999), and learnability and processing (e.g., Klee, 1989; Zyzik, 2004; Zyzik 2006a; Zyzik, 2006b). As in all SLA studies, some works look at comprehension while others examine production; some examine data from reading and/or writing, while others focus on listening and/or speaking. We will see from these studies that L2 Spanish clitic acquisition and processing is multifaceted and complex.

From an instructional- and input-based viewpoint, VanPatten has researched Spanish L2 clitic acquisition by basing himself on his input processing model (IP), highlighting that it "is not a comprehensive theory or model of language acquisition.

Instead, it aims to be a model of what happens during comprehension that may subsequently affect or interact with other processes" (2007, p. 115). IP looks at the way language learners make or fail to make connections between a given form in the input and its given meaning, and how they create a linguistic system from the data that appear in the input. Some of the basic observations of IP are that learners search for meaning in lexical items, first and foremost, and make form-meaning connections. VanPatten also emphasizes the importance of differentiating between 'processing' and 'noticing,' where the former involves mapping meaning and function onto properties of the language, a far more complex process than the latter.

Based on the insights of IP, then, VanPatten and his colleagues (VanPatten & Cadierno, 1993; VanPatten & Sanz, 1995) conducted two studies that sought to test the effect of processing instruction (PI). PI is a method that seeks to "alter the way in which learners perceive and process linguistic data in the input in order to provide the internal learning mechanisms with richer grammatical intake" (VanPatten, 2007, p. 169). This may involve informing the learners that L1 cues are not reliable and alerting them to the pertinent L2 cues (Doughty, 2003).

In VanPatten and Cadierno (1993) the researchers tested the usefulness of PI in third semester college students of Spanish, as compared to students who received no instruction and those who received traditional (explanation of grammar followed by output practice) instruction in the acquisition of Spanish preverbal object pronouns. According to IP theory, learners misinterpret preverbal direct object clitic pronouns due to a processing strategy in which they assign agentive status to the first noun in a sentence. The results showed that the group that received PI performed significantly better on sentence-level interpretation and production tasks. In VanPatten and Sanz (1995), the authors extended the original investigation by adding a structured interview and a video narration task. The results of this study, according to the researchers, corroborated those of VanPatten and Cadierno (1993). From these results, it would seem that processing strategies contribute to learners' interpretation of Spanish clitic pronouns, though these strategies may also be altered by metalinguistic awareness.

Salaberry (1997) challenged the claims of VanPatten and Cadierno (1993) in a study that tested the effects of IP versus output processing on learners' acquisition of the Spanish direct object clitic pronouns *lo*, *la*, *los*, *las*. Essentially a replication of VanPatten and Cadierno's (1993) study, this investigation sought to reanalyse the claims that IP instruction provides advantages for the learner. The study involved two experimental groups and one control, all adult college students studying third semester Spanish. The two experimental groups differed in the instruction received—input versus output processing—while the control group received no instruction. Acquisition was measured by means of a comprehension test, a production test, and a free narration of a one-minute silent video clip. Statistical analyses revealed that no differences were found between instruction types and that both instruction groups outperformed the no-instruction group. Additionally, the effect of monitoring differences did not show any statistically significant effect on acquisition. Through the results found in his research, Salaberry argues that PI (or any other comprehension-based input) is neither the sole nor the salient responsible element for the acquisition of the target language.

In a similar vein of investigation, Camps (1997) tested the difference of effect that three types of instruction that focused attention to different aspects of the input—focus on form, focus on meaning, and focus on form and meaning—had on learners' production of the direct object clitics *lo*, *la*, *los*, *las* in preverbal position. The participants were third semester Spanish college students and were divided into three experimental treatment groups according to the instruction types mentioned above. Treatment consisted of multiple-choice tasks whose requirements specifically manipulated the participants' focus of attention. The pre-test and post-test consisted of a sentence completion task and a video narration task. Additionally, a control group served as a means to compare the experimental treatments to no treatment at all. The results showed that there was no statistically significant difference in the production accuracy between any of the groups in the study, showing no greater effect from one given type of instruction as compared to the others. However, the group that received focus on form and meaning showed the largest reduction in the amount of errors made in both assessment tasks, and this group's sentence completion task results showed statistically significant differences between the pre-test and post-test. The group that received focus on form alone showed a similar pattern with the video narration task. While Camps' (1997) results showed no particular advantage of one mode of focusing the learner's attention on an aspect of the input as compared to others, they do suggest that directing learners' attention to form may be beneficial.

Finally, Rell (2005) investigated the differences in the effect of focus on form instruction given in the L1 as opposed to the L2 on the two features of Spanish: the 'hace...que' construction and the direct (*lo*, *la*, *los*, *las*) versus indirect (*le*, *les*) object pronouns. She tested four groups of adult college L2 learners of Spanish, two of which received focus on form instruction in Spanish (L2) for the *hace...que* construction and focus on form instruction in English (L1) for the clitics, and two of which received the opposite; that is, L1 focus on form for *hace...que* and L2 focus on form for the clitics. Data for the possible effects of comprehension and retention were gathered by administering a pre-test, a post-test and a delayed post-test. Data for the preference of language for the instruction were taken from an exit-survey. The quantitative results were conflicting: for the *hace...que* construction, the groups with L2 focus on form instruction performed better in the pre-test - post-test difference than those who had received instruction in their L1 while the opposite was true for the direct and indirect object clitic pronouns, where the L1 focus on form groups performed better. This pattern held true for the percentages of the pre-test - delayed post-test difference, although the numbers were less disparate. A qualitative analysis of the assessment tests found that in the *hace...que* construction, the group with L1 focus on form did outperform the group with L2 focus on form in the immediate post-test. Rell has interpreted these results as indicative of the fact that language of instruction in the classroom is not the sole determining factor of acquisitional outcomes but rather that it works in combination with the difficulty and nature of the grammatical construction in question. According to Rell, the clitic pronouns are more difficult to acquire because they are less formulaic than *hace...que*, thus providing an ideal setting for the benefits of L1 focus on form instruction, where the students can focus on form in the L1 without struggling to comprehend both form and meaning in the L2 at the same time.

The studies reviewed above find at least some evidence that instruction does help facilitate L2 acquisition of clitic pronouns by means of directing the learners' focus of attention on their form. However, (type of) instruction alone has not been able to fully determine how these kinds of linguistic features are acquired nor explain learners' individual differences in their comprehension and production. Certainly, other factors are at play, such as how L2 features are represented in the learner's L2 system and how this representation determines acquisition or processing of these elements.

The present study was motivated in part by previous research on the processing and acquisition of the Spanish clitic pronouns by native English speakers, which looked into the syntactic nature of the pronouns in L2 learners' interlanguage (IL) grammar[1], as evidenced in how they treated clitic placement (Liceras, 1985; Duffield, Montrul, Bruhn de Garavito, & White, 1998). The results of these studies, reviewed below, were interpreted within a generative grammar theoretical framework.

Liceras (1985) investigated composition and dialogue IL data from native speakers of French or English at a Spanish proficiency level of intermediate-advanced. More specifically, she analyzed the permeability of non-native grammar by asking what value the speakers assign to the clitics as evidenced in their production. Data were elicited from native English and French students enrolled in Spanish courses that had been studying the language for three to four years. The findings showed that learners produced ungrammatical forms such as (1), in which the clitic pronouns appeared after the verb. Recall that Spanish requires that the clitic be placed before a finite verb. The same learners, however, also produced sentences with clitic pronouns appearing in the target position. According to the author, the clitics placed after the finite verb have the properties of words in the IL syntax, rather than affix-like elements in the lexicon,

[1] In studying the nature of L2 grammar representations, the term interlanguage is used and defined as "the proposal that L2 learners have internalized a mental grammar, a natural language system that can be described in terms of linguistic rules and principles" (White, 2003, p. 19).

perhaps because those specific clitics are perceived as having special properties, like tonic pronouns.

(1) *Yo pongo<u>lo</u>
I put CL.3.SG.ACC
'I put it'

Crucially, Liceras' (1985) data point to an unstable L2 system with regards to clitic pronouns, either due to their position in the path of developmental sequences, influence from the L1, or interference from other verbal structures that permit post verbal clitic position. This seeming irregularity in usage is highly reminiscent of the features that clitics display according to their position on the grammaticization path, from lexeme on one end to affix on the other. It suggests that learners' developing L2 clitic system allows for these particles to assume differing features and is susceptible to varying possible influences that dictate what the features are and where the clitics appear with respect to the verb. However, studies have also shown that despite L1 interference, advanced learners are able to show implicit knowledge of ungrammatical clitic-verb word order.

While Liceras examined production data, Duffield, Montrul, Bruhn de Garavito, and White (1998), and Duffield and White (1999) investigated the nature of clitics in the L2 Spanish grammar system in comprehension data. More specifically, they tested clitic placement comprehension in constructions containing: simple finite verbs, auxiliary verbs, causative verbs, infinitive verbs, prepositions, and clitic sequences. The aim was to better understand learners' competence as reflected in reading times for ungrammatical sentences. They tested native English and French learners of Spanish in a sentence matching task and compared them to a native Spanish speaker control group. The results confirmed those found in a previous study involving French L2 clitics (Duffield, Prévost & White, 1997): in general, learners took longer to respond to ungrammatical items than grammatical ones, showing the same pattern as the native Spanish speakers, suggesting that they were able to acquire knowledge of word order regardless of the presence of a similar clitic system in the L1. A crucial finding was that, while advanced learners displayed significantly shorter reading times for the grammatical sentences, intermediate learners reflected the same pattern but the differences were not significant. Duffield, Montrul, Bruhn de Garavito, and White (1998) note that, "most of the failure to find significance is due to subject variance" (p. 182). This is an important observation, as it could point to the possibility that individual differences in such factors as the ones investigated in the present study—cognitive abilities and vocabulary size—affect the developing L2 clitic system of lower-proficiency L2 learners in different ways than that of advanced learners.

In a subsequent study, Duffield and White (1999) replicated the experiment and added an offline grammaticality judgment component in order to assess any potential differences in results between online and offline comprehension. The results of both the grammaticality judgment task and the online sentence matching task corroborated those of Duffield, Montrul, Bruhn de Garavito, & White (1998) discussed above. Duffield and his colleagues have interpreted these results as evidence that the IL system (and L2 acquisition) is not strictly limited by a learner's L1 properties.

Finally, Spanish L2 clitic acquisition research has also been done from the perspective of processing and learnability. Earlier, we saw that VanPatten and colleagues used IP theory in testing the efficacy of PI. In a previous study on the interpretation of Spanish clitic pronouns by L2 learners, VanPatten (1984) set the scene for the later development of his IP model. Based on research in word order strategies (e.g. Bever, 1970) the investigation looked at how an element's position in the sentence is used as a cue by L2 learners to interpret its meaning and function in that sentence. This study focused uniquely on L2 clitic processing due to position in the sentence, with no attention to (type of) instruction. More specifically, VanPatten (1984) investigated learners' interpretation of clitic pronouns in Spanish when the subject of the sentence does not appear in preverbal subject position, as in (2) and (3).

(2) Los invita el chico al cine.
CL.PL.3.ACC invite the boy to the movies
'The boy invites them to the movies'

(3) Le pregunta el chico '¿qué hora es?'
CL.SG.3.DAT asks the boy 'what time is?'
'The boy asks him/her 'what time is it?'

As mentioned above, according to IP theory, learners use a NVN (agent-action-object) strategy to interpret the meaning of the clitic, thus understanding *los* in (2) as *they* and the sentence as *They invite the boy to the movies*, and *le* in (3) as *he* or *she* and the sentence as *S/he asks the boy 'what time is it?*. The experiment consisted of two auditory picture-matching comprehension tasks aimed at testing the interpretation of direct and indirect object clitics. Participants were first and second semester college Spanish students. The results confirmed VanPatten's hypothesis: there was a high incidence of error where learners interpreted the test sentences with the semantic units reversed. Furthermore, although no statistical analysis was made in order to ascertain if the difference reached significance, the percentage of errors was lower for indirect object clitic interpretation than for direct object.

In discussing the question of why the learners performed better with the dative clitics than with the accusative, VanPatten suggests some possible explanations. Reliance on verb morphology was discarded as a possibility because the learners showed no evidence of noticing or processing the plural person morpheme -*n* (e.g, *invita*, *invitan*) in either test. VanPatten also discredited the possibility that learners simply improved by the second test due to a distraction task given to them between the two tests. One of his possible explanations is that the absence of the dative/indirect object marker *a* in the dative test sentences (possibly understood as the preposition *to*) led the learners to properly interpret the post-verbal noun phrase as the agent, thereby leaving the clitic to be interpreted as the object.

A second possible explanation concerns the verbs *dar* 'to give' and *preguntar* 'to ask', the only ones used in the test sentences in the indirect object pronoun test. VanPatten suggests that perhaps the dative clitic *le* was left as an unanalysed portion of a chunk that included the verbs. Because these words are frequent in the language classroom setting, this account seems quite probable, though little could be said without absolute knowledge of the frequency count of these verbs in relation to others. Additionally, the lack of any other verbs in the test sentences gave no opportunity for comparison between verbs within the test. The last possible explanation provided is the relative ease of processing the one-to-one form-meaning relationship of the dative clitics *le* and *les* as compared to the accusatives *la*, *los*, *las*, which can also function as definite articles. The one-to-two relationship of the latter forms is seen as a possible hindrance to their proper processing. All three explanations are plausible and point to the need for more research to shed further light on the processing of L2 clitics, both by learners whose L1 does not contain a similar clitic system and those whose L2 does.

With regards to the learnability of L2 Spanish clitics, one study that gives a preliminary view of how L2 learners spontaneously handle the production of Spanish clitic pronouns is Klee's (1989) investigation. The purpose of the study was to provide a first look at the acquisition of Spanish clitic pronouns by four adult Quechua speakers who have varying degrees of contact with Spanish and varying degrees of education. Based on data collected through sociolinguistic interviews, Klee's observations were the following: the first pronouns acquired seemed to be *me*, *te*, and *nos*, that is, first person singular, second person singular, and first person plural. According to the author, this should not come as a surprise because these forms are the only ones in the Spanish clitic pronoun system that overlap in function, as they represent direct, indirect, and reflexive objects. Klee posits that the one form-various functions relationship makes the acquisition and production of these forms easier. The next clitics to be acquired are *le* and *lo*, (third person single dative and accusative, respectively), followed by *les* and *los* (third person plural dative and accusative, respectively). Klee's findings show that the final forms to be produced are the feminine *la* and *las*.

Interestingly, while previous research (e.g., VanPatten, 1984) has found that American learners of Spanish rely on subject-verb-object (SVO) strategies, the least proficient of Klee's speakers demonstrates subject-object-verb (SOV) preference, the underlying word order in Quechua, as reported by the author. This seems to aid the speaker in maintaining target verb + clitic word order when she does produce the pronouns, though her data also show lack of clitics where target-like sentences would contain them, as well as overgeneralization of *se* and non-target use of reflexives. The remaining three speakers display more accurate, target-like production, with increasing level of education. In sum, the sample of speakers in Klee's study show that the first and second person clitics are acquired first, followed by the third person on the basis of case, then number, then gender. These findings suggest: i) that L1 word order strategies seem to influence Spanish L2 clitic acquisitional patterns; ii) that acquisition of Spanish L2 clitics reflects sensitivity to morphological marking on the forms.

The work of Zyzik (2004, 2006a, 2006b) has also investigated acquisitional patterns of L2 Spanish clitics; however, her research is the only work that has done so from a functional grammar perspective. In all of her investigations, Zyzik has found evidence for lexically-driven acquisition, as evidenced in production data. Her findings (2004) showed that clitics emerge only at the intermediate levels of acquisition and only with the most frequently used verbs. This occurrence was first seen with *se*, *le* and *les*, where *se* appeared with frequently occurring reflexive verbs such as *levantarse* 'to get up,' *despertarse* 'to wake up' and *sentarse* 'to sit down,' and *le/les* appeared with the highly frequent verbs *dar* 'to give,' *preguntar* 'to ask' and *gustar* 'to be pleasing.' The results were interpreted as suggestive of automatization, or chunking.

Furthermore, Zyzik (2006a, 2006b) found that L2 learners generalized the dative clitics *le, les* and the clitic *se* (which can be dative, reflexive, impersonal, and used in the middle voice) to transitive, and that the dative clitic specifically had a tendency to be generalized to accusative contexts with a [+ animate] argument, as in (4).

(4) ?*Y él le tapa con la manta para que ella pueda dormir*
And he CL.3.SG.DAT covers with the blanket so that she can sleep
'And he covers her with the blanket so that she can sleep'

Zyzik explained these findings by positing that learners first process these clitics as unanalysed chunks, where they typically appear with high frequency verbs coupled with an animate recipient, as in *dar(le)* 'to give (to someone)' or *gustar(le)* 'to be pleasing (to someone).' With increasing proficiency levels, learners then generalize these clitics to other two-argument verbs where the object is [+ animate]. Zyzik's interpretation from a cognitive/usage-based perspective is that the L2 learners are "creating a schema in order to make connections among the rote-learned forms they already have" (2006a, p. 131). Crucially, learners' incorrect extension of clitics to other verbs that have a [+ animate] object does not point to a random combination of linguistic elements, but rather a systematic combination based on logical, albeit erroneous, abstraction of properties from a limited amount of input.

Usage-based, cognitive accounts of language acquisition are sometimes misunderstood because frequency and automatization are given fundamental roles, which is erroneously interpreted as a limitation in that they impose a certain rigidity and do not capture free combination of elements as rule-based systems do (Bybee & McLelland, 2005). In fact, frequency and automatization reveal what modular theories of language development do not: they demonstrate sensitivity to item-specific as well as general information and, in doing so, more closely capture the actual degree of productivity and systematicity found in real languages (Bybee & McLelland, 2005, p. 403). While the data from the L2 learners in Zyzik's studies are not what we would find in L1 speaker data, they do suggest that cognitive abilities allow learners to abstract regularities and extend them to new constructions in an analogous and systematically logical manner. The nonnative extension of the dative clitics to accusative contexts does not occur randomly, but rather demonstrates a pattern that emerged due to insufficient input of the L2. Without frequency providing reinforcement for this nonnative pattern, it will probably become quite inactive and will not resurface once sufficient L2 input (and possibly negative feedback from instruction) are provided.

We've seen thus far in the research on Spanish L2 clitic acquisition that directing learners' attention on form may afford benefits in acquisition, that clitics may be perceived as words or affix-like elements, depending on leaners' perceptions of the properties they carry, that the developing L2 system is influenced by L1 word order strategies but that learners also exhibit knowledge of target L2 word order. If highly-proficient learners eventually attain greater degrees of target-like L2 Spanish clitic use, there remains a lot to be understood regarding individual differences in the movement along developmental sequences. One fundamental observation in researching this topic is that of methodology. Duffield, Montrul, Bruhn de Garavito, & White (1998) employed an online (real-time processing) methodology, a relatively new procedure that first emerged in the mid-nineties in SLA research (Chaudron, 2003). Making use of online processing procedures not only adds a great deal to the body of knowledge collected in SLA research but also calls attention to the subtle but marked difference between acquisition and processing. The following section explores research in L2 online processing.

L2 Online Processing

Research in Online Processing

In L2 research, acquisition and processing are treated as separate but related phenomena. Acquisition studies focus more on the state of the L2 system, while processing studies focus on active parsing of linguistic information. While this study is concerned with L2 processing, particularly online reading comprehension, it is understood that processing is an integral part of language acquisition, and vice versa. To say that something must first be acquired in order to be processed would force us to provide some sort of measure for the term. Furthermore, research has shown that L2 learners differ from L1 speakers in processing strategies (see Juffs & Harrington, 1995, 1996, discussed below) and this may be the cause for differences in performance, not the language competence (acquisition) of the learners. This begs the question of whether the definition of competence should then include processing efficacy, for data on performance seems to be the measure of successful acquisition. Perhaps it is the case that processing drives acquisition and acquisition, in turn, facilitates processing. Regardless, the concept of second language acquisition is mentioned in this study when pertinent to the discussion, with the understanding that acquisition and processing function like two sides of the same coin in second language competence.

Research in L2 processing has contributed important information with regards to how learners handle language input in real time. Several online techniques are now used to measure online processing, among which are self-paced reading, eye tracking, ERP, and fMRI. As its name indicates, self-paced reading allows the participant to advance in the text, either word-by-word or phrase-by-phrase, at his/her own speed, and gives accurate measurements, in milliseconds (ms) of the time taken to read each text interval. Eye tracking records the eye's movements (saccades) and time spent in determined regions (fixations) as the participant processes language. ERP (event-related potential) studies measure the electrical activity of the brain as it processes language, and certain ERP signals can reflect specific aspects of real-time language parsing (Van Berkum, Brown, Hagoort & Zwitserlood, 2003). Finally, fMRI (functional magnetic resonance imaging) is a neuroimaging technique that measures the brain's metabolic activity and allows researchers to determine which areas of the brain become activated when processing language (Osterhout, McLaughlin, Pitkänen, Frenck-Mestre & Molinaro, 2006).

The last few decades have seen a considerable amount of research in how L1 speakers process sentences in real time (Marinis, 2003). While still lagging behind, recently, there has been an increased interest in using online experimental methodologies on L2 processing, such as self-paced reading or cross-modal priming[2]. Studies in L1 parsing have shown thus far that speakers of typologically unrelated languages vary in their language processing mechanisms. This may translate into an inability of L2 learners to properly acquire not only the L2 grammar but also the processing strategies. Thus, one of the main questions is whether the relative failure[3] of L2 learners' ultimate attainment[4] is due to a lack of full acquisition of the L2 grammar, the L2 processing mechanisms, or both.

While this study does not seek to explore this particular question, it is worth noting that research in L2 processing has been able to answer questions that other SLA methods cannot. For example, some offline studies (e.g., Brey-Vroman, Felix, & Ioup,

[2] See Marinis (2003) for a detailed explanation of this experimental technique.

[3] When speaking of failure, Marinis (2003) refers to the following: "Children acquiring their native language manage within a relatively short period of time to acquire fully the language they are exposed to, whereas this is not the case for adults acquiring an L2. Adult L2 learners typically do not manage to achieve the full acquisition of the L2 grammar irrespective of the amount of exposure they have in the L2" (p. 144).

[4] There is debate about how ultimate attainment is to be defined and whether such a concept is even plausible. Such debate is beyond the scope of this project and therefore the term is used here in its most general sense to represent the highest level of acquisition achieved by a learner.

1988; Schachter, 1989, 1990; Johnson & Newport, 1991, as cited in Marinis, 2003) have shown that L2 learners of English whose L1 matched the *wh*-movement[5] typology of English were better at judging ungrammatical sentences involving *wh*-movement in English than learners whose L1 was typologically different than English with regards to this feature.

On the other hand, another set of studies (e.g., Martohardjono & Gair, 1993; White & Juffs, 1998, as cited in Marinis, 2003) also showed the opposite finding. Specifically, White and Juffs (1998) found that, in a grammaticality judgment test, both English L1 speakers and Chinese learners of English (ESL) were similarly accurate in judging ungrammatical sentences due to *wh*-movement. However, the judgments of the grammatical sentences showed different accuracy levels between the two groups. The English L1 group had a higher level of accuracy overall; the Chinese ESL group had particular difficulty accepting sentences with subject extractions[6], though its scores were highly accurate on the object extractions. What's more, reading times showed that both groups took longer to read and judge subject extractions than they did the object extractions. The hypothesis that emerged from this finding was that this difference in judgment accuracy was due to processing differences, not the L2 competence of the learners.

[5] Within generative grammar theory, *wh*-movement is a term used to describe the phenomenon whereby interrogative words appear at the beginning of interrogative clauses, as in *What did John buy?* The movement refers to the fact that in declarative clauses, the NP appears after the verb, as in *John bought bread*.

[6] Extraction is another term for *wh*-movement.

Further research from Juffs and Harrington (1995; 1996) in a word by word self-paced reading experiment shed some light on the issue. Reading times showed that the L2 learners behaved differently than the English L1 speakers for sentences such as (3):

(3) Who does Tom expect to fire the manager?

English L1 speakers showed increased reading times after the infinitive *to fire*; the Chinese group did not show this same pattern. Increased reading times are taken as evidence of a process of reanalysis; therefore, the decreased times in the Chinese group was interpreted as a lack of reanalysis at that point in the sentence. Had the Chinese group attempted the reanalysis and failed, this would point to incomplete acquisition of the L2 grammar. On the contrary, the results showed that parsing errors are what led to inaccurate judgment of the grammaticality of the sentence.

Juffs and Harrington's (1995; 1996) research shows how experiments in L2 processing can contribute to our knowledge of the L2 linguistic system and how it functions. More specifically, these studies have shown that L2 performance in real-time conditions (i.e. processing) may differ from performance in tasks that do not impose time-restrictions or may involve metalinguistic analysis. Aside from actual processing strategies, we must question what other factors—linguistic or non-linguistic—may affect L2 processing and how they do so. The possibilities seem endless, and researchers have since begun to explore various L2 processing phenomena. In a survey article, Clahsen and Felser (2006) review some recent findings. For example, while studies have shown ample evidence for L1 transfer in L2 processing at the phonological, orthographical, morpholexical and lexical-semantic levels, the case of morphosyntactic transfer—specifically in local grammatical domains[7]—is less clear. In a series of reading-time experiments, Felser, Roberts and Marinis (2003) and Papadopoulou and Clahsen (2003) looked into relative clause ambiguity resolution of sentences such as (4):

(4) Someone shot the servant of the actress who was standing on the balcony.

In such ambiguous sentences, the relative clause *who was standing on the balcony* may modify either *servant* or *actress*. The results suggest that L2 learners' response patterns, while not native-like (English natives interpret the modified noun as *the actress*), were not influenced by their L1.

Other online studies have also looked at the limitations of cognitive resources during L2 processing. Although the influence of this factor requires further investigation, some ERP studies of grammar processing automaticity have suggested evidence for a difference in cognitive resources during L1 versus L2 processing. In a review article, Clahsen and Felser (2006) discuss the main findings of several ERP studies with regards to the automaticity in processing. First, studies of L2 learner lexical-semantic processing have shown similar N400[8] effects to monolingual processing, though with delayed latencies and reduced amplitudes. Secondly, L2 learners have produced both LAN and P600[9] effects in studies investigating the processing of morphologically complex words, specifically in the areas where they were highly proficient. This has

[7] In generative grammar theory, a local grammatical domain is one where an anaphor is either bound or not bound.

[8] This is a negative wave peak at around 400 ms after stimulus onset associated with lexical-semantic processing.

[9] LAN (left-lateralized anterior negativity) and P600 (positive wave peak at around 600 ms after stimulus onset) index structural processing.

been taken to be suggestive of the ability of native-like processing of these words, and a shift toward automatization. Thirdly, L2 learners have shown P600 effects in sentence processing as well, though they did not display a LAN as did the natives. Only in local grammatical violations do certain L2 learners produce a LAN during processing, and these were only highly proficient learners.

Though its nature is somewhat controversial, some researchers have interpreted the LAN as an indication of automatic, first-pass processing processes, and the P600 as indicative of more controlled processes of reanalysis and repair. If such is the case, the absence of LAN in the majority of L2 studies suggests a reduced automaticity in L2 processing that can increase with proficiency. This reduced automaticity may be caused by a shortage of WM resources, a reasoning supported by behavioural experiments, where L2 learners normally show slower response times compared to natives (Ardila, 2003). Likewise, neuroimaging studies show that structurally difficult sentences in the L2 produce increased cortical activation. There is, of course, no conclusive evidence regarding cognitive resource limitations on L2 processing; however it is possible that these limitations (and the lack of automatization), and not insufficient knowledge of grammar, are responsible for parsing difficulties in L2 learners (Clahsen & Felser, 2006).

There is a need, then, for experimentation in L2 processing and how it interacts with other cognitive resources. If reduced automaticity is characteristic of lower proficiency and may be caused by a lack of sufficient cognitive resources, such as WM, it stands to reason that those individuals with greater cognitive abilities may be better able to render whatever knowledge of grammar they have in online processing. The present study aims to investigate this very notion by means of an eye tracking methodology designed to examine if learners with greater cognitive abilities are more likely to notice non-target L2 clitic + verb word order when the order is the correct one in their L1. The next section, then, briefly introduces eye tracking methodology and reviews some investigations that have employed this method in L2 and bilingual processing studies.

Eye Tracking Research in L2 and Bilingual Processing

Eye tracking gathers data about eye movements during real-time information processing. Two main characteristics of eye movement during processing are fixations and saccades. Fixations occur when the eyes remain relatively still on an object or word, while saccades are eye movements between fixation points (Rayner, 1998). For research in reading, some of the most commonly-analyzed measurements are first fixation duration, first-pass duration, regression path duration, and total fixation duration. First fixation duration refers to the duration of the first fixation made on the area of interest. The first-pass duration refers to the sum of all fixations (if there are more than one) in the area of interest before leaving the area, either to regress to previous material or to advance. The regression path duration is a measure of the time in which the eyes first enter a region until the time when eyes move progressively out of the region. This includes any regression time. The total fixation duration refers to the sum of all fixations in an area. The first-pass duration is normally used as the primary measure of interest for units of analysis that are larger than a single word (Rayner, 1998).

While eye movements are taken to reflect cognitive processing, an eye-mind span has been identified, which reflects a lag between visual and cognitive processing (Rayner, 1998; Rayner & Sereno, 1994). This lag indicates that while the eyes have moved past a word or region, the mind may still be processing information located in the previous region. Any cognitive processing delays or difficulties experienced while the eyes have moved beyond a region of interest are evidenced in a spillover effect. Likewise, eye tracking research has also shown longer reading times for clause-final and sentence-final words, evidencing wrap-up effects of discourse processing (Rayner & Sereno, 1994). It is useful, therefore, to measure not only the region of interest but those downstream as well.

Eye tracking studies are a particularly useful tool in assessing L2 processing. In general, researchers have tended to focus on one of two aspects: lexical processing or grammatical processing (during reading). Several studies in lexical processing have looked into cross-linguistic competition in L2 learners and bilinguals (Spivey & Marian, 1999; Marian & Spivey, 2003a; Marian & Spivey; 2003b; Weber & Cutler, 2004; Kaushanskaya & Marian, 2007; Escudero, Hayes-Harb & Mitterer, 2008; Chambers & Cooke, 2009). The results of these studies are particularly striking for two reasons: first, they display how eye tracking methods reveal aspects of the active L1 and L2 systems that other methodologies cannot; second, they find strong evidence for cross-linguistic lexical competition that may suggest possible cross-linguistic grammatical competition.

In the first of the studies that are reviewed here, Spivey and Marian (1999) tested Russian-English bilinguals in an experiment that recorded eye movements made to objects on a white board, according to auditory instructions. The participants partook in two sessions, English and Russian, each of which tested the effect of the presence of a lexical competitor among the options of objects. Competitors were determined by phonological overlap of the initial sounds of the objects. For example, one instruction in the Russian session was "Put the stamp below the cross," where, among the distractor items, appeared both a stamp ('marka' in Russian) and a marker, which shares initial phonetic features with the Russian target object. This was compared to eye movements made in a condition where no competitor was present.

Overall, the results showed that there were more eye movements to the competitor in the condition where it was present than to the distractor in the condition where the competitor was absent. However, analyses of the separate sessions (Russian vs. English) revealed that, while the English competitor caused significant competition in the Russian session, the same was not true of the Russian competitor in the English session. The authors hypothesized that this was due to increased activation of English in the bilinguals due their immersion in an English-speaking environment and possible differences in phonetic overlap and word frequencies in the stimuli between the two languages.

Marian and Spivey (2003a) then expanded the study in several ways. First, they made efforts to increase activation of Russian in the participants before beginning the experiment (i.e., communication, music, official documents). Secondly, they controlled for the amount of overlap in phonetic features and word frequency in the stimuli. Thirdly, they tested for within-language competition as well as cross-linguistic competition, such that there were now four conditions: within-language competitor, between-language competitor, both within- and between-language competitor, and no competitor. Lastly, they tested monolingual English speakers as well.

The results showed that, with the added activation of Russian and the tighter control of the stimuli, a significant between-language competition was present in both language sessions, this time. Additionally, the researchers found significant within-language competition for both languages in the bilingual group and for English in the English monolingual group. These findings more accurately demonstrate, according to Marian and Spivey, the complexity of activation in bilinguals as the stimuli better reflect the variety and amount of visual information faced by bilinguals in real-life settings.

In a later study (Marian & Spivey, 2003b), the authors further expanded the investigation, based on the notion of language mode—the level of activation (monolingual, intermediate, bilingual) of the bilinguals' languages and processing mechanisms—at the time of testing (pp. 3-4). This was done following literature that suggests that having both languages activated does not show whether between-language lexical competition occurs during maximum monolingual activation in one of the two languages. In order to maximize on monolingual activation, Marian and Spivey (2003b) tested participants who did not know that the experiment was about bilingualism, had no exposure to code-switching during the experiment, were spoken to and tested only in the L2 (Experiment 1) or in the L1 (Experiment 2: different group of participants). The results revealed significant within-language and simultaneous competition for the bilinguals in both languages, with a tendency for within-language competition to be stronger. This time, although there was significant between-language competition from the L1 in the L2 (Experiment 1), the same pattern did not reach significance for competition from the L2 in the L1 (Experiment 2). These results show, once again, that the L1 poses lexical interference, even during maximum L2 activation. While we cannot make any claims on L1 grammatical competition based on the findings above, they not only further demonstrate that eye tracking methods provide useful insight into L2 processing, they also suggest that the L1 grammar may be activated during L2 processing.

In a later study, Kaushanskaya and Marian (2007) examined lexical competition in an investigation whose goals were to determine both the level of recognition of (eye movements) and the level of interference from (picture-naming) a distractor during an L2 production task. This particular study differs from those discussed above in that the eye movements are now being used as a measure of non-target language recognition during target language production. The authors used a modified picture-word interference task in which the participant must name the picture found in one quadrant of the computer screen while a distractor word is present in another quadrant on the screen. The participants were Russian-English bilinguals. The proportion of eye movements made to the distractor word was recorded as a measure of recognition of that word; the picture-naming latency was used as a measure of interference from the distractor. Two experiments tested the effects of Russian orthographic competition (first experiment) and phonological competition (second experiment) during a picture-naming task in English.

The eye tracking results for the first experiment showed that the mean proportion of looks to distractors was significantly higher when these were Russian words semantically related to the picture, as compared to their corresponding English translation controls and non-word controls. Likewise, reaction times (naming latencies) showed a significant delay in picture-naming with the presence of Russian word distractors as compared to the presence of the English translation controls and non-word controls. In other words, the eye tracking data allowed the researchers to observe that Russian orthographic input was detected and recognized during the English production task even with conflicting letter-to-sound mappings for both languages. This finding reinforced previous results that a bilingual's languages are both activated during visual word recognition.

The phonological distractors in the second experiment were constructed such that their letter symbols formed a Russian word only when matched with their English phonemes, but not when matched with their Russian phonemes. Again, the eye tracking data analyses revealed that the mean proportion of looks to distractors was significantly higher when these were phonological Russian words than when they were English translation controls or non-word controls. The reaction times showed a slightly different pattern: naming latencies were similar with phonological Russian words and non-word controls, and both were significantly higher than the condition with English translation controls. Once again, the eye movement data provide extra information regarding activation, particularly in this case, where the naming-latency times did not pick up the processing differences between the phonological Russian words and the non-word controls.

The series of studies reviewed above has replicated several times results suggesting that parallel activation occurs in bilinguals when processing (both parsing and production) in their L2. Weber and Cutler (2004) furthered our understanding of just how complex this activation can be in four L2 comprehension eye tracking experiments that looked at spurious phonemic matches in the L2 that could potentially lead to increased competition. More specifically, the authors were concerned with L2 vowel contrasts that are difficult for non-native speakers to discriminate. The participants consisted of a Dutch-English bilingual group and a native British control group. All experiments were done in English. The experimental condition was created on the basis of English words whose initial sounds overlap save for the vowel. The selected vowel pairs share a close acoustic space and are often confused by Dutch speakers; for example /æ/ (as in *panda*) and /ɛ/ (as in *pencil*). These were compared to word pairs with distinctive vowels (not confusing to Dutch natives) in the initial overlap of sounds, such as /ɒ/ (as in *bottle*) and /i/ (as in *beetle*). Participants' eye movements and fixation durations were recorded as four images appeared on the screen—the confusable pair or distinctive pair, and two distractor objects—at the same time as audio instructions told them to click on a target object and move it to a target space.

Measurements were taken during the time window in which the initial sounds were stated in the instructions. The first experiment results showed that bilingual participants fixated competitors with confusable vowels significantly more often and longer than competitors with distinct vowels. The English participants did not show this behaviour. These findings support the hypothesis that spurious phonemic matches do indeed cause added lexical competition for the bilingual. In the second experiment, the role of target and competitor was switched for confusable vowels. The results differed from the first experiment. Here, there was no significant difference in the number and length of fixations made by the Dutch participants to the confusable vowel competitor when compared with the distinct vowel competitor. In short, *pan*- activated *pen*- but *pen*- did not activate *pan*-. This asymmetric effect of phonetic confusability was thought to better reflect the more complex competition that occurs during communication in the L2.

The third and fourth experiments sought more relevant evidence by considering the role of the bilinguals' native (Dutch) vocabulary. The third experiment now included a distractor item in the display whose initial phonetic sequences in Dutch matched that of the target item in English. The findings showed strong evidence for spurious competition from the native language, even though it was irrelevant for the task. Furthermore, because the effect of the native phonemic interference was the same for both closer matches as well as less closer ones, the authors concluded that when native phonemic categories capture L2 input, native lexical activation occurs. Finally, the fourth experiment looked at the possibility of reverse effects, that is, whether the L2 (English) causes competition in the bilinguals' L1 (Dutch) by translating the materials from the third experiment into Dutch. In contrast to the results found by Marian and Spivey (2003a, b) there was no activation by English competitors, a finding that Weber and Cutler attribute to possible frequency differences in native vocabulary, as the experimental group lived in the Netherlands and was immersed in their L1 environment.

The studies reviewed thus far have dealt with phonemically induced lexical interference, and the findings have strongly indicated that the L1 does exert some influence during L2 processing. Research has also shown that explicit knowledge regarding contrastive sounds may help build separate lexical representations for similar-sounding words in the L2 (Escudero, Hayes-Harb & Mitterer, 2008), and others have suggested that an important feature in the level of competitor activation is context, such that learners show less interference from the L1 when provided with prior context that is incompatible with the competitor (Chambers & Cooke, 2009).

Eye tracking studies of L2 processing have clearly provided a valuable understanding of lexical processing and have proven as important in analyses of grammatical processing as well, specifically with regards to parsing during reading. A common finding in eye tracking research is that difficult text usually produces longer eye fixations, shorter saccades (rapid eye movements), and more regressions (looking back to reread material) (Rayner & Sereno, 1994). In addition, eye tracking allows for relatively natural reading, in that there are no buttons to push in order to advance to the next word or phrase, and the participant may read the sentence or passage fully displayed on the screen at his/her own pace. This methodology is valuable in L2 processing because, in the case of parsing difficulties shown by the three reading measures mentioned above (i.e., fixations, saccades, regressions), it gives more detailed information about the processing of the text, which in turn permits a more thorough analysis of it.

Some studies have looked at L2 parsing of text using eye tracking methodology and it has been beneficial in understanding more about how morphosyntactic features are processed. Keating (2009), for example, compared the eye movements of native English learners of Spanish and native Spanish speakers when processing grammatical gender, a feature of Spanish but not English. More specifically, he investigated whether structural distance affected learners' detection of gender anomalies. The participants consisted of three groups of Spanish L2 learners, beginning, intermediate and advanced, along with a native Spanish group. Their stimuli consisted of sentences that contained a modifying adjective (reflecting either correct or incorrect gender agreement) in one of three positions: in the NP (local), in the VP of the main clause (long distance), and in the VP of a subordinate clause (longer structural distance).

The study reported standard eye tracking measurements for the critical adjective (first fixation duration, first-pass reading time, and total reading time) as well as the probability of two types of regressions: first-pass regression (leftward movement out of the adjective and delayed regression (leftward movement launched shortly after the adjective). It also reported the proportion of total regressions. The results of the local adjective measurements (within the NP) indicated that advanced speakers were the only learner group that behaved as the native group; that is, they spent significantly more time reading the ungrammatical adjectives relative to the grammatical ones and they initiated more total regressions in response to ungrammatical adjectives as compared to grammatical ones. The results of the adjective measurements when the adjective was located in the VP of the main clause (long distance) showed that the native speakers were the only group to spend significantly more time reading the adjective and launching more delayed and total regressions. Finally, the findings of the adjectives in the subordinate clause (longer distance) indicated that, once again, only the native speakers spent a significantly longer time reading the ungrammatical adjectives and showed a greater proportion of total regressions.

As only the advanced learners showed any sensitivity to gender violation, the author concluded that gender agreement is acquirable in the late stages of adult SLA. With regards to L2 processing, Keating interpreted his data as support for Clahsen and Felser's (2006) Shallow Structure Hypothesis, operationalized as the adjective's distance from the noun, with "shallow" being designated as within the NP. Keating proposed a processing deficit, possibly attributable to WM limitations, to account for non-native like processing of long distance structural agreement. Crucially, this study showed, once again, that eye tracking methods access L2 processing mechanisms in ways that other methods may not. More importantly, it found evidence that beginning- and intermediate-level learners do not pattern like advanced and native speakers of the L2, at least in processing local adjectival agreement anomalies. Keating's suggestion that WM limitations may be a critical aspect of non-native like processing calls attention to the role of cognitive abilities in L2 processing and by association, the role of individual differences in said abilities.

In a related line of research, Foucart and Frenck-Mestre (2012) also investigated online processing of grammatical gender, specifically of native English learners of French. In three ERP experiments and one eye tracking experiment, the researchers examined agreement in the following conditions: i. noun and post-posed adjective within the same DP (e.g. *les chaises vertes* 'the green chairs'); ii. noun and pre-posed adjective within the same DP (e.g. *les anciennes montres* 'the old watches'); iii. noun and predicative adjective separated by copula (e.g. *les pommes sont vertes* 'the apples are green').

Learners' processing of incorrect gender agreement in the first two conditions was tested by means of ERP methodology. The results of both experiments indicated that learners, like native speakers, display a processing effect in cases of gender agreement violations[10], suggesting that learners are indeed able to process gender

[10] In the case of the post-posed adjective (condition i), a significant difference between processing of correct and incorrect agreement was found in both French native speakers and English-French learners: both displayed a P600 effect in the incorrect agreement. The results of the ERP experiment for the pre-posed adjective (condition ii) were mixed: gender agreement violations elicited the classical P600 effect in

agreement in local contexts. The third condition tested if the same occurred when the agreement crosses a syntactic boundary, with the rationale that learners may have a difficult time retaining information regarding gender agreement in WM while processing other lexical information. This was tested using both ERP and eye tracking methods. The ERP results revealed that, while the native French speakers showed a P600 effect in the cases of gender mismatch, the learners' responses were mixed: some showed only an early positivity, and others showed no effect for erroneous gender agreement.

In an effort to determine whether a different pattern may be revealed with different methods, the same experiment was tested using eye tracking. The findings of this experiment were more conclusive: both the native French speakers as well as the English-French learners displayed longer first pass, and longer total reading times for the predicative adjective in the cases of gender mismatch as compared to those of gender agreement. Foucart and Frenck-Mestre attribute the difference in findings between the ERP and the eye tracking experiment to the sensitivity of the methodologies themselves. While both have different advantages, in this case the eye tracking experiment was able to reveal that learners are indeed capable of processing gender agreement violations in a manner similar to natives. The authors explain that this is probably due to high taxing of WM capacity in the ERP method, where presentation of the text is word-by-word presentation, thus requiring the participant to retain elements in memory in order to compute the gender agreement. Conversely, the

---

the French native speakers, as was the case with the post-posed adjectives; however, the English-French learners showed an N400 effect, which is not typical for structural errors. The authors speculate that this may be indicative of early stages of syntactic processing.

eye tracking paradigm allowed for the full sentence to be displayed on the screen and placed no time limitations on the participant.

The studies of online L2 processing of morphosyntactic elements discussed above clearly show contrasting results; however, the eye tracking methodologies have undoubtedly added important information to the growing body of knowledge on the L2 system configuration and its interaction with the L1 system. Crucially, both Keating (2009) and Foucart and Frenck-Mestre (2012) made reference to non-linguistic cognitive systems, such as WM and its possible role in processing, specifically with regards to its limitations. In order to address the need for a deeper understanding of how general cognition works with L2 processing, specifically that of morphosyntax and L1 interference, this study incorporates all three elements by focusing on: 1) manipulating the word order in the Spanish clitic + finite verb construction such that 2) the ungrammatical clitic placement reflects grammatical English word order, possibly causing L1 interference, and 3) how cognitive systems such as WM and EF, as well as vocabulary knowledge (as VS), predict clitic placement error detection among learners. The next sections, then, take a closer look at WM, EF and VS, and what research has shown with respect to their role in L2 processing and acquisition.

Working Memory and Language

Among the many factors considered to have an effect on the linguistic system of the L2 learner and speaker are individual differences in cognitive capacities (Robinson, 2003). One often-cited cognitive system is working memory. WM is an essential concept in the field of cognitive psychology because it is thought to play a crucial role in the execution of everyday cognitive tasks, such as reading, conversing, or comparing the prices and specifications of different computers in order to decide which one to buy. All these tasks require information to be kept temporarily active in order to continue processing the inflow and outflow of related information. Shah and Miyake (1999) define WM as "the theoretical construct that has come to be used in cognitive psychology to refer to the system or mechanism underlying the maintenance of task-related information during the performance of a cognitive task" (p. 1).

Several tests are used to measure WM, which include digit span forward (DSF) and digit span backward (DSB) tasks, from the Wechsler Memory Scale (Wechsler, 1987). In these tasks, participants hear lists of numbers increasing in length and are required to repeat each list verbatim in either the same or the reverse order in which they are presented. Word span tasks are also used in the same manner; these use either real words or non-words (Juffs, 2006). A similar measure is the digit-ordering (DO) task (Hoppe, Muller, Werheid, Thone, & von Cramon, 2000), in which subjects must repeat the numbers in ascending order. Other tests include the reading span task (Daneman & Carpenter, 1980), which requires that subjects read lists of sentences out loud and then recall the final word of each sentence. These tests are considered measures of verbal WM, while others, such as the arrow span, matrix span, and ball span tasks, measure spatial WM by having subjects recall spatial sequences. The difference between these two types of WM has been the focus of considerable research (e.g., Kane et al., 2004) that attempts to shed light on the nature of the WM construct.

Models of Working Memory

Research in and with WM generally assumes one of two aspects. The first one concerns the nature, structure and functions of the system itself, and how it relates to other mechanisms and concepts, such as general intelligence (e.g., Conway, Kane & Engle, 2003). The second aspect looks at the role that WM plays in carrying out complex cognitive tasks such as reading comprehension (e.g., Was, 2010), spoken language production (e.g., Acheson & MacDonald, 2009), mental arithmetic (e.g., Imbo & Vandierendonck, 2010), and spatial thinking (e.g., Shah & Miyake, 1996).

To say the least, there is confusion stemming from a lack of consensus among researchers in cognitive psychology about how WM looks and how it functions. In addition, there is no clear distinction between WM and short-term memory (STM), a widespread concept in studies of cognition (Shah & Miyake, 1999). Various models have been proposed to account for the configuration of WM and explain its mechanisms. These models vary in their conceptualization of how the system is designed and how it operates. In order to explain the variation, the researchers who have proposed the models have described them in terms of eight theoretical aspects (Miyake & Shah, 1999). These include the WM system's basic mechanisms and representation of information, its control and regulation, its unitary or non-unitary nature, its limitations, its role in complex cognitive activities, its relationship to long-term memory (LTM) and knowledge, its relationship to attention and consciousness, and its biological implementation. Three well-known models are addressed here (Baddeley & Logie, 1999; Cowan, 1999; Ericsson & Delaney, 1999) and they will be contrasted in their descriptions with respect to five of the eight features mentioned above: the basic mechanisms and representations, the control and regulation of information, the unitary or non-unitary nature, the relationship to LTM, and the relationship to attention and consciousness. A brief review of these models serves to illustrate how complex and multifaceted the WM system is, and while we will see that the present study does not adhere to any one specific model, a consideration of this complexity is necessary as we study its role in L2 processing.

One of the most discussed WM models is Baddley's (Baddley & Logie, 1999). The model originally consisted of three main components: a central executive and two slave systems, the phonological loop and the visuo-spatial sketchpad. The phonological loop is a short-term storage system for verbal-acoustic material. It can hold memory traces for a few seconds, at which point they begin to fade, and is equipped with an articulatory rehearsal process that allows the traces to be refreshed (Baddeley, 2003a). The phonological similarity effect has often been taken as evidence for the existence of the phonological loop (Baddeley, 2003a). The effect describes the observation that phonologically similar sequences or words are less likely to be recalled correctly than phonologically dissimilar ones (Kieras, Meyer, Mueller, & Seymour, 1999). The word length effect, the tendency for longer word sequences to be recalled with more difficulty than shorter ones (Kieras, Meyer, Mueller, & Seymour, 1999), has also been interpreted as support for the existence of the phonological loop, though this effect has been more open to other interpretations as well (Baddeley, 2003a).

The second component of Baddeley's model is the visuo-spatial sketchpad, which is the where visual, spatial, and possibly kinesthetic information is temporarily integrated into a unified representation. Empirical findings that have been seen as support for the visuo-spatial sketchpad include results of the Corsi block tapping test, which measures a subject's ability to imitate the experimenter's tapping sequence of a series of blocks, beginning with a sequence of two blocks and increasing in length until performance breakdown (Baddeley, 2003a). Subjects' difficulty in repeating the tapping pattern with increasing length has been taken as evidence for this component of the model. The visuo-spatial sketchpad is described as being composed of a passive visual cache, responsible for temporarily maintaining visual information, and an inner scribe, where spatial information is kept. The third and final piece of Baddeley's original model, the central executive, is described as an "attentional control system" (Baddeley, 2010) and essentially functions as the brain of the system. Its initial design included some capacity for storage; however, that notion was abandoned with the recent proposal of a fourth component to the system, the episodic buffer.

The concept of the episodic buffer came about in order to explain how visual and verbal codes link to multi-dimensional representations in LTM, and to have a temporary place of storage for excess material that does not fit into either slave system. This was thought necessary given the observation that highly amnesic patients, who clearly lack LTM, proved to be able to recall prose passages of approximately 20 idea units, a digit that surpasses the capacity of WM span (Baddeley, 2003b). In sum, Baddeley and Logie's (1999) model is a multi-component system controlled by the central executive, that has some but not all attentional control (Baddeley & Logie, 1999) and that is separate from LTM, though connects with it through the episodic buffer.

Cowan (1999)'s model, the embedded processes model, differs from Baddeley's model in that it is not as compartmentalized. In Cowan's view, the WM system is a subset of LTM; specifically, it is an active portion of LTM on which attention is focused (Cowan, 1999, p. 67). Codes of all modalities (spoken, visual, sensory) are stored in the LTM and activated by processes of activation and focus of attention, which are controlled and regulated by a central executive that directs attention and controls voluntary processing. The model collapses Baddeley's phonological loop and visuo-spatial sketchpad into two varieties of memory activation (active memory and focused attention) and the processes used to reactivate this memory. Because the system contains encoding of information from all modalities, it can be said to have a unitary constitution, though Cowan (1999) also highlights its non-unitary character in distinguishing between activation and attention, where the former can contain more items than the latter. Activated memory that is not part of awareness is also seen as part of WM because it is differentiated from non-active information.

The system, then, is composed of a set of activation processes that begin with LTM, activate certain information, and focus attention on a subset of the active information. As such, the system doesn't have as defined a structure as Baddeley and Logie's (1999) model; rather, Cowan's (1999) view is that:

> [T]here is no single, separate theoretical entity that I would call working memory; that is a practical, task-oriented label. What are potentially more meaningful in a theoretical sense are the basic mechanisms proposed to underlie this complex system, including activation memory, the contents of an attentional process, and the contextual organization of memory. (p. 88)

A third model of WM is the one developed by Ericsson and Delaney (1999). This model views WM as the mechanisms needed to "control and selectively access relevant information during the sequence of stable cognitive states" (Ericsson & Delaney, 1999, p. 290). The focus is on what Ericsson and Delaney call skilled access, a process in which individuals become capable of encoding information in LTM in such a way as to make it efficiently accessed with retrieval cues when needed. This set of skills is referred to as long-term working memory (LT-WM) and it is characterized by its ability to anticipate demands for information in order to address a particular task. The model is somewhat non-unitary in that LT-WM is typically domain-specific; that is to say, the skills, knowledge and processes relevant to the task are very tightly incorporated with the skills that encode the information. LT-WM is obviously a part of LTM; however, the former is distinguished from the latter in its access to and flexibility of representations.

As stated above, the present study does not adopt a particular model of WM because the nature of the reading task and the objective of the study do not require specific reference to a given component or process of a specific model. That is to say, the eye tracking task completed by the participants measures eye fixations as they read and attempt to comprehend text. The main goal for the inclusion of WM is to ascertain whether greater capacities in keeping active information predict a greater likelihood of noticing non-target verb and clitic pronoun word order. Information may be kept active in the phonological loop, while being controlled by the central executive. Or it may consist of a set of activation and attentional processes on a subset of information in the LTM. Or it may constitute skilled encoding and retrieval of information in the LTM. In all cases, there is a system in place through which immediate information during processing is made available and maintained active. This system is believed to play a role in both L1 and L2 processing, as is discussed below.

Working Memory and L1

Research has explored the relationship between WM and native language for much longer than it has investigated its connection to second or foreign language systems. This breadth of information on WM and L1, a sample of which is reviewed here, provides a foundation upon which research in WM and L2 is based. Baddeley's research (Baddeley & Logie, 1999; Baddeley, 2003b) has focused primarily on the role of the phonological loop in language comprehension and acquisition. With regards to spoken language comprehension, the phonological loop most likely forms a "major bottleneck" (Baddeley & Logie, 1999, p. 41). Studies of children with specific language impairment[11] have shown that they perform substantially below children matched for both verbal and non-verbal intelligence in a nonword repetition test (Baddeley, 2003b). Because the children with specific language impairment had no evidence of articulatory or auditory difficulties, and because their linguistic abilities were those of children four years younger, the results were interpreted as indicative that the language impairment was due to a deficit in the phonological loop. In normal children, correlations were found between performance in the nonword repetition test and the children's vocabulary acquisition (Baddeley, 2003b). These findings may not directly extend to adults or adult learners of an L2, however, they do suggest an intimate relationship between WM and language development. Research may reveal that the nature of this relationship differs in children and adults, or between monolinguals and bilinguals, yet the role of WM is a crucial one, as lower capacity seems to imply limitations on development.

Studies have also looked at the nature of WM regarding its relation to phonological versus semantic abilities. This work not only looks at the role of WM in language comprehension or production but also aims to identify the structure of the WM system itself. For example, Martin, Shelton and Yaffee (1994) carried out a clinical study of two brain-damaged patients in order to ascertain whether WM would show evidence for the separability of phonological and semantic capacities. The patients, both of whom had reduced WM spans, differed in the nature of their impairments, as determined in short-term retention tasks: the first had a phonological retention deficit while the second

[11] Children with specific language impairment (SLI) are described as having deficits in receptive and/or expressive language abilities, but showing age-appropriate scores on non-verbal measures of intelligence (Im-Bolter, Johnson, & Pascual-Leone, 2006).

showed evidence of a semantic retention deficit. Both patients were then administered a sentence processing task and a sentence repetition task, the hypothesis being that each would differ in performance on a given task according to their particular deficit. The results showed that the patient with the semantic retention deficit was better at verbatim recall of the sentences than the patient with the phonological retention deficit. In contrast, the patient with the phonological retention deficit was better at sentence processing than the patient who showed a semantic retention deficit in the short-term retention tasks. According to Martin, Shelton and Yaffee, these results suggest that WM capacities for phonological and semantic retention are separate. While this is a clinical study involving only two patients, and we must be careful about the conclusions we draw from it, these findings raise important questions about the existence of specialized stores or systems within verbal WM, and about any differences in capacity limitations between the two types in populations of adults with no linguistic impairments, and between the L1 and the L2.

Research in the relationship between WM and language has also looked at production, though to a much lesser degree. Acheson and MacDonald (2009) conducted a series of experiments in which they modified the classic serial recall tasks that normally test performance on the immediate recall of words or digits (e.g., Kintsch, Healy, Hegarty, Pennington & Salthouse, 1999). Acheson and MacDonald devised experiments that consisted of the following: rapid, paced reading of nonword tongue twisters, spoken immediate serial recall of nonword tongue twisters, typed immediate serial recall of nonword tongue twisters, and immediate serial recognition of tongue twisters. While most studies suggest that serial order is maintained in specialized storage mechanisms, Acheson and MacDonald (2009) hypothesized instead that maintenance of serial order is in fact contained in the language production architecture and that the phonological similarity effect (discussed above) could be explained by means of errors in the processes of lexical retrieval and phonological encoding.

The tongue-twister effect was seen across all four tasks, as predicted. More specifically, syllable-position and onset effects were clearly observed; that is, phoneme substitution errors occurred primarily across the same syllable position, and occurred in the onset rather than the nucleus or coda. Acheson and MacDonald argue that these findings are indicative of error location being in the speech production mechanisms rather than in the storage mechanisms. In studies such as this one, viewing WM as a storage mechanism may offer a different explanation than viewing it as a set of mechanisms. If viewed as a set of activation and attentional mechanisms, as Cowan's model suggests, then the line between speech production mechanisms and storage mechanisms as separate entities becomes blurred.

The brief review of research in WM and L1 above has shown a clear link between memory capacity and language comprehension and production ability. In particular, these studies have also shown that we know little about how the WM construct is structured, and to what extent its subcomponents or mechanisms are engaged in language processing. They also, and rightfully, distinguish the role of WM in language comprehension from that of production. Though there is still much left to discover with regards to how WM is structured and how it interacts with language, there seems to be a clear indication that impairments in WM result in some type of impairment or deficiency in L1 processing. Studies of WM and L2 have suggested similar effects.

Working Memory and L2

Recently there has been an increased interest in the role of WM in the acquisition, online comprehension and production of second languages. Various studies have examined WM in L2 processing, finding mixed results for the role of WM effects in processing strategies and study abroad benefits. Havik, Roberts, van Hout, Schreuder and Haverkort (2009) investigated native German advanced L2 learners of Dutch processing Dutch subject or object relative clause temporarily ambiguous sentences as compared to the processing of such sentences by a control group of native speakers of Dutch. Previous studies have shown that this ambiguous construction is comparable in both German and Dutch and that native speakers of both languages prefer the subject interpretation (Havik et al., 2009). Examples of the ambiguities are seen in (5a-b):

(5)

a. Subject Relative
Daar is de machinist die de conducteurs heeft bevrijd uit het brandende treinstel.
'That is the engine-driver who the guards has saved from the burning train-carriage'

b. Object Relative—Short
Daar is de machinist die de conducteurs hebben bevrijd uit het brandende treinstel.
'That is the engine-driver who the guards have saved from the burning train-carriage.

Tests of WM span were also administered in order to see if span would affect the processing. Participants were tested both online (for processing) through a self-paced reading task and off-line (for meaning) with a verification sentence that essentially asked to what the NP in the relative clause referred. The results showed that WM capacity affected both L2 learners and native speakers. The learners with high WM spans performed like the natives with low WM spans, preferring a subject reading for the constructions. In the offline task, however, all L2 learners performed like the native speakers.

A second experiment was administered in which only 25% of the experimental sentences contained a verification sentence (and only 25% of the verification sentences asked about the subject or object nature of the NP in the relative clause) in order to better control for participants guessing the purpose of the experiment. The results showed that the L2 learners with higher WM spans had no particular advantage in online response times nor were there any observable WM capacity effects. Havik and colleagues propose that the overall results show evidence that WM capacity affects only those cases where task demands are high; that is, when reading is not for comprehension alone but rather involves metalinguistic decision-making. Overall, the results of this study indicate that L2 learners do not pattern like native speakers in processing ambiguous sentences and, contrary to native speakers, their processing (when reading for meaning alone) is not affected by WM capacity. With specific regards to the role of WM in processing, it should be noted that it may work in different ways with different types morphosyntactic phenomena. Thus, while Havik and her colleagues did not find evidence for a processing advantage for L2 learners afforded by high WM capacity, we must be careful with any generalizations until further research corroborates these findings, as they may be the result of other factors, such as level of proficiency.

McDonald (2006) also investigated processing of late L2 learners (past the critical period of acquisition), with the goal of identifying the precise cause of their poor results in grammaticality judgment tasks. The experiments were designed to take into account three possibilities other than a deficit in the learner's syntax. The first was low L2 WM capacity, the second was poor L2 decoding abilities, and the third was inadequate L2 processing speed. In order to create comparable conditions, the results of a grammaticality judgment task of a heterogeneous group of L2 learners of English were compared with those of native English speakers under stress while taking the grammaticality judgment tasks from factors such as carrying visual or auditory lists of digits (memory span stress), listening to white noise (decoding stress), and faster than normal visual or auditory presentation (processing speed stress).

McDonald found that low WM capacity and decoding ability correlated with low grammaticality judgment scores in both L2 learners and native speakers under stress, displaying the same pattern. In addition, the pattern between L2 learners and stressed natives held true for grammaticality judgments of specific constructions; that is, both groups performed equally well with subject-verb-object word order violations, such as *The teacher the tests graded*, and equally poorly in regular morphology and agreement violations, such as *The boy jumpØ whenever he is startled*. The author emphasized that the strong parallel between the results of late L2 learners and native speakers under stress is evidence that, "while late L2 learners perform quite differently from unstressed natives, this is not adequate evidence to say their grammatical knowledge is qualitatively different" (p. 397). In other words, the results of her study show that cognitive factors such as a taxed WM system and L2 decoding ability may be responsible for poor grammatical performance rather than a deficit in some syntax-specific process or module.

More evidence for the role of WM in L2 comes from Sunderman and Kroll (2009), who found that WM affected the benefits obtained in a study abroad experience. More specifically, they compared a group of Spanish L2 learners who had participated in a study abroad experience with a group of Spanish L2 learners at the same level who had not studied abroad. Comprehension was measured through a translation recognition task that called for the learners to decide if two words were translation equivalents of each other, and production was measured by means of a picture-naming task. Both reaction times and accuracy were measured. The comprehension results showed that high WM span and study abroad experience independently affected speed and accuracy in a positive way. That is to say, there was no interaction between the two factors and, as such, they could be said to each contribute to faster and more accurate processing. The results of the production task were different. WM span alone did not affect reaction times or production, while study abroad experience did have an effect. More importantly, the production data showed a slight interaction between study abroad experience and WM span, suggesting that individuals with a higher WM span were better able to benefit from study abroad. Because WM facilitates automatization, it is not surprising that those students with higher WM developed greater L2 lexical production abilities, as they were more likely to have automatized phonological-semantic pairings into symbolic units.

The studies reviewed above have provided a sample of some interesting findings for the effect of WM in processing. The L1 studies have shown that limitations in the phonological loop, or its equivalent mechanism in other models of WM are related to limitations in the development of the L1. They have also demonstrated that we still know very little about how WM is structured, and that different components or mechanisms of the construct may play varying roles in a given aspect of mode of the language. However, the L1 studies all found significant results that showed a relationship between WM and language development.

On the other hand, the findings of the L2 studies were more mixed. While Havik and her colleagues (2009) found no relationship between WM and reading processing for meaning alone (as compared to reading for a metacognitive task), both McDonald (2006) and Sunderman and Kroll (2009) found evidence that WM affects L2 processing and development. These results strongly suggest that further research is needed in order to ascertain how WM affects the L2 system, both in terms of representation as well as processing. This being said, given the task demands of processing an L2, particularly at low levels of proficiency, it is unlikely that WM plays absolutely no role in processing information. The likelihood is that the linguistic phenomenon studied, type of task or method employed may not reveal all effects. During L2 processing, and particularly during sentence comprehension, WM carries out the important task of maintaining phonological and lexico-semantic information active so that meaning may be integrated as new items are introduced. Using Cowan's (1999) distinction between activated memory and attention, a higher WM capacity for activated memory may also allow other resources, such as attentional control, to be directed to other linguistic phenomena during L2 processing.

Indeed, the research in this section has shown that the WM is not the only cognitive factor to affect language processing (McDonald, 2006), pointing to other cognitive resources and their potential roles. The next section, therefore, discusses the second of the two cognitive systems included in the present study, EF, by briefly considering some of the research on the system's configuration and then looking at its role in language processing.

Executive Function and Language

The Cognitive Processes

We've just seen that the notion of WM and the research into its role in language development and processing may tend to focus on the storage of information. Conversely, EF is a neuropsychological construct that serves as an umbrella term to cover a number of related functions, in particular our ability to form, maintain, and shift mental sets corresponding to reason and the generation of goals and plans, the organization of goals and plans, the maintenance of focus and motivation to follow through with goals and plans, and the goals and plans in response to changing circumstances (Suchy, 2009). It has traditionally been linked to the prefrontal cortex (Ardila, 2008; Aron, 2008; Miyake et al., 2000; Sylvester et al., 2003) but given the number of different function it covers, it is perhaps unsurprising that it has recently been extended to other areas of the brain as well. There have been two fundamental types of executive functions proposed: metacognitive and emotional/motivational (Ardila, 2008). Metacognitive EF includes problem solving, abstracting, strategizing, etc. while emotional/motivational deals with finding ways to fulfill basic, personal impulses in a socially acceptable manner. Research on the role of EF in language processing and production generally focuses on the metacognitive type.

There are many ways to measure EF, the most common being the Wisconsin Card Sorting Test, the Tower of Hanoi, the Trail Marking Test-Part B, and the Stroop task (Ardila, 2008; Aron, 2008; Suchy, 2009). The Wisconsin Card Sorting Test requires subjects to inhibit the tendency to sort cards according to a previously learned rule or category and instead to discover a new rule and begin sorting the cards according this one. The Tower of Hanoi consists of three rods, with a number of disks in a stack slid over one of the rods in ascending order, so as to form a conical shape. The objective of the task is to move the whole cone of disks to another rod; however, only one disk can be moved at a time and slid over another rod, the moved disk must always be the uppermost one, and a disk cannot be placed over a smaller disk. The Trail Making Test-Part B consists of circles distributed over a sheet of paper, with half the circles containing numbers and the other half containing letters. The task involves connecting the circles in ascending order, alternating between numbers and letters, for example, 1-a-2-b-3-c, etc. The Trails task also contains an A part, which consists of connecting randomly distributed numbered circles alone, and is used to establish a performance baseline. The Stroop task involves a list of names of colours written in a different-coloured ink than what the name indicates. For example, the word "red" is written in green ink or the word "blue" is written in yellow ink. The goal is to name the colour of the ink in which the word is printed, not to read the actual word itself. Because reading the word itself is the dominant response, the task requires the subject to inhibit this reaction and direct his attention to the colour of the ink instead (Suchy, 2009). Delayed responses or errors are referred to as the Stoop effect. This task also contains a performance baseline component, consisting of lists of Xs printed in the same colours as the list of colour names.

Other tasks that measure EF are Random Number Generation, Operation span task, and Dual task (Miyake et al., 2000; Unsworth, Heitz, Schrock & Engle, 2005). The Random Number Generation task requires subjects to generate random numbers within a certain range when prompted, without repeating numbers. The Operation span task requires subjects to solve a series of math problems while attempting to remember a set of unrelated words. In the Dual task, subjects are required to complete two tasks simultaneously.

Research in the nature of EF investigates its configuration as well as its role in solving tasks and language processing. With regards to the configuration of EF, Sylvester et al. (2003) note, there is much theoretical debate on "the issue of whether there is a single 'central executive' process mediated by a single brain system, or there are multiple such processes, each different from the others in function and brain mechanism" (p. 357). Miyake et al. (2000) studied the possible separability of three most studied executive functions: i) shifting (of mental sets), ii) updating (and monitoring of WM representations), and iii) inhibition (of prepotent responses). In Baddeley and Logie's (1999) model, the executive central is what regulates these executive functions. Miyake and colleagues asked whether these functions should be considered unitary in the sense that they are reflections of the same underlying mechanism or ability, or whether they are separate. This question brings forth the issue of the task impurity problem, which arises due to the fact that any given EF task may not directly tap into the executive functions but also other cognitive processes that are not directly relevant to it;

therefore, the results are not necessarily evidence of the unitary or not-unitary nature of EF. Other problems associated with testing of EF include low internal and/or test-retest reliability, which happens because a subject may use different strategies on different occasions, or because the task is no longer novel, thereby reducing its effectiveness.

Due to these and other research issues, Miyake et al. (2000) proposed a latent variable analysis as a possible approach. Latent variables in this study were those features that are shared among the multiple exemplar tasks for each executive function. The investigation focused on the three most referenced executive functions: shifting back and forth between multiple tasks, operations, or mental sets (also known as "attentional switching" or "task switching"); updating, monitoring and coding incoming information that is relevant to the current task while removing older, unneeded information from WM; and inhibition of dominant, automatic, or prepotent responses.

The two goals of the study were to investigate how unitary or separable the three target executive functions tested really are, and to determine how executive functions contribute (separately) to the complex tasks used to evaluate EF as a whole. A complex analysis was carried out, involving nine tasks, three for each executive function, in addition to five complex tasks commonly used to measure EF as a whole (the Wisconsin Card Sorting Test, Tower of Hanoi, Random Number Generation, Operation span task, and Dual task). A confirmatory factor analysis was carried out for the three distinguishable executive functions in order to establish their separability, followed by a series of structural equation modeling analyses aimed at verifying the extent to which each function contributed to the five complex cognitive tasks that tested EF. The results indicated that a full three-factor model was the best fit for the data; that is, EF seems to have three distinguishable but not independent constructs—shifting, updating and monitoring—and the complex cognitive tasks used to measure EF as a whole tap one aspect of it. The Wisconsin Card Sorting Test taps seems to access abilities in shifting, the Tower of Hanoi taps inhibition, the Random Number Generation task taps inhibition and updating, the Operation Span task taps updating, and the Dual task didn't show to tap any of the three factors, suggesting that perhaps it taps an independent executive function not studied here.

Thus, the results showed that the three executive functions tested are separable but somewhat correlated constructs and contribute in different though connected ways to commonly administered executive tasks. The executive functions are also thought to have some common mechanism that unites them, such as the maintenance of goal and context information in WM; for example, controlled attention. Miyake and colleagues also suggest that there are most probably other executive functions, some at a higher level than the ones studies here, such as planning, and some at a more basic level.

Further support for the separability of EF includes research done by Sylvester et al. (2003), and Ravizza and Carter (2008). Both studies obtained neurological and behavioural data for switching tasks; that is, tasks that required the participants to switch attention between tasks or switch between competing task responses. Sylvester and colleagues tested for the possibility of different mechanisms underlying counter switching and response inhibition, while Ravizza and Carter analyzed the potential difference in cognitive mechanisms governing perceptual and rule switching. Both used one task that had the same goal but switched either rules or paradigms. Neural data were obtained through fMRI scans and behavioural data was gathered through reaction times. Both studies found behavioural data confirming that there was indeed a shift cost between the two different parts of one task. Neuroimaging data suggested that activation for the different types of switches were concentrated in different parts of the brain. The results, therefore, show evidence that there exist separate executive functions, at least between rule and perception switching, and between attention switching and interference resolution.

The findings of the studies just reviewed are noteworthy for two reasons: first, they highlight the importance of considering the separability of the EF construct, as this divisibility means that different functions of EF may affect language processing in different ways; secondly, the studies suggest that we should be mindful of the task we use to evaluate EF when carrying out research. Because a given task is likely to access only a fraction of the diverse executive functions, task characteristics must be carefully considered in order to determine which abilities are reflected in one's performance on the task and how those particular abilities relate to language processing. We will see in this study that this second point is a crucial consideration in the analyses and interpretation of the results. We now turn to a brief discussion of some of the research that has been done on EF and its relationship to L1 processing and development.

Executive Function and L1

Studies have found evidence suggesting a relationship between EF and language proficiency and processing (e.g., Biegler, Crowther & Martin, 2008; Im-Bolter, Johnson & Pascual-Leone, 2006; Martin & Allen, 2008; Mazuka, Jincho & Oishi, 2009; Ye & Zhou, 2009). This section provides a brief overview of some research, presenting key findings that emphasize the relationship between some commonly-studied executive functions—inhibition, shifting, updating, selectional processes—and L1 development and/or processing.

Martin and Allen (2008) review the literature on patients with aphasia that also have limited-capacity short-term memories and make suggestions for the role of EF in the limitations of the short-term memory system. In order to better understand their proposal, it is necessary to be familiar with their conceptualization of verbal, or language-based, short-term memory. In an earlier study, Martin, Lesch and Bartha (1999) proposed a model for verbal short-term memory in which stores for phonological and semantic representations were separate, based on literature that they believe to be neuropsychological evidence for their proposed construct and based on the results of other tests that have looked at short-term memory spans.

Based on this new model of verbal short-term memory, Martin and Allen (2008) re-conceptualized Baddeley's phonological loop as a verbal short-term memory system containing a lexical-semantic buffer, an input phonology buffer and an output phonology buffer. They believe that behaviour from aphasic patients shows evidence that a defect in the inhibitory ability of the lexical-semantic short-term buffer causes sentence comprehension processing difficulties because it requires retention of lexical/semantic information. For example, certain patients with short-term memory deficiencies carrying out a serial list recall task made intrusions (i.e. recalled an earlier word) from previous lists, even several trials later. This and other similar observations in comprehension and production tasks have been taken by Martin and Allen as evidence that these patients have an inhibition deficit and this EF disorder allows for excessive interference, as well as being the root of lexical-semantic short-term memory deficits, thereby causing processing difficulty.

Evidence for another aspect of EF that affects language processing—updating—comes from Im-Bolter, Johnson and Pascual-Leone (2006). The researchers conducted an investigation comparing children with specific language impairment to those with a normally developing language. The goal was to evaluate the proposal that many of the linguistic difficulties experienced by children with this impairment may be due to non-linguistic constraints: a limited processing capacity. All children were administered a battery of tests aimed at measuring intelligence, language skills, mental attentional capacity and different components of EF. The statistical analyses revealed that the children with specific language impairment had lower abilities of inhibition and updating; however, no differences were found between the groups for shifting.

Crucially, as the author notes, this study employed both simple and complex EF tasks. For example, the antisaccade task is structured such that performance requires the child to inhibit the automatic response of looking at a visual cue because the target stimulus appears shortly after on a different part of the screen for a very brief moment before it is masked. This task is both simple and non-verbal and believed to index inhibitory control. On the contrary, the Trail Making B task, discussed in the previous section, involves shifting, inhibition and updating processes, thereby making it a complex task. In fact, the results showed that children with specific language impairment performed significantly lower than children with normally developing language on the antisaccade task, thus adding evidence for the role of inhibition in language development, yet the Trails B task showed no such significant difference between the groups in the analysis of ratio scores calculated using both Trails A and B parts. These types of findings are important when considering the interpretation of results, particularly, a lack of difference in performance between two groups. Complex tasks may tap into more than one EF process and may mask true differences between groups in a particular EF process. It is crucial to bear this in mind in this study, as we shall see that Trails A and B were both used to measure EF.

EF, therefore, can be challenging to researchers when investigating its contribution to language processing. Selecting the appropriate task, linguistic or non-linguistic, to measure a given EF process is compounded by dealing with a construct composed of several cognitive processes that function both independently and in unison. In addition, linguistic input and output during communication may be ambiguous or unclear, and studies have shown that EF also plays an important role in the language processing of L1 speakers with no linguistic deficits, who must make sense of what may often be conflicting written or spoken utterances. In a review article, Ye and Zhou (2009a) discuss how EF mechanisms are used by the listener and speaker to control interference in comprehension and production. Because there is a considerable amount of information going back and forth during communication, and because the speaker and listener have, at any given moment, many behavioural options, there exists a great deal of interference that any interlocutor must navigate by means of EF control processes of selection.

In research on sentence comprehension, studies have shown that both syntactic algorithms and heuristics may contribute in parallel to interpretation. For example, algorithms are used to identify the anomaly in *at breakfast, the egg would eat...* (rather than *would be* eaten). However, studies have also shown that there are times when the interpretation does not follow the syntax, suggesting that heuristics are acting in order to obtain a quick and plausible interpretation. Where conflicts between the two processes arise, it is suggested that executive control mechanisms monitor and participate in the selection of the final interpretation, according to some studies employing ERP (Ye & Zhou, 2008) and fMRI (Ye & Zhou, 2009b) methods. Likewise, in word selection for production, selection processes of EF are called upon to aid in choosing among competitors in lexical representations. For instance, in tasks of target selection according to feature similarity or strong/weak association to a cue, executive functions were recruited to select the relevant feature of the cue in the former, and to search the inventory and select the right word in the latter, as shown in the common activation sites in the brain (e.g., Badre, Poldrack, Paré-Blagoev, Insler, & Wagner, 2005, as cited in Ye & Zhou, 2009a).

The research on EF and its relationship with L1 provides a promising foundation for investigations of its role in L2 processing and acquisition. Martin and Allen's (2008) review of aphasic patients, for example, while surely not representative of the L2 learner population, is compelling first and foremost because it demonstrates that sufficient inhibition abilities are crucial for sentence comprehension. Additionally, it provides a scenario in which some key components may be compared to that of L2 learners. That is, while a normal population of L2 learners will not have brain damage, it may experience deficits in inhibiting irrelevant representations from the L1 during L2 processing, or perhaps even irrelevant L2 representations. In other words, while the two situations are different, EF may play a comparable role in both.

Likewise, Im-Bolter, Johnson and Pascual-Leone's (2006) study demonstrates that abilities in inhibitory control and updating play a role in specific language impairment in children. If such is the case with the L1, where all representations are of the same language, the possibility that these abilities also contribute to L2 development and processing, where representations come from two languages, must be investigated. Delayed L2 development or processing among adult learners may not constitute the same condition as specific language impairment in children, yet both are characterized by deficits in receptive or expressive language abilities. In the case of specific language impairment, the deficits are relative to a population of children with normally-developing abilities; in the case of L2 development and processing, the deficits are relative to individuals with higher native-like proficiency that have experienced the same type of exposure to the L2 in the same time frame. Thus, while there certainly are many differences between L1 and adult L2 development, there are enough similarities between specific language impairment and individual differences in L2 processing and acquisition such that Im-Bolter, Johnson and Pascual-Leone's (2006) study suggests that inhibition and updating abilities may play a similar role in L2 processing.

We have seen thus far that EF abilities are closely linked to L1 language development and that some similarities with L2 development suggesting that the role of EF in L2 processing and acquisition warrants research. Indeed, such research is currently underway. In their review article, Ye and Zhou (2009a) also address bilingual and second language processing, and discuss evidence that the same EF control mechanisms that play a role in L1 development and processing act in bilinguals as well, with the added facet of language selection.

Executive Function and L2

In the brief review above, we saw research that has strongly suggested that limitations in certain functions such as inhibition and updating contribute to limitations in L1 abilities. If inhibiting interfering representations, updating WM with new information and selecting among competing representations are crucial for L1 processing and development, there is all the reason to believe that these same cognitive processes may act in L2 processing and acquisition, where the situation now includes linguistic representations (and thus interference) from two languages instead of one. Indeed, Ye and Zhou (2009a) note that studies have shown an overlap on the cerebral cortex level for the representations of the two languages in bilingual speakers. In conversation, bilingual speakers are faced with the task of selecting the appropriate language in which to speak and simultaneously control for interference from active representations in the non-target language (Ye and Zhou, 2009a, p. 1173). Exactly how this is done is not fully known. As Rodriguez-Fornells, De Diego Balaguer and Münte (2006) state, "It is necessary to postulate a control mechanism that regulates the activation of the different languages in bilinguals and polyglots and what the neural mechanisms might be that implement this process" (p. 138). Researchers agree that in selecting to produce a word in a given language, bilinguals are faced with the activation of the word's lexical and phonological representation in both languages (Rodriguez-Fornells et al., 2006; Ye & Zhou, 2009a). In fact, there is empirical evidence to support that EF is necessary in order to enhance lexical processing in a less proficient L2 when confronted with this dual activation.

Hernandez and Meschyan (2006) conducted an fMRI study in which late bilingual participants who were significantly less proficient in their L2 were required to take a covert picture-naming task in an attempt to discover what differs in the lexical retrieval processes for the L1 and the L2. Both behavioural and fMRI data were obtained. The behavioural data showed an effect both for accuracy and reaction times, such that participants scored significantly better in percent correct and reacted significantly quicker in their L1 than in their L2. The fMRI data paralleled these findings: a comparison between rest and activation status in the L2 showed increased activation in naming the object than the rest and activation comparison in the L1. In addition, some of the areas in the brain that revealed neural activity (DLPFC and anterior cingulate gyrus) during picture naming in the L2 are regions known for their activation when selecting between response alternatives, when inhibiting irrelevant items in the WM and when maintaining goal-related information (p. 183).

The models that attempt to explain the selection process approach it in one of two ways. Some claim that inhibitory processes are responsible for the selection of the correct language while others postulate an increased level of activation of the target language (Rodriguez-Fornells et al., 2006). Hernandez and Meschyan's (2006) investigation discussed above produced evidence for the role of EF in language selection during L2 lexical retrieval but does not allow us to distinguish the most likely model. However, Rodriguez-Fornells et al. (2006) provide evidence that supports the inhibitory processes model. The authors discuss two studies they previously carried out in order to gain insight on the level of phonological (Rodriguez-Fornells et al., 2005) and syntactic activation in bilinguals. Both studies employed the Go/noGo task, adapted to the goal of the investigation. The Go/noGo task measures the element of inhibition within EF (Denckla, 1996) by setting a stimulus that requires the participant to react and setting a second stimulus in which the participant is to do nothing (i.e. inhibit a reaction). In the phonological Go/noGo task, the bilingual participants had to decide whether the word for a given picture began with a consonant or a vowel, alternating the target language (German/Spanish) between blocks. The same task required them to withhold a response when the word corresponding to the picture started in a vowel in the determined language. Crucially, in half the trials, the names in both languages would lead to the same response (coincidence condition), while in the other half, the names led to different responses in the two languages (noncoincidence condition). The alternation of target languages between blocks was used to represent the switching of codes often observed in bilingual speech. Monolinguals produced only German name responses. The hypothesis was that no phonological activation should be observed if language selection in bilinguals occurs at the lemma level.

Behaviourally, the results pointed to phonological interference: bilinguals were less accurate overall and displayed longer response times in both languages. Importantly, they made more errors in the noncoincidence trials. The comparison of ERP data between bilinguals and monolinguals also showed evidence of partial inhibition of the Go response in the target language in noncoincidence trials when there was noGo interference from the non-target language. Results of fMRI data partially supported these findings as well, revealing activated brain areas for the bilinguals in the coincidence condition that have been associated with EF processes.

In a follow-up study Rodriguez-Fornells et al. (2006) examined whether this interference continued at the syntactic level. The Go/noGo covert naming task for this second experiment consisted of responding or not according to a noun's gender in the specified language (German or Spanish) for a given block of trials. Interference was expected when the languages did not agree in syntactic gender. Again, behavioural data showed longer reaction times for bilinguals in noncoincidence trials, as well as lower accuracy rates, indicating inhibition of the non-target language. ERP data supported these findings by revealing a large negativity in noncoincidence trials.

From the results of these two studies, Rodriguez-Fornells et al. (2006) argue that bilinguals process language through executive functions of inhibition when both languages are activated, not only at the lexical level, but also at the phonological and syntactic levels. These investigations provide crucial information in understanding how EF processes operate during L2 processing. Importantly, Rodriguez-Fornells and colleagues' (2006) second study looks into additional facets of the lexical retrieval process, investigating the role of inhibition in processing linguistic features of phonology and morphosyntax, and strongly suggesting inhibition of activated features at both levels. Nonetheless, care must be taken when interpreting what their results demonstrate for long-distance or discourse processing of syntax. Their findings do provide convincing evidence that phonological and syntactic interference is present during bilingual processing, and that inhibition processes act to suppress the features of the non-target language when both are active; however, the way in which these processes manifest themselves during discourse or sentence processing that requires long-distance agreement, rather than retrieval of discreet lexical items and their features, may not be the same. Having said this, these results continue to provide solid support for the notion of syntactic schema-level interference and EF inhibition processes undertaken in the present study.

The literature reviewed above has strongly suggested that EF plays an important role in L2 processing, most notably by means of inhibition of the dominant (or active) language (L1). Studies of EF and L1 also demonstrated that updating and selectional processes are intimately related with language development. Further, investigations of EF and L2 showed evidence that processes of selection, inhibition and maintenance of goal-related information are active during L2 and bilingual processing. These findings, while interesting and warranting further research, are perhaps not surprising given the cognitive weight of maintaining two (or more) language systems. In cases of lower L2 proficiency (as compared to the L1), where entrenchment of linguistic representations in the input (and output) is low, it seems logical that features of a more dominant, more entrenched L1 would cause interference, thereby urging their suppression if the task requires the speaker to continue processing in the L2. Additionally, recall that Marian and Spivey (2003a, 2003b) (discussed in the Eye Tracking Research in L2 and Bilingual Processing section in this chapter) found within-language competition, as well as between-language, which makes an even stronger case for the role of EF inhibition and selection processes during L2 processing, and for the advantage that higher abilities afford L2 learners. Finally, processing sentence or discourse-level morphosyntactic phenomena logically requires EF abilities in updating the WM with new information that is being integrated and allocating attentional resources to the various linguistic phenomena that contribute to the meaning of the spoken or written text.

Other research has also considered the effect of EF in the L2 acquisition of morphology (Brooks, Kempe & Sionov, 2006), in bilingual verbal fluency (Luo, Luk & Bialystok, 2010), and proactive interference (Bialystok & Feng, 2009); however, these studies also take into account the participants' VS and, as this is the third factor analyzed in this study with respect to non-target clitic placement detection, are therefore discussed in the following section.

Vocabulary Size and Language

Since Anderson and Freebody (1981) suggested that VS had an important impact on reading comprehension, researchers have investigated and come to agree that VS is intimately connected with the child's acquisition of grammar (Freebody & Anderson, 1983; Bates & Goodman, 1997). Since then, this finding has also been suggested for second language reading comprehension (Laufer, 1992). Although interest in VS, particularly in SLA research, is relatively recent, the potential impact that VS may have on the development of L2 learner's linguistic system, as well as on his/her processing abilities should not be undervalued. We have seen above that the cognitive system employs resources of WM and EF during processing, both in the L1 and the L2. Seemingly, the role of such resources is to facilitate processing, and limitations in them correlate with slower processing and affect sentence comprehension. Furthermore, the research has also implied that greater resources are employed when processing in a less-proficient L2. It is quite apparent, then, that VS would play a crucial role during processing in terms of providing a maximally-entrenched lexical foundation that may serve to free up cognitive resources needed for other linguistic features, such as morphosyntax.

Two types of VS may be measured: receptive (how many words a learner understands) and expressive (how many words a learner can produce). Some standard tests used to measure VS include the Boston Naming Test (BNT) (Kohnert, Hernandez & Bates, 1998; Bialystok, Craik & Luk, 2008), the Peabody Picture Vocabulary Test

(PPVT) (Bialystok, Craik & Luk, 2008), the Expressive Vocabulary Task (Luo, Luk & Bialystok, 2010), the Eurocentres vocabulary tests (Meara, 1990), and Snodgrass and Vanderwart's (1980) test.

Various studies have addressed the role of VS in bilingual processing and production, some simultaneously with EF, as previously above. For example, Bialystok & Feng (2009) conducted two experiments aimed at testing verbal performance and memory in bilingual children and adults as compared to their monolingual counterparts. The rationale behind the study was the previous findings reported in the literature concerning the impact of bilingualism on language proficiency. In two separate bodies of research, evidence has shown both disadvantages and advantages for the role of bilingualism in performance: bilinguals have been shown to perform more poorly than monolinguals in verbal tasks assessing linguistic processing; however, the opposite has been found for non-verbal cognitive tasks that rely on EF (Bialystok & Feng, 2009; Luo et al., 2010). Therefore, bilingualism seems to have an impact both within the language domain and beyond it.

Bialystok and Feng (2009) used a proactive interference task to test for EF in their groups. The task consisted of four lists of words, three of which contain words belonging to the same semantic category. The fourth list contained words from a different category. A filler task was placed after each list. All participants were tested for receptive VS. In the first experiment, the children heard a word every two seconds and repeated each word out loud. After the filler task, the children were asked to name as many words as they could recall. Interference buildup occurs during lists two and three because the fact that the semantic category is the same causes a decline in the number of words recalled due to interference from the other active lemmas. On the fourth list, the buildup is released as a result of the category change, and the number of words recalled rises again. The results of the experiment with bilingual and monolingual children were not very decisive. Bilingual children did not show a significant decline in the number of words recalled between the first and second lists, and between the second and third lists, as did the monolinguals. Bialystok and Feng interpret these results as indicative that bilingual children experience no disadvantage in controlled attention to word lists.

The second experiment had adults engaging in a similar proactive interference task. The results of the bilinguals as compared to the monolinguals mirrored those of the children. However, in the adults there was one main difference: a correlation was found between recall and VS score. Given that the bilinguals had lower vocabulary than monolinguals, a significant advantage showed up when an analysis of covariance corrected for differences in VS. When the recall scores by vocabulary groups were analyzed statistically without correcting for difference in VS, a large difference in recall between groups emerged. Bialystok and Feng acknowledge that these findings are preliminary but highlight what the results suggest: first, VS affects verbal performance; second, bilinguals show evidence of superior attentional control.

Bialystok et al. (2008) and Luo et al. (2010) both investigated bilinguals and monolinguals that varied in VS on performance in letter and category fluency tasks. The letter fluency task tests verbal fluency by requiring participants to generate words according to specific letter restrictions and is said to depend on phonemic abilities. Category fluency requires production of words from a determined category, such as fruits or animals and is believed to rely on semantic abilities (Holtzer, Goldin & Donovick, 2009). In Bialystok et al. (2008), the findings showed that bilinguals performed more poorly on word naming and verbal fluency; however, correction for VS revealed that group differences largely disappeared, showing that VS is an important factor in verbal fluency and naming tasks. In a letter fluency task that was more demanding on executive control, however, high proficiency bilinguals outperformed monolinguals, indicating that bilinguals do have an advantage in executive control abilities. Similar results were found in Luo et al. (2010).

Crucially, this research has highlighted two key concepts. The first concerns the relationship between EF and bilingual processing. All studies reviewed before this section have addressed how EF is employed during processing, and have revealed results that suggest greater resources may facilitate it, particularly while inhibiting interference from a competing language. The three studies discussed in this section thus far, however, have shown that maintaining more than one language system enhances EF, and have highlighted the intimate relationship between EF and language systems. On one hand EF seems to facilitate L2/bilingual processing; on the other, developed L2 proficiency/bilingualism seem to aid in EF development. The second, and more important, factor that has been emphasized in the studies discussed in this section thus far is that of VS and processing. Accounting for VS in all three studies showed that a higher VS correlates with higher abilities in recall and verbal fluency. If this is the case with lexical items, there is good reason to believe that VS potentially plays a crucial role in L2/bilingual processing of morphosyntax as well.

Indeed, the research reviewed above looks at lexical retrieval and verbal fluency but did not address acquisition of grammatical features. One study that examines the role of VS in the acquisition of L2 morphology is that of Brooks, Kempe and Sionov (2006). They trained participants on Russian vocabulary and case at the same time in order to test whether greater input variability in the form of greater VS would provide learners with the necessary type frequency that would allow them to generalize grammatical regularities (i.e. case) to new nouns. The participants, who had no previous experience with Russian, were divided into groups according to vocabulary training size (6, 12, or 24 nouns). They underwent six aural and visual (pictures) trainings in which the new vocabulary also taught them nominative, dative and genitive case, followed by a testing phase that added 12 new nouns to assess generalization of case marking, and a vocabulary test that measured how much vocabulary each group acquired. The findings revealed no effect of VS in the generalization of case in new vocabulary items. However further analysis of this apparent null effect showed that only those individuals in the 24-noun group with high scores in a nonverbal intelligence IQ test that required attentional and EF resources were able to acquire the necessary vocabulary to benefit from the greater input variability. According to these results, VS is an essential component in L2 acquisition of morphosyntax but without sufficient EF and attentional resources learners may not benefit from greater variable input that would allow them to make such generalizations in a morphologically rich language.

In sum, studies have found that VS is related to L2 lexical processing and acquisition. Importantly, Brooks et al.'s investigation highlights the importance of individual differences in cognitive abilities, not only in the acquisition of grammar but in learning vocabulary as well. It seems that while a sufficient VS is crucial in generalizing morphosyntactic features of the L2 to new items, insufficient cognitive resources may prevent the necessary vocabulary acquisition required to do so. The question is what this means for the L2 processing. The role of VS may vary somewhat during L2 processing of morphosyntax in sentence reading. In the first place, a distinction must be made between parsing known versus new items. Parsing written sentences with familiar vocabulary frees up cognitive resources, which may be allocated to other linguistic features of morphosyntax. Parsing sentences with unfamiliar items burdens the cognitive system with added semantic difficulties and attentional resources are directed at lexical items that offer better opportunities to build meaning. Recall, as well, that (entrenched) lexical symbolic units are easily accessible symbol-meaning pairings. Infrequent or unfamiliar lexical items may also use up WM resources, as symbol-meaning pairings are being formed, not easily accessible, and must be kept active during processing. This process, in turn, leaves less WM capacity available to keep active other linguistic features of the discourse/sentence during processing. Thus, a greater inventory of familiar (i.e. entrenched) lexical items removes burden from the cognitive system and leaves resources free to be used in the morphosyntactic demands of the processing task.

This chapter has thus far reviewed research on Spanish L2 clitic acquisition and processing, which has suggested that clitics may function as both words and affix-like elements in the L2 learner's system, and that L1 word order strategies influence the developing L2 system. We've also seen that acquisition of clitic pronouns is lexically driven, with clitics emerging with the most frequently-used verbs, and that learners abstract linguistic properties in a logical manner, based directly on input.

A review of research on L2 online processing, and more specifically, eye tracking, has provided useful information to explain how learners parse and produce L2 constructions. It has shown some possible differences with respect to L1 processing and has also allowed us to see that the L1 may indeed be activated during L2 processing and cause interference. Furthermore, we've seen that abilities of non-linguistic cognitive factors, such as WM and EF, play an crucial role in facilitating L2 processing by maintaining important lexical and grammatical information active and inhibiting interference from the L1. Lastly, we've seen that VS plays an important role in generalizing grammatical patterns to new items.

In order to better understand how L2 learners parse syntax in the target language and what factors may help them overcome difficulties, the present study incorporates the possibility of L1 syntactic interference by manipulating the word order in the Spanish clitic + finite verb construction so that placing the clitic after the conjugated verb reflects grammatical English word order. With this notion of L1 transfer, the study seeks to examine how the capacity of cognitive systems such as WM and EF, as well as vocabulary knowledge (as VS), predict non-target word order detection.

L2 Object Clitic Processing, Cognitive Linguistics, the Cognitive System, and Vocabulary Size

The previous chapter and this one have presented much information relevant to this study, all of which integrates to present a combined view of Spanish L2 clitic processing. Frequent clitic + finite verb collocations with a variety of clitics and verbs are necessary in the L2 learner's input in order for general cognitive processes of automatization and abstraction to i) form symbolic units, and ii) form schemas for the clitics and the constructions. Additionally, this high frequency also leads to categorization, whereby linguistic units (i.e., object pronoun clitics [in finite verb constructions]) are arranged into categories containing both more and less prototypical exemplars. Because frequency is said to be the driving force, limited occurrences of these constructions possibly leads to less automatization, partial schematization or, if the schematization is maximal, less-accessible schematization (Ellis, 2003, p. 75).

Additionally, the cognitive processing clitic + finite verb constructions involves the categorization (assessment) of various features of its schema, which include the anaphoric reference point relationship between the nominal antecedent and the clitic, the valence relations between verb and clitic pronoun (which includes the clitic's case feature), the number and gender agreement features, the pre finite-verb position of the clitic pronoun, and all semantic content. If the clitic + finite verb collocation is not automatized enough, its processing can be taxing to the cognitive system.

Moreover, the task is complicated by the presence of the L1 system and its corresponding schemas. Chapter 1 highlighted the main differences between the Spanish pronominal clitic system, the English clitic system, and the English object pronoun system. In the first place, the English clitic system is composed of mainly reduced forms that obey the syntactic requirements of their full-form counterparts, complicated some by the negator *n't* and the possessive marker *'s*. The Spanish clitic system is very different. Spanish clitic pronouns are "special" clitics: they are not reduced forms of their corresponding strong pronoun forms, and they have different syntax, the full forms appearing after a finite verb. English object pronouns, on the other hand, are strong pronouns that may cliticize in rapid speech, showing up as phonetically reduced forms, but still retain the same syntax as the strong pronouns. In English object constructions, whether with strong pronouns or reduced, cliticized forms, the syntax has the pronoun appear after a finite verb.

Furthermore, English third person object pronouns contain gender and animacy features in the singular form (*him, her, it*) but not in the plural (*them*), while the Spanish clitics mark gender and number features in both singular and plural forms. Additionally, English pronouns have the same forms for both accusative and dative case while Spanish forms differ. Finally, the Spanish feminine accusative clitic forms 'la' and 'las' are polysemous with the feminine definite articles, and the masculine plural accusative clitic form 'los' is polysemous with the masculine plural definite article. What is already a complex task is now further complicated by interfering factors both from the L1 and the L2. English accusative and dative object pronouns mark different features and their verbal construction schemas have a different word order than Spanish. In addition, as noted above, Spanish clitic pronouns are low-saliency elements in that they are phonologically weak.

In these cases, the constructs researched in cognitive psychology, such as WM, EF, become very pertinent. Greater EF abilities may serve to facilitate non-target word order detection by inhibiting English object schemas and contributing to the selection of the low-salience clitic (Robinson, 2003, p. 635). Greater WM may, among other things, facilitate maintenance of the antecedent nominal and its features active in its system while other grammatical and semantic information is processed and integrated. Finally, a greater VS may work to facilitate integration of semantic information, thereby freeing up the cognitive system so that it may attend to the more grammatical parts of the schema. Thus, the objectives of this investigation are to determine whether higher abilities in WM and EF, and a greater VS, predict a greater likelihood that non-target L2 verb + clitic pronoun word order is detected when the non-target L2 represents a grammatical structure in the L1.

To this end, the following chapter discusses the methods followed to carry out the study. It looks at the research questions, participant selection process, materials and design—including, but not limited to, a description of the stimuli and measures of WM, EF and VS—along with the experimental procedures and methods of data analyses.

CHAPTER 3
METHODOLOGY

Chapters 1 and 2 have considered how L2 features are processed and acquired by the L2 learner. We have seen that SLA studies of Spanish clitic pronouns have looked at how pedagogical intervention might facilitate their acquisition. We have also seen other approaches that dealt with how they are acquired, be it from a generative grammar perspective in which intermediate stages in the interlanguage are addressed, or in usage-based accounts that argue for lexically-driven stages of acquisition. Research has shown that learners are able to acquire knowledge of clitic placement, whether their L1 contains a similar clitic system or not. The main goals of the this study are to better understand, through eye tracking methodology, how incorrect clitic placement in Spanish is processed by L2 learners when said placement reflects correct English word order and, more specifically, whether non-linguistic cognitive abilities such as WM and EF, as well as L2 VS facilitate morphosyntactic error detection in the L2. To this end, describes the experiments used in the present study and explains the analysis of the resulting data. It looks at the research questions and predictions, the participants, materials and procedure used for the experiments and for testing WM, EF and VS, while the next chapter will explore the results.

Data were obtained from English-dominant adult L2 learners of Spanish at a late beginner-early intermediate level of proficiency. This level was deemed appropriate because learners are not advanced enough to have fully automatized the constructions whose processing is examined here, nor is their level so low that they are not able recognize the constructions.

Two eye tracking experiments were created in order to test learners' processing of clitic-verb word order; the first tested processing of clitic + simple finite verb constructions (and the reverse order), and the second tested processing of clitic + complex finite verb constructions (and two other ungrammatical word orders, as is explained in more detail later in this chapter). Examples of these constructions are presented in (1), the preterite tense, and (2), the present perfect tense.

(1) El niño lo comió por la tarde
The boy CL.3.SG.ACC ate during the afternoon
'The boy ate it in the afternoon'

(2) El niño lo ha comido por la tarde
The boy CL.3.SG.ACC has eaten during the afternoon
'The boy has eaten it during the afternoon'

Using an eye-tracking methodology carries the advantage of capturing aspects of processing that may not be observable with other psycholinguistics techniques. Because it measures both the location of the pupil and the time spent during fixations, eye tracking is an ideal methodology for this study. It provides detailed information about the eye's path while readers process the construction and the material before and after it, including any regressions (i.e. looking back) to the construction, which can offer useful insight into how material is integrated and where processing difficulties lie.

In order to address the role of non-linguistic cognitive abilities and that of VS in the processing of these constructions, participants were also tested for WM, EF and VS. Finally, they were tested for proficiency as well, so that the variability responsible by this element could be accounted for.

Research Questions

The research questions that guided the present study are the following:

1. How well does Working Memory capacity predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing?
2. How well does Executive Function ability predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing?
3. How well does L2 vocabulary size predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing?

For the reasons discussed in chapters 1 and 2, it is predicted that greater WM capacity, EF ability and VS, individually and/or together, all increase the likelihood of non-target word order detection. We now turn to a description of the participants selected for this study, followed by an explanation of the materials and design of the experiments.

Participants

Participant Recruitment and Selection

Participants consisted of 30 adult Spanish L2 learners, both females (*n* = 26) and males (*n* = 4); all reported having begun learning Spanish at the age of 11 or later. The age range was 18 to 24 (*M* = 19.70; *SD* = 1.26). All participants had normal or corrected-to-normal vision. All were selected specifically from the third and fourth semester Spanish classes at the University of Florida. These classes were deemed appropriate sources for participant selection due to the following criteria: 1) Object pronoun clitics are covered in the first semester of all beginner sequence classes; therefore, all participants had either seen the forms in their first semester Spanish class at the university, or had been placed in one of the third or fourth semester classes based on standardized test scores and/or number of years studying Spanish in high school, and would therefore have previously covered the material as well; 2) Students enrolled in Spanish sequence classes at the University are taught the present perfect tense at the very beginning of the third semester, and therefore all students in third and fourth semester Spanish have seen the complex finite verb construction; 3) There is typically adequate variability at this level to provide for a suitable range in VS so that we may examine how well it predicts errors in clitic verbal construction word order.

After having received prior approval from the instructors, the researcher visited all SPN 2200 (third semester) and 2201 (fourth semester) courses at the beginning of a class approximately six weeks into the semester. The scope of the study was broadly explained to the students as an eye tracking experiment on L2 reading. Participation in the experiment was entirely voluntary and, with the approval of the program director, participants were compensated with extra credit in the form of one point added to their lowest test grade or by replacing a 0 on a homework assignment with the total points the assignment was worth. Additionally, they received a five-dollar gift card for use at a popular coffee shop.

Background Information

Participants were provided a language background form, which they completed either before arriving at the laboratory or upon arrival for participation in the experiment. The form was adapted from Rodríguez Prieto (2009) and is provided in Appendix A. The range in number of years studying Spanish, including middle school, high school and college, was two to eight; the mean was 4.83; the standard deviation was 1.46. All but two were native speakers of English who had begun learning Spanish at eleven years of age or older. One participant reported her native language as both Haitian Creole and French, and stated that she began learning English at the age of eight, and stopped speaking French at nine years of age. She also reported having studied abroad in a Spanish-speaking country for six weeks. Another participant reported her native language as Malay, and having learned English at the age of six[1]. Two other participants reported having studied abroad in a Spanish-speaking country for three months, while one reported having traveled to one Spanish-speaking country for three weeks, and another country for two weeks. Five participants reported having occasional exposure to Spanish in the form of socialization with people outside the classroom who spoke Spanish. Of these, only one reported daily exposure in the form of conversation with a family member. The other four ranged in exposure from once per week to once per month. Because all these participants' data generally fell within the upper and lower limits established by other participants whose L1 was English, who had not studied abroad nor had exposure to Spanish outside the classroom (i.e., they were not outliers), they were used in the analyses. Variability in proficiency was accounted for in the statistical analyses and is described in more detail below, as well as in chapter 4.

Materials and Design

Stimuli

Lexical items

As the general aim of this study is to better understand how learners process erroneous L2 clitic placement when the incorrect word order represents a proper and competing word order in their L1, it was crucial to carefully choose all lexical items in the stimuli so as to maximize the likelihood that the participants understood all words. Eye tracking experiments in L2 processing can be complicated by the fact the learners may not comprehend all items in the stimuli. In an experiment seeking to test how morphosyntax is processed, being unfamiliar with the vocabulary may cause longer

[1] Neither participant was eliminated from the study as they learned English at a young age and were thus considered native English speakers.

fixations or regressions to items that were not fully understood. If these longer fixations and/or regressions coincide with items in critical areas of analysis, there is added variability in the data that is difficult to tease apart from the variability caused by the experimental (morphosyntactic) manipulation.

An initial attempt was made to construct all stimuli with lexical items taken from frequency dictionaries, such as Alameda and Cuetos' *Diccionario de frecuencias de las unidades lingüísticas del castellano* (1995) (e.g. used in Moreno & Kutas, 2005) and Almela's (2005) *Frecuencias del español: Diccionario y estudios léxicos y morfológicos*; however, it became apparent that these items could be problematic because the higher frequency verbs in the simple and auxiliary past tenses either did not coincide with what was presented in the relevant courses, or were not transitive or ditransitive, which was specifically needed to form the constructions examined in this study.

Consequently, all lexical items that appeared in the stimuli—nouns, adjectives, and verbs—were taken from *¡Anda! Curso Elemental* (Heining-Boynton & Cowell, 2009), the textbook used in the first and second semester courses at the University, as well as in the accelerated first year course offered in preparation for the intermediate courses from which the participants were selected. All items appeared either as active vocabulary or in glosses, as well as in the glossary at the back of the textbook.

While there is no way to gauge what participants have been exposed to outside the classroom, the textbook material acts as a common denominator in that the participants that had enrolled in any first-year classes at the University had studied from that textbook. Furthermore, those who placed directly in either the third or fourth semester courses due to standardized test scores were likely to have seen the items, as they appear in most beginner Spanish textbooks whose target users are American students.

Clitics

We saw in chapter 1 that the Spanish clitic forms display a considerable amount of syncretism, particularly in the first and second persons, which share the same form in accusative and dative case, as well as in the reflexive form. Additionally, the form *se* carried a multitude of potentially confoundable functions for the L2 learner. In order to streamline this study, the clitics used in the stimuli were limited to accusative and dative third person only, where the least degree of syncretism is observed[2]. Both gender and number alternative forms were included, shown in Table 3-1.

We will recall that research has identified various functions for the dative clitic pronouns (Maldonado, 2002; Zyzik, 2004), some of which were (3a) recipient, (3b) psychological experiencer, (3c) beneficiary, (3d) possessor, and (3e) superfluous dative, reproduced below from chapter 1.

(3)

a. Juan le entregó la tarea al profesor
Juan CL.3.SG.DAT turned in the homework to the professor
'Juan turned in the homework to the professor'

b. A Miguel le encantó la película
PRON Miguel CL.3.SG.DAT fascinated the movie
'Miguel loved the movie'

c. Juan le abrió la puerta
Juan CL.3.SG.DAT opened the door
'Juan opened the door for him/her

d. La tormenta le destruyó el jardín

[2] It should be noted again that the accusative feminine pronoun, *la* and *las*, share the same form with the feminine definite articles. The same occurs with the masculine plural pronoun and masculine plural definite article, which both have the form *los*. These forms are polysemous, a feature that may cause difficulties for the learner but is inevitable in the present study.

The storm CL.3.SG.DAT destroyed the garden
'The storm destroyed his/her garden'

e. Este niño no me come nada
This child no CL.1.SG.DAT eat nothing
'This child won't eat anything (for me)'

In order to better control for possible difficulties the participants could experience in interpreting the dative clitics' function, all dative constructions in the stimuli belonged to one of two of these five categories: recipient (3a) or beneficiary (3c). Because this study is specifically concerned with clitic placement, it was deemed that recipient and beneficiary were the best options because the students' textbook uses these two functions in its presentation and explanation of indirect object pronouns. Consequently, all practice exercises in the book are of the same nature. Limiting the dative constructions to these two functions was the best way to increase the likelihood that participants fully understood the content, thereby reducing the amount of other factors outside of the experimental manipulation—clitic placement—causing variability in the data.

Antecedents

Because the clitics used in this experiment are anaphoric, each stimulus was preceded by a referent sentence that provided context and contained the clitic's antecedent NP. All antecedents were controlled for three factors: gender, number and animacy. Controlling for gender and number was a necessity so that all the clitic forms in table 3-1 could rightfully be used. Animacy was controlled for so that the stimuli contained an equal balance of animate and inanimate antecedents. Likewise, for consistency, all antecedents functioned as objects in the referent sentence.

Factors

The present study looks at clitic placement in constructions containing two verb tenses. The stimuli for Experiment 1 consisted of simple finite (preterite) verb constructions, while Experiment 2 tested processing of complex finite (present perfect) verb constructions. Following are the conditions generated by clitic placement manipulation in this study.

Experiment 1 had a 2 x 2 design, with clitic type (accusative vs. dative) and clitic position (PreV vs. PostV) as factors. These factors were fully crossed, creating four conditions. Two clitic types were used, accusative and dative, and the clitic was placed in one of two possible positions: either before the verb, or after it. In this case, the post verbal position is ungrammatical form. Sample stimuli are summarized in Table 3-2.

This first experiment contained 16 items, with grammatical and ungrammatical forms, 8 of which are ACC and 8 of which are DAT. Each set contained four singular and four plural clitics, further subdivided into two masculine (one animate, and one inanimate) and two feminine (one animate, one inanimate) per number feature. A given participant saw either the grammatical or the ungrammatical version for each of the items. This amounts to 16 total critical items seen by each participant for Experiment 1. For the full list of stimuli for Experiment 1, see Appendix B.

Experiment 2 had a 2 x 3 design, with clitic type (accusative vs. dative) and clitic position (PreV vs. PostV vs. PostAux) as factors. The clitic was placed in one of three positions: before the auxiliary + main verb construction, after that construction, or in between the auxiliary and main verb. In these cases, the PreV position is the only grammatical condition. Sample stimuli are summarized in Table 3-3.

The stimuli for the second experiment consisted of nine sets of critical items per case, for a total of 18 items, each with grammatical and two ungrammatical versions (for a total of 54 sentences across all conditions). Because this experiment has three conditions per case (one grammatical and two ungrammatical), the number of sets was required to be a multiple of three in order to build a Latin square model (see Table 3.4 below). As such, there was a slight imbalance in the proportion of gender and number clitics used. Each set contained five singular and four plural clitics. As in Experiment 1, the plural clitics consisted of two masculine and two feminine clitics, each one referring to one animate and one inanimate antecedent. The singular clitics, due to the imbalance imposed by the Latin square design, consisted of three masculine (two animate and one inanimate) and two feminine (one animate and one inanimate).

The limited amount of transitive and ditransitive verbs used in the textbook forced the repetition of some verbs across Experiments 1 and 2; however, no scenarios were repeated. That is, a verb that appeared with certain objects, and formed a particular scenario in Experiment 1 was not used with those same objects and the same scenario in Experiment 2. Again, because each participant saw only one condition of each item, the total amount of critical items seen by each participant for Experiment 2 was 18. A full list of stimuli for Experiment 2 is found in Appendix C.

The critical items for Experiments 1 and 2 were combined into one seamless experimental session for the participant. Each participant saw a total of 34 critical items, including Experiments 1 (16 critical items) and 2 (18 critical items). These were distributed among filler items.

Filler Items

Online processing experiments commonly use filler items, also called distractors, to divert the participants' attention from recognizing the critical items and what they aim to test. Thus the stimuli in this experiment also contained 80 filler items, among which were interspersed with the critical items in a pseudorandom fashion. Half the filler items were grammatical, while the other half contained a grammar error. Of the 40 ungrammatical items, the error types were divided in the following manner: 10 number agreement errors, 10 gender agreement errors, 10 preposition errors, five aspect errors (preterite versus imperfect), five mood errors (indicative versus subjunctive). The number agreement error types were divided as follows: four article/noun, two qualitative adjective, two demonstrative adjective, two verb. The gender agreement error types were: four qualitative adjective, two demonstrative adjective, one quantitative adjective, three article/noun. As with the critical items, each filler item was introduced by a sentence that provided context. The full list of filler items is found in Appendix D.

Comprehension Statements

In order to ensure that participants followed the directions and read the passages for meaning, a true/false comprehension statement followed every item, both critical and filler. The comprehension statement for the critical items made no reference to the clitic pronouns or their antecedents. Rather, they focused on other elements of the referent sentence or critical item, such as subjects or adjectives. The comprehension statement for the filler items, on the other hand, included any element of the context or main sentence. Comprehension statements for each critical item and filler are found in the respective appendices for the stimuli. For Experiment 1, half the comprehension statements were true and half were false. For Experiment 2, due to the odd number of items, four comprehension statements were true, while five were false.

Lists

As each set of stimuli contains two or more version of the same item, care was taken to make sure that a given participant was not exposed to more than one version (i.e. condition) of a given item, and that all items were uniformly balanced among participants so that an equal amount of data were obtained for each item. This was done by means of a Latin square design, used to counterbalance items across participants. Tables 3-4 and 3-5 show the Latin square designs for Experiment 1 and 2, respectively.

We can see that using a Latin square design forms a number of lists for each experiment, the number being equivalent to the number of conditions in the experiment. Thus, the version of each item that appears on a list is alternated per list, such that if one version of a given item appears in the first list, the second list will contain the other version of that item. For example, if Participant 1 is presented with List 1, s/he only sees the ACC-PreV condition of Item 1. Participant 2, who is presented with List 2, then sees the ACC-PostV condition of the same item. Because each participant only saw the items in one of the possible lists, no one participant was exposed to more than one condition of a given item.

Clearly, the Latin square design for Experiment 2 required three lists, as there were three conditions, based on clitic placement options. However, combining the lists for Experiments 1 and 2 left List 3 of Experiment 2 with no corresponding list from Experiment 1. Recall that the items from the two experiments, while separate in analyses, were presented to the participants as one seamless experiment. The mismatch in number of lists between Experiments 1 and 2, therefore, required the creation of six master lists that had equal combinations of the lists from Experiments 1 and 2. These master lists represent the contents of both experiments, and are shown in Table 3-6. Again, because Experiment 2 had three conditions, the number of critical items for Experiment 2 was greater than that of Experiment 1. This simply meant that there were more data gathered for Experiment 1 than for Experiment 2: for each set of six participants, each list from Experiment 1 was seen three times, while each list from Experiment 2 was seen twice. Additionally, in order to ensure that critical items were properly distributed, once all master lists were created with the critical and filler items, they were pseudo-randomized. This was done by using the *=rand()* formula in Excel, followed by a manual adjustment to ensure that: i) no critical items were contiguous; ii) repeated verbs between the two experiments were not adjacent or close to each other.

Setting Interest Areas

Referent sentences and critical items were divided into interest areas (IAs), so that eye-tracking measurements could be taken for each area in order to potentially show how the clitic + finite verb construction is processed. IAs for the referent sentence and critical items were set as shown in Table 3-7. A sample stimulus and its corresponding IAs is shown in Figure 3-1. Crucially, the antecedent's IA included contiguous material that functioned to form a semantic unit with it, such as the article and adjective. In the case of PPs, they were only included in the IA if their meaning constituted an intrinsic part of the antecedent's meaning. For example, in the phrase *dos nuevas agencias de viaje* 'two new travel agencies,' the PP *de viaje* 'of travel' specifies the type of agency, of the many possible ones, and was therefore considered to be a feature that formed part of the antecedent's semantic unit. Likewise, in the case where the article formed part of a contraction with a preposition, as in the contraction *al* (from the preposition *a* and the masculine definite article *el*), the contraction was included in the antecedent's IA.

With regards to the critical item, it is common practice in eye tracking experiments that involve sentence processing to designate the final word with its own IA because time spent on this word typically reflects wrap-up effects (e.g. Rayner & Sereno, 1994). IAs six and seven are spillover regions, which may reveal any delayed processing effects (Rayner & Sereno, 1994). It should be noted that, due to the nature of the stimuli, 30% did not have an IA7. In addition, one critical item (2.9% of the items) did not have an IA6, while one other critical item (2.9% of the items) had an IA6 of one word only.

Eye Tracking Measurements

Chapter 2 reviewed some of the basic reading time (RT) measurements taken in eye tracking studies of reading processing. For the present study, the measurements taken for each IA include: first-pass reading time (also called gaze duration), regression path reading time, total reading time, and total trial reading time. Once again, the first-pass reading time refers to the sum reading time of all fixations made in an IA before leaving the area, either progressively or regressively. The regression path includes the sum of the reading time of all fixations in an IA until leaving the area progressively. This measure includes the reading times of all regressions made outside the area from the point of first entering it. The total reading time measure is the sum of all fixations in a region, excluding regressions. Finally, the total trial reading time is the total reading time for the whole sentence.

Proficiency, Cognitive and Vocabulary Size Tests

Given the variability observed at the stage of acquisition of the participants that partook in the experiments for this study, it was imperative to measure proficiency so that it could later be taken into account as a predictor during the statistical analyses, and factored out. Proficiency was determined through a test based on the DELE assessment (official proficiency exam administered by the Spanish Ministry of Education), commonly used in generative L2 Spanish research to assess participants' L2 ability (e.g., White, Valenzuela, Kozlowska-MacGregor & Leung, 2004; Slabakova, Kempchinsky & Rothman, 2012). The test consists of two parts, both multiple choice, printed with black ink on white paper. The first part is a series of 30 incomplete sentences; the second is a short story with twenty missing grammatical and lexical elements. A sample of the test is provided in Appendix E.

In addition to proficiency, all participants were tested for their abilities in the three predictor factors that form part of the research questions of this study: WM, EF and VS. These consisted of some of the standard tests discussed in chapter 2. Three tasks were used to measure WM capacity. These included digit span forward and digit span backward, from the Wechsler Memory Scale (Wechsler, 1987), and a digit-ordering task (Hoppe, Muller, Werheid, Thone, & von Cramon, 2000; Werheid, Hoppe, Thöne, Müller, Müngersdorf, & von Cramon, 2002). The digit span forward task requires participants to repeat verbatim lists of numbers increasing in length. In digit span backward, the participants repeat the lists of numbers in the reverse order of presentation. Both tasks contain seven sets of two trials at each list length, ranging from three to nine digits. Testing was discontinued when a participant missed both trials on a given list length. The score for both tasks is the number of lists repeated correctly, with the maximum possible score being 14. In the digit-ordering task, participants must likewise repeat lists of numbers increasing in length, this time in ascending numerical order. The task contains a total of six sets of four trials per list length, ranging from two to seven digits in length. In this task, testing was discontinued when a participant missed two or more trials at a given list length. The score for this task is the number of lists correctly ordered, the maximum possible score being 24. Appendix F contains samples of items from the digit span forward, digit span backward, and digit ordering tasks.

As a measure of EF, the tasks given to each participant were Stroop Color Xs and Words (Rinne et al., 2000), Trail Making A and B (Spreen & Strauss, 1998), and Digit Symbol Subtitution (DSST) (Lezak, Howieson, Loring, Hannay, & Fischer, 2004). The Stroop Color Xs consists of five columns of twenty rows of Xs printed in one of three colours: blue, green and red. Moving down the rows, column by column, the participant must name as many colours as possible in 45 seconds. The Stroop Color Words entails the same layout and process as the Color Xs; however, the columns are made up of printed non-congruent colour words, and participants must name the colour of the ink in which the word is printed, rather than read the word itself. For both tasks, the score is the total number of colors correctly named.

The Trail Making tasks require participants to connect items by drawing lines. In the Trails A task, participants must connect numbers in ascending order, ranging from one to 25. In Trails B, they must connect numbers and letters in alternating and ascending order (e.g., 1-A-2-B-3-C...), ranging from one to 13 and A to L. For both Trails tasks, the score is the number of seconds required to complete the task without any errors. The DSST is composed of a legend of nine symbol-digit pairs, followed by a list of digits 100 digits. Participants must correctly write the corresponding symbol under each digit, completing as many as they can in 90 seconds. The total amount of correct symbols constitutes the score on the task. Appendix G contains item samples of the Stroop, Trails Making and DSST tasks.

Finally, Spanish L2 VS was measured using the X_Lex v.2.05 test developed by Paul Meara at University of Wales Swansea, freely downloadable at: http://www.lognostics.co.uk/tools/index.htm. In searching for possible tests that could measure the participants' VS, the options seemed less than satisfactory as they had been developed with other research goals in mind. For example, The Boston Naming Test (Kaplan, Goodglass & Weintraub, 1983) was used as a measure of Spanish vocabulary proficiency in Hernandez and Meschyan (2006). However, because the test was originally developed to test for word retrieval in individuals with language disorders, such as aphasia, and because many of the items appearing in the test are dated and not likely to be recognized or known by L2 learners at beginner and intermediate levels of proficiency, the test was not deemed appropriate for the goals of the present study. Another option was to use a verbal fluency task (Gollan, Montoya & Werner, 2002), in which participants would name as many items of a given semantic category as they could in a limited timeframe. While more appropriate than the Boston Naming Test, it has not been confirmed that the verbal fluency task is a direct measure of vocabulary size, which is the ideal test for one of the goals of this study.

The X_Lex test, on the other hand, was developed specifically to estimate L2 learners' VS. It uses a YES/NO method, in which a series of words appears on a screen, one by one. For each word, the participant indicates whether he/she knows the word by clicking on a smiley face, or does not know it, by clicking on a sad face. In order to account for false claims, the program contains a number of imaginary words that do not really exist, and uses these words to check on the reliability of the participant's claims. If a participant claims to know a lot of the imaginary words, then his/her claims to know the real words is suspect, so the program adjusts the score downward. According to the manual included with the software download, this generally means that the scores produced by X_Lex are conservative scores, and may underestimate the participant's true vocabulary knowledge. Nonetheless, because it was the only test available conceptualized and developed to measure Spanish L2 VS, and because it is a test of receptive, rather than productive, vocabulary, it was deemed to be the best choice for the purposes of the present study. Appendix H shows the interface of X_Lex v.2.05 test.

Other Materials

In addition to the language background form used to collect information, two other documents were developed for this experimental process. The first of these is the informed consent form, used to explain the experiment's goals and procedure to the participants and as an agreement between the experimenter and the participants. The second is the protocol checklist of all the procedural steps to follow through with the full experiment. The consent form, found in Appendix I, was read by every participant upon arrival at the laboratory, and was subsequently signed and dated by the participant and the experimented.

Apparatus and Procedure

Eye Tracking Experiment

For the eye tracking experiment, stimuli were presented on a 21” CRT computer screen with a 100 Hz refresh rate. Participants wore a headset as part of an Eyelink II eye-tracking system (SR Research), which collected eye movement data with a 250Hz sampling rate and a spatial calibration accuracy of better than 5°. Eye movement was recorded from whichever eye that the system determined was more accurate during calibration.

All stimuli were written in normal, black uppercase and lowercase letters on a white background. After a brief setup and calibration procedure, participants read instructions for the experiment on the screen, available in Appendix J. Following the instructions, participants went through five practice trials, where they were able to get accustomed to the prompts and procedure, and ask any questions. The components of each trial were presented in three separate screens. As the instructions in Appendix K indicate, before each trial participants saw the word "¿Listo?" (Ready?) on the screen. They then pushed the right shoulder button on a hand-held game controller to advance to the items screen. Participants were instructed to look at a fixation target while pressing the right shoulder button once again to display the referent sentence and critical item. These were presented together, on separate lines. In order to advance to the comprehension sentence, the participants had to press the right shoulder button once again. The comprehension statement was listed in the middle of the screen. Below it, two yellow circles appeared, the left one containing the word "Cierto" (True) and the right one containing the word "Falso" (False). The participants were instructed to press the left shoulder button if they believed the statement to be true about the passage they had just read, or the right shoulder button if they believed the statement to be false. Participants were assigned to take the experiment with one of the six master lists discussed in above to ensure that an equal amount of participants took the experiment with each list.

Data Collection

The full experiment was administered in one session that lasted between 120 and 150 minutes. As a timesaving measure, the language background form was emailed to all participants the day before they were scheduled to participate in the experiment, so that they could complete it at their own leisure. Some participants completed it electronically and emailed it back to the experimenter; others completed it by hand and brought the printed copy with them to the experiment. On a few occasions, participants did not complete the form prior to arriving at the laboratory and thus did so at the very beginning, in order to ensure that they were eligible for participation.

All participants signed in upon arrival, were given two identical copies of the informed consent form and asked to read it. Once both copies were signed, counter-signed and dated, one was filed in the laboratory and the other was given to the participant. The eye tracking portion of the experiment was first. Participants sat comfortably in a chair in front of the computer and followed the process outlined in the previous section. Because the eye tracking experiment could last up to one hour, depending on the participant's reading rate, participants were told that they would be advised once they'd completed 50% of the experiment and they would be given the option to take a short break or continue. If a break was requested, the participant further had the option of resting, getting a drink of water, etc., or completing one or more of the cognitive tasks found later in the protocol.

Upon completion of the eye tracking experiment, the participant took the Spanish vocabulary test, which was installed on the same computer. This test normally took about 10 minutes to complete. Next, the participant moved to another room with the experimenter in order to carry out the rest of the cognitive tasks. This different room was more appropriate for this phase of testing because it allowed the experimenter and participant to face each other while the tasks were completed. The cognitive tasks were carried out according to the processes described above for each one, with the WM first, followed by EF. Lastly, the DELE proficiency test was given to the participant, who was left on his/her own in the room to complete it, while the experimenter sat in an adjacent room available to answer questions. The proficiency test took approximately 30 minutes to complete. The protocol checklist is found in Appendix K[3].

Methods of Analysis

Preparation of Data

Before any analyses could be performed on the data obtained, it was necessary to inspect the data in order to ensure that fixations were accurately assigned to IAs. For example, while the eye tracker can correct for small changes in head position during tracking, sometimes the tracker may become less accurate with respect to vertical positioning, creating "drift". Drift was checked manually for each critical trial by the experiment, and was corrected using a drift correction option in the data viewing software when possible. In some cases, the drift was too far above the text for drift

[3] The protocol shows three additional steps not discussed in this study. The first is a production task in which clitic production was tested in a task where participants looked at pictures of actions with a context sentence underneath, and then had to completed a sentence using the transitive or distransitive verbs provided. The informed consent makes reference to this production task as well. The second is a speed of processing task, another cognitive ability. The third is an English vocabulary size test. The results of these three additional factors are not discussed in the present study.

correction to be automatically applied, and in those cases where it was clear that only vertical orientation was inaccurate, drift was corrected manually by shifting the entire set of fixations downward to the text.

Additional scrutinizing and preparation of data included pooling of all fixations less than 80 ms with larger contiguous fixations, if these were located in the same IA. Any fixation less than 80 ms followed by a fixation in another IA was deleted (Sturt, 2003). In some cases, entire trials had to be omitted from analysis. In these cases, fixations showed no discernible reading pattern, or a very erratic, illogical pattern, reflecting either tracker error or the reader engaging in some other, non-reading eye movement. This impacted only 16 out of 986 total trials.

Statistical Analyses

Although eye movements were recorded for every IA in both the reference and critical sentences, analyses were limited to the data obtained for IA5 through IA8, for both experiments. IA5 was the primary area where the clitic placement was altered, and the subsequent IAs were analyzed for spillover and wrap-up effects. Additionally, while the conditions specified above differentiate between accusative and dative case, for the purposes of the present study, all data were collapsed into determined levels of one factor only: placement with respect to the verb. This was done in the interest of time and in order to lend power to the statistical analyses. This means that for Experiment 1, all data were collapsed into two conditions: PreV (pre-verbal) and PostV (post-verbal). For Experiment 2, the data were collapsed into three conditions: PreV, PostV and PostAux (post auxiliary—where the clitic appeared between the auxiliary and the main verb).

In this study, non-target clitic placement detection is operationalized as longer RTs for the ungrammatical conditions, given the general interpretation in online studies that longer RTs are indicative of processing difficulties. Additionally, non-target clitic placement detection is seen as suggesting that Spanish syntactic schemas are more active during processing, while English ones are being properly inhibited. In the case longer RTs for the grammatical conditions, this is interpreted as non-target clitic placement having not been detected in the given region and measure, and therefore suggesting that English syntactic schemas are more active during the processing moment indicated by the IA and eye tracking measure.

Variability attributable to experimental manipulation. For each IA it is necessary to explain as much of the variability in the data as possible. In this design, there are four analyses that can help us understand which factors account for the variability. In the first place, there is the change in clitic placement/word order. In order to understand if clitic placement had an effect on the variability, two repeated-measures ANOVAs were conducted for each measure (i.e., first-pass, regression path, total reading time) of IA analyzed, one across subjects and one across items. The same two types of ANOVAs were also conducted for the total trial reading time. The subjects ANOVAs help us determine if any effects found are generalizable to the population of adult English-dominant/native L2 learners of Spanish, while the items ANOVAs help us understand if these effects are generalizable to other constructions of the same nature found in the language, and not only applicable to the critical items used in this study.

WM, EF and VS and non-target clitic placement detection. The research questions were addressed by means of a logistic regression for each of the three measures taken (first-pass, regression path, total duration) of each IA analyzed (IAs 5, 6, 7, and 8), as well as for the total trial reading time measurement. Logistic regression was chosen as the preferred test because the difference in reading times contained a theoretical meaningful zero. The assumptions were based on the possible options in reading time differences among the individuals in the group. Reading time delays are often interpreted as indicative of parsing difficulties (Rayner & Sereno, 1994), so if a participant spent a longer time in a given IA or showed longer regression path reading times for a given IA, this could indicate that s/he had problems integrating the information. Detecting a syntactic error, such as word order, could cause longer reading times, in that the participant hesitates while attempting to make sense of the order of elements, especially if the parsing the construction is further complicated by the fact that one of the elements is anaphoric and requires making the clitic-antecedent connection.

With this assumption, there are three possibilities to consider when calculating difference scores of the mean reading times for each measure of each IA for each participant. For the logistic regression analyses, the data were transformed in two ways. First, the difference scores of the means for each participant were calculated by the formula 3-1.

$$\text{Difference score}_{\text{measure A, IAX}} = \text{Ungrammatical}_{\text{measureA, IAX}} - \text{Grammatical}_{\text{measureA, IAX}} \quad (3\text{-}1)$$

This could theoretically yield results in one of three categories. A positive difference score indicates that the participant took longer to read the ungrammatical items than the grammatical ones, therefore indicating parsing difficulties with the ungrammatical items. A negative difference score indicates the opposite case, in which the participant took longer to read the grammatical items than the ungrammatical ones, suggesting that the participant did not recognize the error in ungrammatical condition, but for some reason experienced parsing difficulties with the grammatical condition. Finally, the third possible result is no difference between the two times, indicating that the participant did not differentiate at all between the grammatical and ungrammatical conditions.

A meaningful zero in the calculation of difference scores led to the choice of logistic regression as an optimal analysis for the research questions because this test allows us to examine a continuous predictor (e.g., WM, EF, VS) with a categorical dependent variable. That is, we can analyze whether WM, EF and/or VS ability predicted the likelihood that the difference score would be either positive or negative. In order to prepare the data for the logistic regression analyses, then, the second manner in which the data were transformed was by conversion into binary data, such that the positive difference scores were made to belong to one group, while the negative scores belonged to a second group. There were no instances of a zero difference score in the present dataset.

With regards to the offline data obtained for WM and EF, these were gathered by means of the three tests for each cognitive construct described previously. As each set of tests was designed to measure the same construct or at the very least tap into a latent variable that represents the construct, and in order to not violate the multicollinearity assumption of regression analysis, the data for each construct were reduced by calculating new scores for each set. This was done in two ways: i) a composite score was calculated by converting each test score into a percentile and then finding the average of the three converted scores; ii) a principal component analysis (PCA) was carried out that included the scores for all cognitive tests, in which factor scores representing the latent variables were generated. Separate regression analyses were done with the composite scores and the factor scores as predictors in order to determine which one generated the more parsimonious model.

Lastly, in all regressions, proficiency was forced into the model along with the predictor in question (i.e., WM, EF, VS) so that the variability due to proficiency could be accounted for. The data from one participant (female) were excluded from the regression analyses because the proficiency score was not available and thus could not be placed in the equation. With these analyses in mind, the following chapter systematically presents and discusses the findings obtained for both experiments.

Table 3-1. Clitic pronouns used in stimuli

	ACC		DAT
	Masc.	Fem.	Masc./Fem.
SG	lo	la	le
PL	los	las	les

Table 3-2. Sample stimuli for Experiment 1

Clitic Type	Preverbal (PreV) (Grammatical)	Postverbal (PostV) (Ungrammatical)
ACC	El niño lo comió por la tarde porque tenía hambre. *The boy ate it in the afternoon because he was hungry.*	*El niño comió lo por la tarde porque tenía hambre. *The boy ate it in the afternoon because he was hungry.*
DAT	Una señora rica le escribió un cheque para las camas. *A rich lady wrote him a check for the beds.*	*Una señora rica escribió le un cheque para las camas. *A rich lady wrote him a check for the beds.*

Table 3-3. Sample stimuli for Experiment 2

Clitic Type	Preverbal (PreV) (Grammatical)	Postverbal (PostV) (Ungrammatical)	Postauxiliary (PostAux) (Ungrammatical)
ACC	El estudiante lo ha hecho bien según el profesor. *The student has done it well according to the professor'*	* El estudiante ha hecho lo bien según el profesor. *The student has done it well according to the professor*	El estudiante ha lo hecho bien según el profesor. *The student has done it well according to the professor*
DAT	El policía le ha dado una multa esta mañana. *The police officer gave him a ticket this morning*	* El policía ha dado le una multa esta mañana. *The police officer gave him a ticket this morning*	*El policía ha le dado una multa esta mañana. *The police officer gave him a ticket this morning*

Table 3-4. Latin square design for Experiment 1

Item #	List 1	List 2
1	Acc-PreV	Acc-PostV
2	Acc-PostV	Acc-PreV
3	Acc-PreV	Acc-PostV
4	Acc-PostV	Acc-PreV
5	Acc-PreV	Acc-PostV
6	Acc-PostV	Acc-PreV
7	Acc-PreV	Acc-PostV
8	Acc-PostV	Acc-PreV
9	Dat-PreV	Dat-PostV
10	Dat-PostV	Dat-PreV
11	Dat-PreV	Dat-PostV
12	Dat-PostV	Dat-PreV
13	Dat-PreV	Dat-PostV
14	Dat-PostV	Dat-PreV
15	Dat-PreV	Dat-PostV
16	Dat-PostV	Dat-PreV

Table 3-5. Latin square design for Experiment 2

Item #	List 1	List 2	List 3
1	Acc-PreV	Acc-PosV	Acc-PosAux
2	Acc-PosAux	Acc-PreV	Acc-PosV
3	Acc-PosV	Acc-PosAux	Acc-PreV
4	Acc-PreV	Acc-PosV	Acc-PosAux
5	Acc-PosAux	Acc-PreV	Acc-PosV
6	Acc-PosV	Acc-PosAux	Acc-PreV
7	Acc-PreV	Acc-PosV	Acc-PosAux
8	Acc-PosAux	Acc-PreV	Acc-PosV
9	Acc-PosV	Acc-PosAux	Acc-PreV
10	Dat-PreV	Dat-PosV	Dat-PosAux
11	Dat-PosAux	Dat-PreV	Dat-PosV
12	Dat-PosV	Dat-PosAux	Dat-PreV
13	Dat-PreV	Dat-PosV	Dat-PosAux
14	Dat-PosAux	Dat-PreV	Dat-PosV
15	Dat-PosV	Dat-PosAux	Dat-PreV
16	Dat-PreV	Dat-PosV	Dat-PosAux
17	Dat-PosAux	Dat-PreV	Dat-PosV
18	Dat-PosV	Dat-PosAux	Dat-PreV

Table 3-6. Contents of the master lists

Master List #	Experiment 1	Experiment 2
1	List 1	List 1
2	List 2	List 2
3	List 1	List 3
4	List 2	List 1
5	List 1	List 2
6	List 2	List 3

Table 3-7. Interest areas for referent sentence and critical item

Sentence	Material	IA Num.
Referent	Subject and verbal construction	1
	Antecedent	2
	All material that comes after the antecedent	3
Critical	Subject	4
	Clitic + finite verb construction	5
	First two words following the verbal construction	6
	Any material between the previous IA and the final word	7
	Final word	8

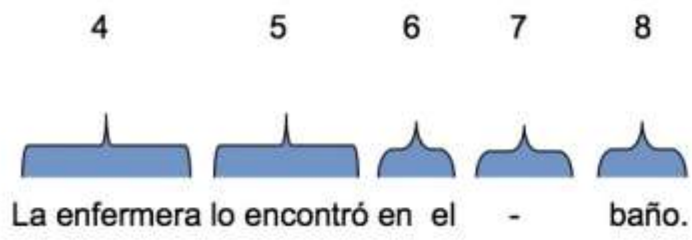


Figure 3-1. Sample stimulus with IAs

CHAPTER 4
RESULTS

This chapter presents the results of all tasks, experiments and analyses carried out for the present study. First, a description of all data obtained, including WM scores, EF scores, VS, proficiency, and RTs for the different measures of the various IAs is provided. Then, the variance in the data attributed to grammaticality, in other words, how the RT scores differ between the conditions in each experiment, is examined. Finally, each research question is addressed by examining the analyses that provide the results to answer those questions. A more thorough discussion of the what the results mean is provided in the final chapter.

Description of the Data

Before examining the eye tracking data, the first four tables in this section present the offline data; that is, the scores for the WM and EF tasks, as well as the VS and proficiency results. As noted in the methods chapter, both composite scores and factor scores were used in the logistic regression analyses. Composite scores were calculated for WM, the Stroop tasks of EF, and the Trails tasks of EF. Complementary to the composite scores for these tasks, the DSST raw scores were also used as a predictor in separate analyses and are therefore included below. The factor scores are the results of the PCA, which generated three factors for all the cognitive scores (excluding VS) placed in the analysis: a WM factor (accounting for 39% of the variance), a Stroop and DSST factor (accounting for 20.3% of the variance), and a Trails factor (accounting for 13.7% of the variance). The Stroop and DSST factor taps into inhibition and processing speed, while the Trails factor assesses sequence maintenance and task switching. The following subsections present the results on each of these measures.

Offline Data

Table 4-1 shows the various scores for the individual WM tasks, along with the composite and factor scores. The three tasks that were administered to measure WM were DSF (digit span forward), DSB (digit span backward), and DO (digit ordering). The maximum possible score was 14 for the digit span forward and backward tasks, and 24 for the digit ordering task. The score range for the DSF task was 5 to 13 (M = 9.10; SD = 2.19). The score range for the DSB task was 5 to 14 (M = 8.13; SD = 2.06). Finally, the score range for DO was 13 to 24 (M = 20.73; SD = 2.90). As discussed in chapter 3, the WM composite scores were generated by converting all task scores into percentiles, then calculating the average of the three scores. The maximum percentile score possible is 1. The range for the composite scores was .49 to .96 (M = .70; SD = .12).

Table 4-2 displays all scores for the individual EF tasks, separate composite scores for the Stroop and Trails tasks, along with the factors and their respective scores generated in the PCA. The four tasks administered to measure EF were Stroop Xs, Stroop Words, Trails Making A, Trails Making B, and DSST. The score range for Stroop Xs was 59-130 (M = 90.13; SD = 14.66) and the score range for the Stroop Words was 42 to 85 (M = 64.53; SD = 11.03); for the Stroop composite score, the range was 58 to 106 (M = 77.33; SD = 11.68). For the Trails tasks, the score range for Trails A was 36 to 86 (M = 56.53; SD = 12.16), while that of Trails B was 40 to 117 (M = 71.17; SD = 17.71). The Trails composite score range was 40 to 93.5 (M = 63.85; SD = 13.20). Finally, the DSST had a score range of 63 to 93 (M = 78.53; SD = 8.61) out of a possible maximum score of 93.

Table 4-3 presents the individual participants' results of the Spanish X_Lex vocabulary task, which was administered to provide an estimate of the participants'

Spanish VS. The range was 1050 to 3150 words (*M* = 1976.67; *SD* = 577.26). The reader will recall that each participant's Spanish proficiency was tested using a proficiency test that has been employed in several other studies of Spanish acquisition (e.g., White, Valenzuela, Kozlowska-MacGregor & Leung, 2004; Slabakova, Kempchinsky & Rothman, 2012). This was done in order to be able to factor out the role of language proficiency in reading processing. Table 4-4 presents the results of the proficiency test scores. Out of a maximum possible score of 100, the range was 26 to 68 (*M* = 42.00; *SD* = 9.49). We now turn to a description of the online data. The tables in following sections describe the recorded eye-tracking RTs of Experiments 1 and 2.

Online Data (RTs)

The tables in this section display the RT means in ms and standard errors for each IA of the critical sentence, averaged over participants, in order to display any obvious differences between conditions. Although IA 4 is displayed for the sake of completeness, the RTs analyses described below were limited to IAs 5 through 8, for reasons previously discussed in the Methods chapter. Values are displayed for each of the measures that were prespecified—first pass, regression path, total fixation duration—as well as for all conditions. PreV is the only grammatical condition in both experiments, and its means are displayed first. The ungrammatical conditions are PostV and PostAux (the latter seen only in Experiment 2). RTs for the total trial measure are shown last.

Experiment 1

Table 4-5 shows the mean RTs for subjects, averaged over items. At first glance, the most apparent pattern is that of IAs 5, 6 and 7. For all three measures—first pass, regression path, total fixation—the RTs for IAs 5 and 7 longer for the PreV condition than for the PostV, while this pattern is reversed in IA 6. The total trial measurement RTs follow the same pattern as that of IAs 5 and 7 as well. It is not the case in IA 8, where the first-pass measure is the only one that shows longer PreV RTs; however, this difference is almost negligible (3 ms). Therefore, a preliminary glance at the data indicates that participants took longer to read the grammatical sentences than they did the ungrammatical ones; however, they also took longer to process the region immediately following the ungrammatical critical one than they did the same region when it followed grammatical critical one. Statistical analyses used to determine any significant differences, as well as their interpretation, are discussed shortly.

RT means were also calculated for items, averaged over subjects. These are shown in table 4-6. The same pattern is evident here as with the subjects means: IAs 5 and 7 show longer RTs in PreV for all measures, while IA 6 shows longer RTs for the PostV. Likewise, the total trial RT measure mirrors that of all measures for IAs 5 and 7: longer PreV RTs. IA 8 displays a very similar pattern for items as it does for subjects means: RTs are longer for the PostV condition in regression path and total fixation, and there is no difference between conditions in the first pass measure.

The data seen in Table 4-6 is further analyzed later in this chapter by ascertaining whether the differences in RTs noted are statistically significant. Before proceeding to the statistical analyses, however, the next section looks at the subjects and items RTs for Experiment 2.

Experiment 2

Table 4-7 lists the subjects RTs for the three conditions of Experiment 2. With a complex verb construction and the addition of a second ungrammatical condition, the RT patterns differ in some respects from those of the first experiment but remain the same in other respects. For example, when comparing the PreV and PostV conditions of IAs 5 and 6, the pattern is the same as observed in the previous experiment: RTs for all three measures are longer for the PreV condition in IA 5; however in IA 6, the RTs are longer for the PostV condition. IAs 7 and 8 do not show the same consistency of pattern: IA 7 showed longer RTs for the PreV condition in the first pass measure only and IA 8 showed longer RTs for the PreV condition in the regression path measure only. The total trial measure shows longer RTs for the PostV condition than for the PreV.

Comparing the third condition, PostAux, with the previous two conditions reveals that it displays the longest RTs in IA 5 for the regression path and total fixation measures. However, this rank is lost in IA 6, where RTs for all measures fall between those of the PreV and PostV conditions. A similar pattern continues in IA 7, in which the RTs for PostAux once again fall between those of the other two conditions, save for the first pass measure, where it has the shortest RTs. In IA 8 all measures show the longest RTs for the PostAux condition, thus approaching the pattern seen in IA 5. Finally, total trial RTs are longest for the PostAux condition and shortest for the PreV. This pattern is the opposite of that found for the Experiment 1 total trial measure.

Table 4-8 displays the items RTs. These follow the same patterns as the subjects RTs. Thus, when looking at all three conditions in the Experiment 2 data, the RTs suggest that participants take longer to process the PreV condition critical item than the PostV one, as seen in IA 5, but take the longest time processing the PostAux condition. However, IAs 6 and 8 suggest that the ungrammaticality of the PostV condition may be integrated at a later time. Before furthering the discussion in a more definitive direction, however, the next section presents the statistical analyses carried out to ascertain which differences were statistically significant, after which the results of those analyses and the patterns considered above are discussed in more detail.

Effect of Non-Target Clitic Placement on Reading Times

This section explores the variance in the data that is attributed to the manipulation of word order in the clitic + finite verb construction. In other words, it looks at the effect of clitic placement on participants' RT data for the critical region, IA 5, along with the ones that follow it, IAs 6 through 8. The significant results of both subjects and items ANOVA analyses are presented for each of the measures shown in tables 4-5 to 4-8. Again, the PreV condition is the only grammatical one in both experiments.

Experiment 1

Repeated measures ANOVAs of subjects' means were conducted for each IA for each measure (i.e., first pass, regression path, total fixation) and for total trial, with clitic placement (PreV or PostV) as a within-subjects factor. No significant results were found for first-pass and total trial measures in any of the IAs. Main effects of other measures were found in IAs 5 and 6, each of which is described below.

IA 5. The ANOVA for the regression path measure of IA 5 revealed a main effect of placement in the critical region, $F_1(1,29) = 5.29$, $p = .029$; $F_2(1,15) = 6.16$, $p = .025$. This shows that the regression path RTs shown in Table 4-5 were significantly longer for the PreV condition ($M = 1053.22$, $SD = 373.05$) than for the PostV condition ($M = 914.69$, $SD = 427.13$).

IA 6. The regression path measure ANOVA of IA 6 also showed a main effect of placement, this time in the first spillover region, $F_1(1,29) = 9.09$, $p = .005$; $F_2(1,15) = 9.90$, $p = .007$. This shows the reverse pattern of IA 5, i.e. that regression path times were significantly longer in the PostV condition (*M* = 1449.07, *SD* = 451.89) when compared to the PreV condition (*M* = 1160.47, *SD* = 563.89).

The total fixation measure analysis of IA 6 also showed a main effect of placement F_1 (1,29) = 8.07, *p* = .008. This means that total fixation RTs were also significantly longer in the PostV condition (*M* = 1443.74, *SD* = 438.08) than the PreV condition (*M* = 1225.12, *SD* = 484.68). Items analyses for this measure were not significant.

Figure 4-1 plots the subjects regression path RT means for all IAs in the critical item, along with the standard error (*SE*). The figure clearly displays the inverse processing pattern in IAs 5 and 6, where the significant differences lie. This same pattern of significant differences found in the total fixation duration measurement is shown in the following chart.

Figure 4-2 shows the subjects total fixation duration RT means and *SE* for all IAs in the critical sentence. The RT patterns in IAs 5 and 6 evidently mirror those illustrated in the regression path measurement though significant differences were only found in IA6. While the ANOVA analyses of the first pass measurement show no significant differences between the PreV and PostV conditions, RT patterns of IAs 5 and 6 would show a similar reversal pattern on the chart.

Summary and Interpretation of Experiment 1

The results discussed above may be summed up as the following: the time spent on IA 5 from first entering the region, including regressions to previous material, to the time of first exiting it to the right was significantly longer for the PreV condition, while the time spent on IA 6 from first entering it, including the re-reading of previous text, to first exiting it to the right was longer for PostV. These RT patterns suggest spillover effects in the PostV condition, whereby IA 5 is feasibly still being processed after the eyes have entered IA 6, a supposition supported by the fact that it is the regression path measure that shows the differences. The results of IA 5 indicate, therefore, that before reading past the region for the first time, participants experience more processing difficulties with the grammatical condition than the ungrammatical. The findings of IA 6 then suggest that, at this later stage, participants may integrate information from previous text and detect the non-target clitic placement, experiencing more difficulties with the ungrammatical condition. The significantly longer total fixation RTs of subjects means in IA6 also support this interpretation.

Experiment 2

As with Experiment 1, repeated measures ANOVAs of subjects means were also conducted for Experiment 2, for each measure of each IA and for total trial, with clitic placement (Prev, PostV, PostAux) as a within-subjects factor. Significant differences were found in all measures, in all IAs except 7.

IA 5. The analyses for the critical area showed significant differences in two measures. The regression path analysis revealed a main effect of placement, F_1 (2,58) = 8.44, p = .001; F_2 (2,34) = 4.28, p = .022. Posthoc pairwise comparisons with Bonferroni adjustment for the subjects means showed that regression path RTs were significantly longer for the PreV condition, (M = 1536.80, SD = 480.74) than for the PostV, (M = 1279.67, SD = 476.25), p = .016. Likewise, regression path RTs were significantly longer for the PostAux condition, (M = 1649.24, SD = 701.00) than for the PostV (M = 1279.67, SD = 476.25), p = .001. Mean differences between PreV and PostAux positions were not significant. Only PostAux - PreV differences were significant in items analyses.

The ANOVA for total fixation duration of IA 5 also revealed a main effect of placement, for subjects only, $F_1(2,58) = 4.87$, $p = .013$. Due to sphericity violations, Greenhouse-Geisser values are reported for this dependent variable. Posthoc pairwise comparisons with Bonferroni adjustment revealed that total fixation RTs were significantly longer for the PostAux condition ($M = 2226.82$, $SD = 783.55$) than the PostV ($M = 1893.89$, $SD = 762.43$), $p = .013$. Mean differences between PreV and PostV, as well as between PreV and PostAux were not significant.

IA 6. In this first spillover area, analyses showed significant differences in the same two measures as in IA 5. The regression path analysis revealed a main effect of placement, $F_1(2,58) = 5.45$, $p = .007$; $F_2(2,34) = 4.41$, $p = .020$. Posthoc pairwise comparisons with Bonferroni adjustment showed that regression path RTs were significantly longer for the PostV condition ($M = 1176.11$, $SD = 538.73$) than for the PreV one ($M = 868.31$, $SD = 388.17$), $p = .015$. Subjects analyses also showed that regression path RTs were significantly longer for the PostV condition ($M = 1176.11$, $SD = 538.73$) than for the PostAux one ($M = 883.35$, $SD = 517.63$), $p = .027$. Mean differences between PreV and PostAux conditions were not significant.

The total fixation RTs analysis for IA 6 also revealed a main effect of placement, $F_1(2,58) = 17.48$, $p = .0001$; $F_2(2,34) = 20.26$, $p = .0001$. Posthoc pairwise comparisons with Bonferroni adjustment showed that total fixation RTs were significantly longer for the PostV condition ($M = 1355.36$, $SD = 513.75$) than for the PreV one ($M = 902.43$, $SD = 403.46$), $p = .0001$. Likewise, total fixation RTs were significantly longer for the PostV condition ($M = 1355.36$, $SD = 513.75$) than for the PostAux one ($M = 1018.45$, $SD =$

363.91), p = .001. Mean differences between PreV and PostAux conditions were not significant.

IA 8. The significant findings for this IA (final word) emerged only in the subjects analyses. The analysis of RT means of the first pass measure revealed a main effect of placement, $F_1(1,29) = 4.09$, $p = .033$. Due to sphericity violations, Greenhouse-Geisser values are reported for this dependent variable. Posthoc pairwise comparisons with Bonferroni adjustment did not reveal where the significant differences occurred. Further posthoc paired samples t-tests revealed that first pass RTs were significantly longer for the PostAux condition (M = 395.06, SD = 159.03) than for the PreV (M = 326.00, SD = 100.36), p = .033. Likewise, first pass RTs were significantly longer for the PostAux condition (M = 395.06, SD = 159.03) than for the PostV one (M = 331.38, SD = 83.38), p = .041. Mean differences between PreV and PostV conditions were not significant.

The analysis of the IA 8 means of the regression path measure also revealed a main effect of placement, $F_1(2,58) = 6.17$, $p = .005$. Again, due to sphericity violations, Greenhouse-Geisser values are reported. Posthoc pairwise comparisons with Bonferroni adjustment showed that regression path RTs were significantly longer for the PostAux condition (M = 3259.93, SD = 1660.53) than for the PreV one (M = 2574.73, SD = 1376.67), p = .042. Likewise, regression path RTs were significantly longer for the PostAux condition (M = 3259.93, SD = 1660.53) than for the PostV one (M = 2524.20, SD = 1029.51), p = .004. Mean differences between PreV and PostV conditions were not significant.

Finally, the analysis of RT means of the total fixation measure also revealed a main effect of placement, $F_1(2,58) = 4.29$, $p = .019$. Greenhouse-Geisser values are once again reported for this dependent variable. Posthoc pairwise comparisons with Bonferroni adjustment showed that RTs were significantly longer for the PostAux condition (M = 654.88, SD = 292.97) than for the PreV condition (M = 526.35, SD = 213.68), p = .032. Mean differences between PreV and PostV conditions, as well as those between PostV and PostAux, were not significant.

Figures 4-3, 4-4 and 4-5 summarize the results seen above by measure, across IAs. Figure 4-3 charts the subjects RTs in the first pass measure. The significant differences lie in IA 8, with PostAux RTs being longer than PreV and PostV ones. Figure 4-4 shows the subjects RTs of the regression path measure. Here, the significant differences were in IAs 5, 6, and 8. IA 5 shows that PostV has significantly shorter RTs than both PreV and PostAux. IA 6 shows the opposite: PostV RTs are significantly longer than both PreV and PostAux. In IA 8, PostAux subjects RTs were significantly longer than both PreV and PostV.

Figure 4-5 charts the subjects RTs of the total fixation measure. Again, significant differences were found in IAs 5, 6 and 8. In IA 5, PostAux was longer than PostV. In IA 6, PostV was longer than both PreV and PostAux. Finally, in IA 8, PostAux was longer than PreV.

Total trial time. Placement also had a main effect on subjects total trial RTs, $F1_1$ (2,58) = 3.86, p = .027. Posthoc pairwise comparisons with Bonferroni adjustment revealed that RT means were significantly longer for the PostAux condition (M = 10867.03, SD = 2813.01) than for the PreV one (M = 10025.12, SD = 2605.70), p = .022. Mean differences between PreV and PostV conditions, as well as between PostV and PostAux conditions, were not significant. Figure 4-6 displays the means per condition. Items analyses for this measure did not yield significant results.

Summary and Interpretation of Experiment 2

Unlike the results of Experiment 1, there were a number of significant findings in the analyses of subjects means than those of items means in Experiment 2. Following Clark (1973) both subjects and items ANOVAs must be significant in order for the results to be generalizable to both the population and language. With this in mind, the results that were significant in both types of analyses are discussed first but the results that were significant in either subjects or items (but not both) are also taken into account, in light of the sample size used for this study.

The subjects and items ANOVAs for Experiment 2 yielded four significant findings. The IA 5 analyses show longer regression path RTs for PostAux compared to PostV (with no difference between PostAux and PreV, and between PostV and PreV). IA 6 is the location for the remaining three. Regression path RTs are longer for PostV than PreV, and total fixation RTs are longer for PostV than both PreV and PostAux. The results of IA 5 suggest that participants take longer to process a syntactic structure that matches neither their English nor their Spanish grammar than they do a likewise ungrammatical structure in Spanish that does exist in their English grammar. The effects are quite immediate, as the differences are found in the critical region and with a relatively early measure. That is, even though the regression path measure involves time spent regressing to previous text, and thus is not the most immediate measure of processing, the PostAux condition seemingly posed processing difficulties compared to PostV before the participants' eyes moved beyond it. The noteworthy aspect of these findings is that there are no significant differences between the PreV and PostAux conditions, or between the PreV and PostV conditions, suggesting that participants are not differentiating between the grammatical and ungrammatical conditions, but rather only between the two ungrammatical ones. In IA 6, however, spillover effects of other processing difficulties emerge. Here the findings are similar to those of Experiment 1: the ungrammaticality effect of processing the PostV condition emerges after the eyes have left the critical region and entered into the spillover region, while information from previous text is still being integrated. The findings of IA 6 amount to longer PostV processing times than both PostAux and PreV. This suggests delayed detection of the ungrammatical structure that exists in the participants' English grammar, as compared to the ungrammatical structure that does not exist. Again, there are no differences in processing times between PreV and PostAux.

Drawing a conclusion from the findings described above calls for some conjecture in terms of explaining why participants would not differentiate between a structure that does not exist in the L1 but does in the L2, and one that exists in neither. The most logical answer is that the two structures have in common the fact that neither exists in the participants' L1 and that this shared feature is the cause for this lack of distinction. In other words, both structures are foreign to the L1 grammar and, in that sense, equally "ungrammatical" to a more dominant English syntax during processing. This interpretation makes sense with regards to the results of IA 5, although in IA 6, the significant differences between PostV and PreV, as well as PostV and PostAux, point to detection of an ungrammatical structure in Spanish that is grammatical in English (PostV). This suggests some activation of Spanish syntax. There is still no differentiation between PreV and PostAux at this point.

The results that were significant only in the subjects RTs, but not the items, may serve here to shed some light on what may be occurring. These results emerged in the final word (IA 8) and in the total trial measure. Both the first pass and regression path measure RTs of the final word showed that PostAux RTs were significantly longer than PostV and PreV. In addition, the total fixation measure of IA 8 and the total trial measure reveal significant differences between PostAux and PreV. It would seem, then, that the differentiation between PostAux and PreV emerges in the wrap-up effects. This may be indicative that the L2 syntax must be more active, or perhaps active for a longer period of time, in order to distinguish between two structures that are ungrammatical in the L1, one of which is grammatical in the L2.

The implications of these findings are discussed in more detail in the final chapter. In the next section, the research questions are addressed by means of the results of the logistic regression findings, which are then considered again in the final chapter, alongside the results of the ANOVAs discussed above.

The Role of WM in Processing Non-Target Clitic Placement

This section marks the beginning of the analyses aimed at answering the main research questions of this dissertation. This first portion is dedicated to analysing the variance in the data that can be attributed to WM, following the results of logistic regression models. In other words, it explores how WM predicts the RT differences of IAs 5 to 8 for each measure, and for total trial measures. The analyses focus on the odds ratio (OR), the 95% confidence intervals (CIs) and the p-value. The OR (exp *b* value) indicates if and how a unit increase in the predictor variable (e.g., WM composite scores, WM factor scores, Stroop composite scores, etc.) predicts a change in the odds that the RTs for the ungrammatical conditions are either longer or shorter than the RTs for grammatical one. As both composite and factor scores of the DSF, DSB and DO tasks were calculated and used in the regression analyses, significant results of each are presented. For Experiment 2, two analyses were conducted for each predictor: the first with the difference scores obtained by subtracting the PreV RTs from the PostV RTs as the dependent variable, the second with the difference scores from the PostAux-PreV subtraction as the dependent variable. To this end, the first research question is revisited: How well does WM capacity predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing? The prediction was that higher WM ability would predict a greater likelihood of non-target placement detection, operationalized as delayed RTs for the ungrammatical conditions (PostV, PostAux) with respect to the grammatical (PreV) condition.

WM Effects in Experiment 1

Predictions with WM composite scores

The results of the logistic regression analyses using the WM composite scores as a predictor (independent) variable did not yield reliable results. For example, after controlling for proficiency, the OR of the regression model for the first pass measure of IA 7 is 6926608.11, the 95% CIs are 22.416 to 2.140E+12, and the *p*-value is 0.015. Although the finding is significant, such high ORs and upper CIs indicate that, possibly due to a small sample size and thus insufficient data, or perhaps due to outliers, the model is a very uncertain estimate of the relationship between the WM composite scores and the odds that the RTs are longer for the ungrammatical conditions than the grammatical one. Because all significant results for the analyses conducted with WM composite scores are of this nature, they are not considered here.

Predictions with WM factor scores

This section reports the results of the logistic regression models with the WM factor scores as a predictor of RT differences. Table 4-9 summarizes the OR, 95% confidence intervals (CIs) and p-values of the logistic regression analyses of each measure for each IA, as well as total trial. The left-hand side of the table presents the unadjusted values by measure and IA; that is, the values of the model that contains only WM factor scores as the predictor in the equation, without accounting for proficiency. The right-hand side of the table shows the adjusted values, estimated by the model in which proficiency is included in the equation.

Without accounting for proficiency the analysis of first pass RT differences for IA 7 shows that every unit increase in the WM factor scores increased the odds of the PostV condition having longer reading times than the PreV by 458.2% (unadjusted OR = 5.582; 95% CI [1.415, 22.017]; p = .014). After adjusting for proficiency, there is still a 455% increase in the odds of longer PostV RTs (adjusted OR = 5.551; 95% CI [1.396, 22.072]; p = .015).

Summary and Interpretation of WM effects in Experiment 1

Before summarizing and interpreting the results discussed above, a brief reminder of how non-target clitic placement detection has been operationalized in this study, as well as the implications therein, is provided. Given the general interpretation in online studies that longer RTs are indicative of processing difficulties, detection of the non-target clitic placement is defined as longer RTs for the ungrammatical conditions. As conceptualized in this study, with the framework of cognitive linguistics, non-target clitic placement detection is seen as suggesting that Spanish syntactic structures are more active during processing, while English ones are being properly inhibited. In the opposite scenario, longer RTs for the grammatical conditions indicate that non-target clitic placement has not been detected in the given region and measure, and thus English syntactic structures are more active at that particular moment in processing. This interpretation will be revisited, as the results of this study proved to be more complex to comprehend.

The findings of the second spillover region (IA 7) suggest that higher WM does indeed predict an increase in the odds that non-target clitic placement is detected, due to the increase in the odds of longer RTs for the ungrammatical condition, and that this does not happen while the eyes are still in the critical region but rather as a spillover effect; that is, after the eyes have exited the region to the right. The fact that the findings occur in the first pass measure, which means that the RTs do not include any time spent regressing to previous text, points to the ungrammaticality effect being relatively immediate in the spillover regions. Thus, a more dominant Spanish syntax that would allow detection seems to be activated only after the eye have left the critical region.

WM Effects in Experiment 2

Predictions with WM composite scores

PostV-PreV difference RTs. The results of the logistic regression analyses that had as a dependent variable the difference scores calculated by subtracting the PreV condition RTs from the PostV did not yield significant results. From these null effects, it would seem that, if the same lack of results appear with the factor scores as predictors, then this will indicate that WM does not predict any difference in reading times between sentences containing the non-target clitic placement in the complex verbal construction and those containing the target structure, when the non-target structure is grammatical in the L1.

PostAux-PreV difference RTs. Results were also examined of analyses whose dependent variable was the difference in RTs calculated by subtracting the PreV from the PosAux RTs. As with Experiment 1, analyses using the WM composite scores, the analyses that did have significant p-values were not reliable. For example, after controlling for proficiency, the OR of the regression model for the first pass measure of IA 7 is 0.0001, the 95% CIs are 0.0001 to 0.638, and the *p*-value is 0.04. Although the finding is significant, very low ORs and lower bound CIs, as well as high ones, indicate that the model is a very uncertain estimate of the relationship between the WM composite scores and the odds that the RTs are shorter for the PostAux condition than for the PreV one. As all significant results for the analyses conducted with WM composite scores and PostAux difference RTs are of this nature, they are not considered here.

Predictions with WM factor scores

PostV-PreV difference RTs. As with the analyses containing the composite scores as predictors, the results of the analyses that used the WM factor scores as the predictor variable and the difference scores obtained by subtracting PreV from PostV RTs as the dependent variable did not yield any significant results. This confirms that, at least in the present study, WM does not predict added processing effort or difficulty for learners between sentences containing complex verbal structures where the clitic is placed either in the L1 target position or in the L2 target position.

PostAux-PreV difference RTs. In this section, the results obtained from the analyses that used WM factor scores as the predictor and the difference scores of the PostAux - PreV subtraction as the dependent variable are presented and discussed.

Table 4-10 summarizes the findings. The first pass measure of IA 7 shows some interesting and unexpected findings.

Without accounting for proficiency the model for first pass measure of IA 7 shows that for every unit increase in the WM factor scores, there is a 66% decrease in the odds that the PostAux condition has longer reading times than the PreV (unadjusted OR = 0.340; 95% CI [0.122, 0.945]; $p = .039$). After adjusting for proficiency, there is virtually no change: a 65.5% decrease in the odds of longer PostAux RTs (adjusted OR = 0.345; 95% CI [0.123, 0.973]; $p = .044$). Using the calculated OR from the reciprocal allows us to translate this result into a 189.9% increase in the odds of longer PreV RTs.

Summary and Interpretation of WM Effects in Experiment 2

As with Experiment 1, only WM factor scores generated significant results in Experiment 2. Unlike Experiment 2, however, the findings here do not support the predictions. As we saw earlier, the logistic regression results may be interpreted either from the direction of increasing WM as a predictor or decreasing WM. Recall also that longer RTs for a given condition were said to represent processing difficulty. Following this interpretation, longer RTs for the non-target condition—in this case, PostAux—were operationalized as indicative of detection of said structure. In addition, the predictions made at the start of this investigation were that higher WM capacity would predict a greater likelihood of longer RTs for sentences containing the non-target structure. Per these assumptions, the results of this experiment contradict the predictions, suggesting instead that lower WM capacity predicts a greater likelihood of detection, while higher abilities predict a greater likelihood of processing difficulty with the target structure.

Summarizing the results of both experiments, the evidence for the role of WM in non-target clitic placement detection both supported and opposed the prediction.

Experiment 1 found that higher WM predicts an increase in the odds of longer ungrammatical (PostV) RTs when compared to grammatical RTs (PreV) in the more immediate processing measure of the spillover regions. By contrast, Experiment 2 found no significant results in the PostV-PreV RT-difference analyses. However, the PostAux-PreV analyses suggest that an increase in WM predicts an increase in the likelihood of processing difficulties in the grammatical condition, or, put differently, a decrease in WM capacity predicts an increase in the likelihood of non-target clitic placement detection, which emerges in the spillover regions. Because this finding would not only be inconsistent with basic logic, but also with the fact that no studies have shown an advantage for lower WM capacity, other viable options for interpretation are considered in the final chapter.

The Role of EF in Processing Non-target Clitic Placement

This section examines how EF predicts the RT differences between conditions of IAs 5 to 8 for each measure, and for total trial. As discussed above, composite scores were calculated separately for Stroop and Trails Making tasks, while the DSST consisted of only one set of scores and therefore these were used in a separate analysis. The factor scores used to analyse the role of EF were those generated in the PCA. Stroop and DSST loaded onto one latent variable, which I will call inhibition and processing speed (IPS). Trails loaded onto a separate variable, which represents task-switching and sequence maintenance. As was done with WM, two analyses were conducted for each predictor for Experiment 2: the first with the difference scores obtained by subtracting the PreV RTs from the PostV RTs as the dependent variable, the second with the difference scores from the PostAux-PreV subtraction as the dependent variable. The second research question, then, was: How well does Executive

Function ability predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing? The prediction was that higher EF ability would predict a greater likelihood of non-target placement detection, operationalized as longer RTs for the ungrammatical conditions with respect the grammatical one.

EF Effects in Experiment 1

Of the logistic regression analyses using Stroop composite scores, DSST scores, and IPS factor scores as predictors, none yielded significant models. Only analyses with Trails composite and factor scores as predictors found marginally-significant results that may indicate trends.

The Trails tasks access different aspects of EF than do the Stroop tasks and DSST and were therefore treated separately in the calculation of composite scores. The PCA, having loaded Trails onto its own latent variable separate from the others, confirmed the soundness of this method. Table 4-11 presents the models of the analyses with the composite scores as predictors.

The only analysis approaching significance is the regression path measure of RT differences of IA 6. While this model is not significant, it is worth mentioning for two reasons: first, the results are significant before accounting for proficiency; second, the trend it displays becomes more robust in the model using the Trails factor scores, as we will see. Thus, without accounting for proficiency the model estimates that for every unit increase in the Trails tasks composite scores, there is a 9.3% increase in the odds of longer PostV RTs, as compared to PreV (unadjusted OR = 1.093; 95% CI [1.003, 1.191]; p = .042). After adjusting for proficiency, there is a slight change to an 8.8% increase in the odds, although this value loses significance at the $p<.05$ level (adjusted OR = 1.088; 95% CI [0.996, 1.190]; p = .062). We must recall here that the Trails composite and factor scores are a measure of the time taken to complete the tasks; therefore, higher scores are indicative of lower ability. Thus, we can alternately describe the change in odds as the Trails scores decrease by one unit (and thus ability increases): for every unit decrease in Trails composite scores, there is an 8.8% increase in the odds of longer PreV RTs. These findings indicate that proficiency did indeed play a part during processing in this group of participants.

The finding above is more robust when using the PCA-generated factor scores as a predictor, as shown in Table 4-12. The model of the unadjusted regression path measure of IA 6 shows that for every unit increase in the Trails factor scores, there is a 225.6% increase in the odds of longer RTs for the PostV condition than for the PreV (unadjusted OR = 3.256; 95% CI [1.107, 9.578]; p = .032). After adjusting for proficiency, there is a slight change to a 205.6% increase in the odds of longer PostV RTs and the model is now just shy of reaching significance (adjusted OR = 3.056; 95% CI [1.000, 9.337]; p = .050). Again, this means that the reverse relationship holds true as well: for ever unit decrease in Trails factor scores—that is, increase in ability—there is a 205.6% increase in the odds of longer PreV RTs.

Summary and Interpretation of EF Effects in Experiment 1

The analyses of the EF components in Experiment 1 were broken down into the following predictors: Stroop composite scores, DSST raw scores, IPS factor scores, Trails composite scores, and Trails factor scores. Only the models with the Trails scores as predictors reached p-values close to being significant. As previously discussed, the Stroop task measures goal-oriented abilities, suppression (or inhibition) of interfering information and processing speed. The DSST also measures processing speed, along with attention, switching, and memory. These results suggest, therefore, that higher inhibition and processing speed abilities do not provide any particular advantage in the detection of non-target clitic placement during L2 processing. However, we will see that the findings of Experiment 2 provide evidence that these abilities do in fact play a role in processing low-salience morphosyntactic cues.

The results of the Trails analyses seem to tell a more complex story. The strongest model, which was marginally significant, predicted that in the regression path measure, participants with higher abilities in completion of the Trails task were more likely to spend a longer time in the spillover region of the grammatical sentence, as compared to the same region of the ungrammatical one. Recall that the Trails tasks measure abilities in sequence maintenance and task switching. As in the case with WM in Experiment 2, per the assumptions made at the outset of this investigation with regards to longer RTs, these results refute the predictions made for the research question, indicating instead that participants with lower sequence maintenance and task switching abilities were more likely to detect the non-target clitic placement.

Again, this unexpected finding becomes difficult to explain in light of the research presented earlier, which has found strong indications that EF processes are not only involved in facilitating L2 processing (e.g., Hernandez & Meschyan, 2006; Rodriguez-Fornells et al., 2006) but that higher abilities are advantageous for the L2 learner (e.g., Brooks et al., 2006). As with the analyses of WM, other possible interpretations for these findings are thus explored in the final chapter.

EF Effects in Experiment 2

Of the logistic regression analyses for the PostV-PreV difference RTs, the models that used Stroop composite scores and the IPS factor scores as predictors did not yield significant results. For the PostAux-PreV difference RTs, the analysis that used the Trails composite scores did not yield significant findings. The remaining models are presented below. For each predictor, the significant models of the PostV-PreV difference RTs are presented first, where applicable, followed by those of the PostAux-PreV difference RTs.

Predictions with Stroop composite scores

PostAux-PreV difference RTs. The PostAux-PreV analyses generated two significant models, which are presented in Table 4-13. The first model is the analysis of the first pass reading time measurement of IA 5. Without accounting for proficiency, the analysis shows that for every unit increase in the Stroop task, there is a 10.7% increased in the odds of longer PostAux RTs as compared to PreV (unadjusted OR = 1.107; 95% CI [1.015, 1.208]; p = .022). After adjusting for proficiency, there is an 11.2% increase in the odds of longer PostAux RTs (adjusted OR = 1.112; 95% CI [1.017, 1.216]; p = .020).

The inverse relationship is found in the analysis of total trial measure. The unadjusted model shows that for every unit increase in the Stroop task composite scores, there is an 11.8% decrease in the odds of longer PostAux RTs (unadjusted OR = 0.882; 95% CI [0.798, 0.974]; p = .014). This percentage remains virtually the same after adjusting for proficiency: for every unit increase in Stroop composite scores at there is an 11.9% decrease in the odds of longer PostAux RTs (adjusted OR = 0.881; 95% CI [0.796, 0.975]; p = .014), or, otherwise stated, a 13.5% increase in the odds of longer PreV RTs.

Unlike Experiment 1, the inhibition abilities tested in the Stroop task seem to corroborate the predictions, on one hand, suggesting that participants with higher inhibition abilities are more likely to spend longer in the first pass measure of the critical region, and thus detect the non-target clitic placement. Crucially, the first pass measure is usually taken to represent relatively early processing, and therefore these results point to immediate detection of the non-target structure. On the other hand, the same greater inhibition abilities predict longer total sentence RTs for the grammatical sentence. Once again, based on the assumptions made at the beginning of this investigation, these findings seem to refute the predictions, suggesting that lower abilities predict a greater likelihood of detecting non-target clitic placement. In light of previous findings such as these, and especially given the opposite finding for the first pass measure of the critical region, alternative interpretations for these results are once again discussed in the final chapter.

Predictions with DSST scores

PostV-PreV difference RTs. Table 4-14 contains the models of the analyses conducted with the raw DSST scores. The analysis of the unadjusted regression path RT-difference measure of IA 6 shows that for every unit increase in DSST scores, there is a 15.8% decrease in the odds of longer RTs for the PostV condition than for the PreV (unadjusted OR = 0.842; 95% CI [0.732, 0.969]; p = .016). This percentage remains virtually the same at a 16% decrease after adjusting for proficiency (adjusted OR = 0.840; 95% CI [0.730, 0.968]; p = .016). This translates into a 19% increase in the odds of longer PreV RTs. Again, these results seem to refute the predictions made, suggesting instead that increased abilities in processing speed predict a greater likelihood of processing difficulties with the grammatical sentence, emerging in the spillover region. As stated in the previous section, alternate explanations for longer RTs with greater cognitive abilities are explored in the last chapter of this work.

PostAux-PreV difference RTs. The findings are somewhat different in the models for the PostAux-PreV RT differences, shown in Table 4-15. Here, the unadjusted first pass measure analysis of IA 5 shows that for every unit increase in DSST scores, there is an 11% increase in the odds of longer RTs for the PostAux condition than for the PreV (unadjusted OR = 1.110; 95% [CI 1.002, 1.229]; p = .046). This percentage remains virtually the same at 10.7% after adjusting for proficiency, though the model now loses significance (adjusted OR = 1.107; 95% [CI 0.998, 1.227]; p = .054). Crucially, these results mirror those of the PostAux-PreV ones with the Stroop composite scores as a predictor. It seems, then, that higher abilities in both inhibition and processing speed are likely to lead to immediate detection of the non-target structure.

Predictions with IPS factor scores

PostAux-PreV difference RTs. The separate analyses with Stroop composite and raw DSST scores as predictors both showed an increase in the odds of longer PostAux RTs with increasing Stroop and DSST scores, in the first pass measure of IA 5. Unsurprisingly, this finding is reflected once again in the analyses with the IPS factor scores generated by the PCA. The results are displayed in Table 4-16. The analysis of the unadjusted first pass measure shows that for every unit increase in the IPS factor, there is a 321% increase in the odds of longer RTs for the PostAux condition than for the PreV (unadjusted OR = 4.210; 95% CI [1.351, 13.124]; p = .013). After adjusting for proficiency, the model shows a 334.2% increase in the odds of longer PostAux RTs (adjusted OR = 4.342; 95% CI [1.396, 13.505]; p = .011). Together, the models with the Stroop composite scores, DSST scores and IPS factor scores all strongly suggest that greater abilities in IPS predict an increased likelihood of early detection of the non-target

PostAux structure, as these findings occur not only in the critical region but also in the first pass measure.

These results are incongruent with those of total trial RTs, as well as with those found for the PostV analyses. A more integrated account of these findings is thus provided in the conclusion chapter. We now turn to the results of the Trails scores as predictors of PostV-PreV and PostAux-PreV difference RTs.

Predictions with Trails composite scores

PostV-PreV difference RTs. Table 4-17 presents the three significant models found for the PostV-PreV analyses with the Trails composite scores as predictors. The first one is found in the critical region, IA 5. The unadjusted regression path analysis shows that for every unit increase in Trails scores, there is a 13.3% decrease in the odds of longer PostV RTs (unadjusted OR = 0.867; 95% CI [0.775, 0.791]; p = .013), and a very slight change to a 13% decrease when adjusting for proficiency (adjusted OR = 0.870; 95% CI [0.777, 0.794]; p = .016). Restated in terms of increasing abilities, this result indicates that the for every unit decrease in the Trails scores, there is a 14.9% increase in the odds of longer PostV RTs. This outcome is the opposite of what is found in IA 7.

In the second spillover region, IA 7, two models are significant. The unadjusted first pass reading time measurements differences indicate that for every unit increase in the Trails tasks, there is a 8.6% increase in the odds of longer PostV RTs (unadjusted OR = 1.086; 95% CI [1.004, 1.175]; p = .040). Adjusting for proficiency raises the increase in odds to 9% (adjusted OR = 1.090; 95% CI [1.006, 1.181]; p = .035). From the perspective of increasing abilities, this means that for every unit decrease in Trails scores, there is a 9% increase in the odds of longer PreV RTs.

This same pattern is held consistent in the regression path measurements differences in IA 7, with similar numbers. For every unit increase in the Trails tasks, there is a 8.1% increase in the odds of longer PostV RTs (unadjusted OR = 1.081; 95% CI [1.002, 1.167]; p = .046). Adjusting for proficiency barely changes the result: 8% increase in the odds, the p-value now reaching significance (adjusted OR = 1.080; 95% CI [1.000, 1.166]; p = .049). Otherwise stated, the model estimates that for every unit decrease in Trails composite scores there is an 8% increase in the odds of longer PreV RTs.

Again, employing the operationalization of longer RTs and assumptions established at the outset of this study, the pattern of these results is such that the findings of the critical region support the predictions, indicating a greater likelihood of detecting the non-target structure with higher abilities in the Trails task, yet those of the second spillover region refute them, suggesting instead that higher abilities lead to processing difficulties with the grammatical sentence. By this same account, individuals with lower abilities are more likely to detect the non-target clitic placement. This pattern is, of course, found with the analyses of the Trails factor scores as well.

Predictions with Trails factor scores

PostV-PreV difference RTs. This section presents the results of the analyses in which the Trails factor scores were used as the predictor of longer PostV RTs. The models are summarized in Table 4-18, with the significant ones mirroring those found in the analyses with the Trails composite scores, seen in the previous section.

The analysis of the regression path measure of IA 5 shows that the unadjusted model estimates that for every unit increase in the Trails factor scores, there is a 91.5% decrease in the odds of longer RTs for the PostV condition than for the PreV (unadjusted OR = 0.085; 95% CI [0.014, 0.511]; p = .007). After adjusting for proficiency, there is 91.3% decrease in the odds of longer PostV RTs (adjusted OR = 0.087; 95% CI [0.014, 0.527]; p = .008). In other words, with every unit decrease in Trails factor scores, there is a 1149.4% increase in the odds of longer PostV RTs; that is, they are 11.49 times more likely to occur.

The remaining two significant models were found for measurement in the second spillover region, IA 7. The unadjusted analysis of the first pass measure of IA 7 shows that for every unit increase in the Trails factor scores, there is a 324.6% increase in the odds of longer RTs for the PostV condition than for the PreV (unadjusted OR = 4.246; 95% CI [1.261, 14.302]; p = .020). After adjusting for proficiency, the model estimates a 345.9% increase in the odds of longer PostV RTs (adjusted OR = 4.459; 95% CI [1.340, 14.835]; p = .015). This result denotes a 345.9% increase in the odds of longer PreV RTs for every unit decrease in the Trails factor scores.

The unadjusted regression path analysis of IA 7 shows a similar finding: for every unit increase in the trails factor scores, there is a 255.6% greater likelihood of longer RTs for the PostV condition than for the PreV (unadjusted OR = 3.556; 95% CI [1.192, 10.609]; p = .023). After adjusting for proficiency, there is an increase to a 254.3% greater likelihood of longer PostV RTs (adjusted OR = 3.543; 95% CI [1.179, 10.648]; p = .024). Again, restated in terms of increasing cognitive ability, this finding translates into a 254.3% increase in the odds of longer PreV RTs for every unit decrease in Trails factor scores. These two models are significant in the analyses with the Trails composite scores as well.

On the surface, these findings present an apparent contradiction. In the critical region, the findings support the predictions, while in the spillover region, they oppose them. Two contradictions arise from this pattern. The first has been previously discussed and concerns the problematics with explaining why individuals with higher abilities would experience processing difficulties with the grammatical structures, while those with lower abilities would be more likely to detect the ungrammatical clitic placement. The second is specific to the pattern found with the Trails composite and factor scores in the PostV-PreV analyses. If the findings for the regression path measure of IA 5 provide evidence to support the predictions, this makes the results of IA 7 even more complex to integrate in the account. That is, we must explain how it is possible that participants with a greater ability in the Trails task, which measures sequence maintenance and task switching, are more likely to detect the non-target structure as early as the critical region, yet those same individuals experience processing difficulties with the grammatical sentence as late as the second spillover region. This account simply does not make sense. Thus, as has been concluded with other results above, another explanation must be found for the increase in odds of longer RTs for participants with higher abilities. Other possibilities are once again explored in the final chapter. We now proceed with the final results of the Trails analyses.

PostAux-PreV difference RTs. As was the case with the PostV-PreV difference RTs findings above, and several other findings in this chapter, the results of the one significant model in the PostAux-PreV analyses with the Trails factor scores do not support the predictions. The unadjusted total fixation analysis of IA 6 shows that for every unit increase in the Trails factor scores, there is a 166% increase in the odds of longer RTs for the PostAux condition than for the PreV (unadjusted OR = 2.660; 95% CI [1.021, 6.929]; *p* = .045). After adjusting for proficiency, there is a 164.3% increase in the odds (adjusted OR = 2.643; 95% CI [1.009, 6.926]; *p* = .048). Otherwise stated, with every unit increase in Trails ability, the odds of longer PreV times are increased by 164.3%.

Summary and Interpretation of EF Effects in Experiment 2

This present section summarizes and interprets the findings of the various analyses of the EF components in Experiment 2. Because the second experiment had two sets of difference scores calculated to reflect the two ungrammatical conditions with respect to the grammatical one, the results are summarized here by each type of difference score, keeping in mind that the PostAux condition sets itself apart from Experiment 1 with the added facet of being structurally unfeasible in both English and Spanish.

PostV-PreV difference RTs. Of the analyses carried out for the RT differences between PostV and PreV, two abilities produced significant results. First, higher DSST scores predicted longer grammatical RTs for the regression path measure of the spillover region, thus countering the predictions. Second, the higher abilities in the Trails tasks predicted longer RTs for the ungrammatical sentence in the regression path measure of the critical region, thus supporting the predictions. These were followed by longer RTs for the second spillover region of the grammatical sentences, in both first pass and regression path measures, thereby once again refuting the predictions. For a non-target L2 structure that represents a symbolic unit in the L1, we must explain two counterintuitive findings, then: i) why greater processing speed abilities tested in the

DSST would lead to difficulties with the grammatical structure; and ii) why greater sequence maintenance and task switching abilities measured in the Trails tasks would first lead to a greater likelihood of immediate detection of the non-target structure but also predict processing difficulties with the target structure that manifest themselves as late as the spillover region. A possible explanation for these seeming contradictions is explored in the final chapter of this work.

PostAux-PreV difference RTs. The analyses carried out for the RT differences between PostAux and PreV found results that contrasted with the PostV-PreV ones. First, unlike PostV-PreV, the three analyses with Stroop composite, DSST, and IPS scores all predicted longer RTs for the first pass measure of the critical region of ungrammatical sentences. Crucially, not only do these results support the predictions, indicating that higher abilities in inhibition and processing speed facilitate detection of the non-target L2 structure, the fact that they occurred in first pass measure and in the critical region suggests very immediate detection of said structure. However, here as well we found apparent contradictions. The analysis of the total trial RTs using Stroop composite scores as predictors found that higher abilities in the Stroop task predicted longer RTs for the ungrammatical sentences. Finally, higher abilities in the Trails tasks also predicted the opposite of what was expected: longer RTs for the grammatical sentences, in the total fixation measure of the spillover region.

Crucially, the PostAux non-target structure is inexistent in both the L1 and the L2. We must understand, then, why greater inhibition abilities and processing speed, as measured in the Stroop task, would predict both immediate detection of the non-target structure and processing difficulties with the grammatical sentences at the same time. In the first place, PostAux should theoretically be equally detectable by all learners, as is further discussed in the final chapter. Secondly, even though learners with higher abilities are more likely to detect it, we must still account for the longer RTs for the grammatical sentences. Likewise, we must explain why and how greater sequence maintenance and task switching abilities, as measured in Trails, would lead to difficulties in processing the grammatical sentences, and why these would emerge in the spillover region, when the results of the ANOVAs suggest that, on the whole, participants detected the PostAux structure as early as the total fixation measure in the critical region. Answers to these questions are explored in the last chapter of this work, along with the discussion on the results of the WM analyses, as some of these showed similar findings.

Overall Summary of EF Effects

In summary, two facets of EF were analyzed for their role in the detection of non-target clitic placement: inhibition and processing speed (from the Stroop tasks and DSST), and sequence maintenance and task switching (from the Trails tasks). Experiment 1 yielded scarce results that countered the predictions, showing that higher sequence maintenance and task switching increased the likelihood of added reading time in the spillover regions of the grammatical sentences. Experiment 2 added to the complexity of the account. In the comparison between both non-target structures, only higher sequence maintenance and task switching abilities predicted detection of PostV, while at the same time, and together with higher processing speed, these same abilities predicted longer RTs for the grammatical spillover regions. Importantly, with this L1 entrenched structure, detection was predicted in the regression path measure, not earlier, unlike the findings of the PostAux analyses. In the results of this second, highly unautomatized structure, higher inhibition and processing speed abilities were found to predict a greater likelihood of immediate detection, as evidenced in longer RTs for the first pass measure of the critical region, as well as an unexpected finding of longer total-sentence reading times. Higher sequence maintenance and task-switching also predicted longer grammatical RTs, in this case for the total fixation measure of the spillover regions.

Thus, as with WM, the analyses of the data have found clear evidence that higher EF abilities increase the likelihood that ungrammatical structures are detected during L2 processing, as predicted at the beginning of the investigation. However, and again as with WM, the findings have also refuted these predictions, indicating that greater EF abilities also predict longer RTs for sentences containing grammatical structures. Crucial in the interpretation of these results has been the meaning assigned to longer RTs. Following prior research in L1 and L2 processing, parsing difficulty, and hence evidence of non-target clitic placement detection, were operationalized as longer RTs for the ungrammatical sentences, or IAs within them. Thus, longer RTs for grammatical sentences and/or IAs within them, were accordingly interpreted as processing difficulty with the target structures in these sentences. It is clear by now that the meaning of longer RTs must be revisited, as the one determined at the start of this study has proven to be inadequate to describe L2 processing, at least of the structures analysed in the present investigation. A new interpretation of longer RTs is thus explored in the last chapter, in an attempt to reconcile the apparently conflicting results that have emerged in both the WM and EF analyses.

The Role of Vocabulary Size in Processing Non-target Clitic Placement

This final section analyzes how VS predicts the RT differences between conditions of IAs 5 to 8 for each measure, and for total trial. Results are presented uniquely for Experiment 2, specifically for the PostV-PreV difference RTs. The Experiment 1 logistic regression analyses with VS as a predictor of the PostV-PreV difference scores, and the Experiment 2 PostAux-PreV analyses did not yield any significant results, and are thus not presented. The third research question was: How well does VS predict Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing? The prediction was that higher VS would predict a greater likelihood of detecting non-target clitic placement, operationalized as delayed RTs for the ungrammatical conditions with respect to the grammatical one.

The analyses of the PostV-PreV difference scores in Experiment 2 did show some significant findings, although the models are not very reliable. For example, the unadjusted first pass RT analysis of IA 5 shows that for every unit increase in VS scores, there is a 0.2% decreased likelihood of longer RTs for the PostV condition than for the PreV (unadjusted OR = 0.998; 95% CI [0.997, 1.000]; $p = .062$). This percentage also remains the same after adjusting for proficiency (adjusted OR = 0.998; 95% CI [0.997, 1.000]; $p = .064$). Similarly, the analysis of the unadjusted first pass RT difference of IA 6 shows that for every unit increase in VS scores, there is a 0.2% greater likelihood of longer RTs for the PostV condition than for the PreV (unadjusted OR = 1.002; 95% CI [1.000, 1.004]; $p = .031$). This percentage remains the same after adjusting for proficiency (adjusted OR = 1.002; 95% CI [1.000, 1.004]; $p = .032$).

An OR that is very close to 1, as occurs in the cases here, shows that, although the findings may be significant, there is a minute change in the OR with every unit increase in VS. This finding suggests, at least for the models in these analyses, VS may not a good predictor of RT differences between grammatical and ungrammatical cases of non-target clitic placement.

Given the lack of results for the analyses of VS as predictor, there is little to interpret. What can be said is that these findings do not support the predictions established at the outset and would seem to indicate that VS does not accurately predict the likelihood of detecting the non-target structure. This being said, because the results of the PostV-PreV differences displayed a pattern seen in the other analyses—namely, processing difficulties with the grammatical condition in the critical region, followed by longer RTs in the ungrammatical condition in the spillover region—it is worth noting that perhaps VS might be revealed to play a bigger role in a study with a greater sample size. This is further discussed in the final chapter.

Conclusion

Several results emerged from the analyses run to answer the research questions, although many seem to provide mixed conclusions. The first research question asked how well WM capacity predicts Spanish L2 learners' detection of non-target clitic pronoun placement in online reading processing. Experiment 1 showed that higher WM capacity does predict a greater likelihood of detecting the non-target structure and that this appears in the spillover region. Experiment 2 revealed only increased processing time for higher WM individuals for the grammatical spillover region of the PostAux-PreV comparison. The question emerged, then, of how to explain longer RTs, as the findings of Experiment 2 seemed conflictive and counterintuitive.

The second research question asked how well EF ability predicts Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing.

Similarly conflicting results were revealed, showing that higher abilities in inhibition and processing speed, as well as sequence maintenance and task switching, predicted increased reading time for both critical regions of ungrammatical sentences and spillover regions of grammatical ones. The overarching trend, then, has been that individuals with higher abilities show a greater likelihood of longer RTs for IAs in both ungrammatical and grammatical sentences, thus forcing us to revisit the originally-established interpretation of longer RTs.

Finally, the third research question asked how well L2 VS predicts Spanish L2 learners' detection of non-target clitic pronoun placement in reading processing. The only two significant models were not very reliable and thus the most cautious interpretation is that higher VS does not increase the likelihood of detecting the non-target structure, at least in the present study, but that given previous research, this may be due to methodological limitations of this investigation.

In addition to the research questions that asked how well higher cognitive abilities would predict L2 learners' detection of non-target structures during online reading processing, the interpretation and explanation of the results, outside of emphasizing the obvious limitations caused by a small sample size, has led to an additional question: What do longer RTs indicate in this group of participants, and, by extension, what can they mean in low-proficiency leaners? This additional issue is addressed in the next chapter, along with a reinterpretation of the results of the WM and EF analyses. The following chapter, then, addresses this new issue, revisits the results of the WM and EF analyses with a in light of a more adequate interpretation of longer RTs, the theory discussed in chapter 1, the L2 processing literature seen in chapter 2, and discusses methodological issues, limitations and important points for future research.

Table 4-1. Working memory individual task, composite and factor scores

Participant Num.	Digit Span Forward	Digit Span Backward	Digit Ordering	WM Composite	WM Factor
1	13	8	23	.82	.66819
2	6	6	18	.54	-1.34283
4	9	7	20	.66	-.40569
5	7	7	16	.56	-.90267
6	13	11	24	.90	1.61422
7	9	8	24	.74	.01629
8	8	9	19	.67	-.19126
9	11	9	23	.80	.74363
10	13	14	23	.96	2.32341
11	9	5	18	.58	-.92423
12	10	8	23	.75	.47919
13	11	9	21	.77	.53538
14	8	6	13	.51	-1.67835
15	9	8	22	.71	.31494
16	7	6	21	.60	-1.05608
17	13	13	23	.94	2.03061
18	7	8	20	.63	-.68781
19	9	7	21	.67	-.02462
20	7	7	20	.61	-.61311
21	8	8	24	.71	.45900
22	9	7	22	.69	-.11191
23	8	7	21	.65	-.45676
25	8	10	19	.69	.16117
26	5	7	23	.61	-.79698
29	10	11	24	.83	1.02036
28	11	8	22	.76	.55601
29	8	10	20	.71	.18059
30	8	7	21	.65	-.50790
33	7	6	13	.49	-1.94330
36	12	7	21	.74	.54050

Table 4-2. Executive function task, composite, and factor scores

Part. Num.	Stroop X	Stroop Words	Trails A	Trails B	Digit Symbol	Stroop Comp.	Trails Comp.	IPS Factor	Trails Factor
1	104	85	40	40	79	94.5	40.0	.53532	-1.82744
2	80	66	61	77	70	73.0	69.0	-.40108	.05179
4	73	51	38	57	77	62.0	47.5	-1.29553	-1.30161
5	83	49	70	80	70	66.0	75.0	-.94454	.66900
6	110	70	46	64	82	90.0	55.0	.42757	-.57824
7	106	81	36	45	87	93.5	40.5	1.13662	-1.62780
8	97	68	62	75	76	82.5	68.5	.29989	.34099
9	110	60	41	65	85	85.0	53.0	.25437	-.86036
10	84	62	62	60	82	73.0	61.0	-.16590	.62956
11	59	57	72	112	83	58.0	92.0	-.33047	1.94740
12	82	42	36	54	65	62.0	45.0	-2.32707	-1.83565
13	104	72	53	66	63	88.0	59.5	-.56736	-.84487
14	87	70	55	93	74	78.5	74.0	-.00251	.20809
15	77	49	70	117	71	63.0	93.5	-1.02624	1.73654
16	102	85	50	61	79	93.5	55.5	1.08748	-.86615
17	98	67	60	77	88	82.5	68.5	.70292	.93423
18	98	77	47	47	82	87.5	47.0	.81122	-1.05891
19	84	45	56	78	67	64.5	67.0	-1.62520	-.23321
20	93	63	64	65	79	78.0	64.5	.23826	.14156
21	98	64	86	73	84	81.0	79.5	.95352	1.64250
22	81	66	62	79	81	73.5	70.5	.11930	.51737
23	83	69	59	65	83	76.0	62.0	.38956	.06393
25	72	57	67	64	69	64.5	65.5	-1.03366	.40667
26	85	68	58	68	89	76.5	63.0	.95323	.28577
29	130	82	53	63	93	106.0	58.0	2.29416	-.05019
28	88	62	63	56	93	75.0	59.5	.66016	.35842
29	68	62	69	98	69	65.0	83.5	-.77803	1.39952
30	89	62	46	82	75	75.5	64.0	-.39794	-.44631
33	97	68	46	86	93	82.5	66.0	1.21541	.07853
36	82	57	68	68	68	69.5	68.0	-1.18346	.11887

Table 4-3. Spanish vocabulary size scores

Participant Num.	Vocabulary Size
1	1750
2	2950
4	1950
5	2300
6	1500
7	1900
8	1550
9	2850
10	1650
11	2000
12	1100
13	2500
14	1700
15	2150
16	2600
17	2100
18	2200
19	3150
20	1100
21	1950
22	2100
23	1350
25	2000
26	2200
27	1100
28	2450
29	1800
30	1050
33	1400
36	2900

Table 4-4. Proficiency scores

Participant Num.	Proficiency
1	46
2	28
4	50
5	34
6	54
7	36
8	48
9	N/A
10	34
11	42
12	28
13	38
14	44
15	40
16	32
17	48
18	26
19	68
20	48
21	52
22	32
23	48
25	34
26	52
29	44
28	48
29	40
30	50
33	34
36	40

Table 4-5. Subjects reading time means and (standard error), Experiment 1

	Interest Area				
	4	5	6	7	8
e.g.:	*El niño*	*lo comió*	*por la*	*tarde porque tenía*	*hambre*
			First pass gaze duration		
PreV	699 (47)	621 (37)	634 (37)	765 (45)	332 (15)
PostV	779 (64)	554 (32)	692 (37)	702 (41)	329 (21)
			Regression path duration		
PreV	943 (76)	1053 (68)	1160 (103)	1436 (106)	2168 (175)
PostV	968 (80)	915 (78)	1449 (83)	1399 (111)	2242 (257)
			Total fixation duration		
PreV	1164 (89)	1391 (98)	1225 (88)	1372 (101)	411 (32)
PostV	1060 (73)	1302 (95)	1444 (80)	1288 (79)	465 (36)
			Total trial time		
			PreV 11627 (665)		
			PostV 11380 (578)		

Table 4-6. Items reading time means and (standard error), Experiment 1

	Interest Area				
	4	5	6	7	8
e.g.:	*El niño*	*lo comió*	*por la*	*tarde porque tenía*	*hambre*
			First pass gaze duration		
PreV	697 (64)	622 (38)	633 (59)	788 (121)	333 (15)
PostV	758 (74)	556 (35)	691 (50)	714 (78)	333 (22)
			Regression path duration		
PreV	909 (73)	1063 (58)	1149 (104)	1510 (218)	2160 (171)
PostV	949 (84)	910 (66)	1433 (135)	1433 (198)	2320 (215)
			Total fixation duration		
PreV	1165 (88)	1393 (101)	1229 (131)	1493 (225)	413 (39)
PostV	1064 (94)	1308 (86)	1460 (116)	1369 (211)	471 (44)
			Total trial time		
			PreV 11649 (541)		
			PostV 11477 (431)		

Table 4-7. Subjects reading time means and (standard error), Experiment 2

	Interest Area				
	4	5	6	7	8
e.g.:	*El camarero*	*la ha traído*	*a la*	*mesa*	*inmediatamente*
			First pass gaze duration		
PreV	612 (49)	993 (64)	532 (27)	497 (46)	326 (18)
PostV	554 (31)	854 (66)	594 (37)	486 (50)	331 (15)
PostAux	585 (40)	955 (71)	582 (37)	422 (32)	395 (29)
			Regression path duration		
PreV	819 (74)	1537 (88)	868 (71)	790 (122)	2575 (251)
PostV	646 (42)	1280 (87)	1176 (98)	1257 (253)	2524 (188)
PostAux	815 (92)	1649 (128)	883 (95)	1064 (141)	3260 (303)
			Total fixation duration		
PreV	977 (59)	2006 (142)	902 (74)	685 (73)	526 (39)
PostV	908 (52)	1894 (139)	1355 (94)	740 (74)	573 (47)
PostAux	1032 (74)	2227 (143)	1018 (66)	700 (62)	655 (53)
			Total trial time		
		PreV	10025 (476)		
		PostV	10559 (552)		
		PostAux	10867 (514)		

Table 4-8. Items reading time means and (standard error), Experiment 2

	Interest Area				
	4	5	6	7	8
e.g.:	*El camarero*	*la ha traído*	*a la*	*mesa*	*inmediatamente*
		First pass gaze duration			
PreV	590 (30)	987 (65)	514 (39)	464 (71)	322 (27)
PostV	565 (30)	887 (81)	598 (33)	435 (53)	342 (22)
PostAux	583 (35)	949 (68)	571 (43)	402 (53)	388 (38)
		Regression path duration			
PreV	802 (79)	1529 (79)	828 (100)	791 (125)	2630 (264)
PostV	669 (46)	1320 (87)	1163 (101)	971 (158)	2555 (216)
PostAux	779 (74)	1629 (82)	889 (95)	880 (207)	3238 (196)
		Total fixation duration			
PreV	979 (70)	2007 (98)	901 (80)	709 (153)	519 (60)
PostV	928 (68)	1914 (97)	1344 (107)	741 (136)	580 (69)
PostAux	1031 (66)	2226 (142)	1016 (66)	722 (141)	652 (78)
		Total trial time			
		PreV	10033 (414)		
		PostV	10589 (338)		
		PostAux	10901 (499)		

Table 4-9. Logistic regression models with WM factor scores as predictor, Experiment 1

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	1.123 [0.527, 2.396], *p* = .763	2.410 [0.946, 6.137], *p* = .065†	5.582 [1.415, 22.017], *p* = .014*	0.941 [0.448, 1.974], *p* = .872	1.045 [0.475, 2.297], *p* = .913	2.489 [0.955, 6.484], *p* = .062†	5.551 [1.396, 22.072], *p* = .015*	0.838 [0.381, 1.843], *p* = .660
Regression path	0.953 [0.417, 2.178], *p* = .910	2.021 [0.758, 5.387], *p* = .160	2.028 [0.847, 4.855], *p* = .113	1.147 [0.547, 2.404], *p* = .717	0.930 [0.398, 2.174], *p* = .868	1.721 [0.641, 4.621], *p* = .281	2.094 [0.857, 5.112], *p* = .105	1.082 [0.506, 2.310], *p* = .840
Total fixation	0.510 [0.216, 1.201], *p* = .123	1.578 [0.582, 4.282], *p* = .370	1.034 [0.491, 2.181], *p* = 0.929	1.159 [0.538, 2.500], *p* = .706	0.431 [0.170, 1.092], *p* = .076†	1.419 [0.522, 3.859] *p* = .493	1.036 [0.485, 2.213], *p* = .928	1.121 [0.514, 2.448], *p* = .774
Total trial	1.164 [0.554, 2.448], *p* = .688				1.022 [0.460, 2.269], *p* = .958			

‡Adjusted for proficiency, **p* < .05, †*p* < .1

Table 4-10. Logistic regression models with WM factor scores as predictor of PostAux-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	1.359 [0.636, 2.906], *p* = .428	0.480 [0.201, 1.147], *p* = .099†	0.340 [0.122, 0.945], *p* = .039*	1.164 [0.530, 2.554], *p* = .706	1.291 [0.596, 2.798], *p* = .517	0.480 [0.198, 1.161], *p* = 0.103	0.345 [0.123, 0.973], *p* = .044*	1.044 [0.467, 2.336], *p* = .916
Regression path	1.163 [0.546, 2.476], *p* = .696	1.094 [0.523, 2.289], *p* = .812	0.592 [0.263, 1.335], *p* = .206	0.825 [0.389, 1.749], *p* = .615	1.162 [0.538, 2.512], *p* = .703	1.111 [0.523, 2.359], *p* = .785	0.622 [0.272, 1.423], *p* = .261	0.852 [0.396, 1.835], *p* = .683
Total fixation	1.861 [0.776, 4.463], *p* = .164	1.401 [0.630, 3.114], *p* = .408	0.507 [0.216, 1.188], *p* = .118	0.859 [0.389, 1.895], *p* = .706	1.762 [0.728, 4.263], *p* = .209	1.372 [0.609, 3.090], *p* = .445	0.477 [0.197, 1.152], *p* = .100	0.812 [0.362, 1.821], *p* = .614
Total trial	1.012 [0.467, 2.193] *p* = .977				1.025 [0.465, 2.260] *p* = .951			

‡Adjusted for proficiency, **p* < .05, †*p* < .1

Table 4-11. Logistic regression models with Trails composite scores as predictor of PostV-PreV difference RTs, Experiment 1

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First Pass	0.953 [0.892, 1.018], *p* = 0.150	0.992 [0.938, 1.049], *p* = 0.779	0.996 [0.942, 1.054], *p* = 0.899	1.019 [0.962, 1.079], *p* = 0.521	0.946 [0.881, 1.015], *p* = 0.121	0.992 [0.937, 1.049], *p* = 0.771	0.994 [0.939, 1.053], *p* = 0.848	1.016 [0.958, 1.077], *p* = 0.593
Regression Path	1.002 [0.941, 1.066], *p* = 0.957	1.093 [1.003, 1.191], *p* = 0.042*	0.972 [0.913, 1.034], *p* = 0.364	1.007 [0.952, 1.065], *p* = 0.812	1.001 [0.940, 1.066], *p* = 0.977	1.088 [0.996, 1.190], *p* = 0.062†	0.972 [0.912, 1.034], *p* = 0.366	1.004 [0.949, 1.063], *p* = 0.878
Total Reading Time	0.970 [0.915, 1.029], *p* = 0.319	1.065 [0.981, 1.156], *p* = 0.133	1.001 [0.946, 1.059], *p* = 0.970	1.012 [0.955, 1.072], *p* = 0.693	0.966 [0.909, 1.027], *p* = 0.266	1.059 [0.976, 1.149], *p* = 0.170	1.001 [0.946, 1.060], *p* = 0.970	1.010 [0.953, 1.071], *p* = 0.732
Total Trial	0.988 [0.933, 1.045] *p* = 0.670				0.981 [0.924, 1.043] *p* = 0.543			

‡Adjusted for proficiency, *$p < .05$; †$p < .1$

Table 4-12. Logistic regression models with Trails factor scores as predictor of PostV-PreV difference RTs, Experiment 1

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	0.478 [0.200, 1.146], *p* = .098†	1.137 [0.541, 2.387], *p* = .735	1.047 [0.498, 2.199], *p* = .904	1.234 [0.582, 2.621], *p* = .583	0.429 [0.171, 1.077], *p* = .072†	1.135 [0.537, 2.397], *p* = .740	1.016 [0.479, 2.158], *p* = .966	1.171 [0.538, 2.550], *p* = .690
Regression path	1.019 [0.446, 2.327], *p* = .964	3.256 [1.107, 9.578], *p* = .032*	0.736 [0.333, 1.628], *p* = .450	1.350 [0.632, 2.884], *p* = .439	1.006 [0.436, 2.318], *p* = .990	3.056 [1.000, 9.337], *p* = .050†	0.736 [0.330, 1.639], *p* = .453	1.306 [0.604, 2.825], *p* = .498
Total fixation	0.609 [0.275, 1.347], *p* = .220	3.016 [0.984, 9.241], *p* = .053†	1.003 [0.474, 2.120], *p* = .995	1.217 [0.565, 2.622], *p* = .615	0.561 [0.247, 1.275], *p* = .168	2.814 [0.916, 8.639], *p* = .071†	1.003 [0.471, 2.133], *p* = .995	1.190 [0.548, 2.582], *p* = .660
Total Trial	0.921 [0.438, 1.937] *p* = .829				0.829 [0.375, 1.832] *p* = .643			

‡Adjusted for proficiency, **p* < .05, †*p* < .1

Table 4-13. Logistic regression models with Stroop composite scores as predictor of PostAux-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted[‡] odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First Pass	1.107 [1.015, 1.208], *p* = 0.022*	0.974 [0.913, 1.039], *p* = 0.423	1.034 [0.968, 1.104], *p* = 0.319	0.978 [0.915, 1.045], *p* = 0.507	1.112 [1.017, 1.216], *p* = 0.020*	0.974 [0.913, 1.039], *p* = 0.421	1.034 [0.968, 1.105], *p* = 0.317	0.976 [0.911, 1.044], *p* = 0.475
Regression Path	0.978 [0.917, 1.043], *p* = 0.494	0.978 [0.917, 1.043], *p* = 0.493	1.019 [0.953, 1.089], *p* = 0.582	0.964 [0.902, 1.030], *p* = 0.275	0.978 [0.917, 1.043], *p* = 0.494	0.978 [0.917, 1.043], *p* = 0.492	1.019 [0.952, 1.091], *p* = 0.579	0.963 [0.900, 1.030], *p* = 0.271
Total Reading Time	1.017 [0.952, 1.086], *p* = 0.627	0.977 [0.915, 1.043], *p* = 0.486	1.048 [0.978, 1.124], *p* = 0.184	0.972 [0.908, 1.041], *p* = 0.414	1.016 [0.951, 1.087], *p* = 0.631	0.977 [0.915, 1.043], *p* = 0.485	1.048 [0.978, 1.124], *p* = 0.183]	0.972 [0.907, 1.040], *p* = 0.409
Total Trial	0.882 [0.798, 0.974] *p* = 0.014*				0.881 [0.796, 0.975] *p* = 0.014*			

[‡]Adjusted for proficiency, **p* < .05

Table 4-14. Logistic regression models with DSST scores as predictor of PostV-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	1.033 [0.945, 1.128], *p* = .474	0.948 [0.866, 1.037], *p* = 0.245	0.994 [0.912, 1.083), *p* = 0.894	1.049 [0.958, 1.148), *p* = 0.300	1.032 [0.944, 1.128), *p* = .490	0.945 [0.861, 1.036), *p* = 0.227	0.998 [0.914, 1.089), *p* = 0.961	1.046 [0.954, 1.146), *p* = 0.339
Regression path	1.005 [0.916, 1.102), *p* = .917	0.842 [0.732, 0.969), *p* = .016*	1.030 [0.944, 1.123), *p* = .505	0.927 [0.843, 1.019), *p* = .116	1.103 [0.921, 1.114), *p* = .791	0.840 [0.730, 0.968), *p* = .016*	1.028 [0.941, 1.122), *p* = .545	0.930 [0.845, 1.024), *p* = .141
Total fixation	0.952 [0.870, 1.041), *p* = .280	0.972 [0.867, 1.090), *p* = .628	1.089 [0.987, 1.202), *p* = .088†	1.008 [0.925, 1.098), *p* = .860	0.956 [0.872, 1.048), *p* = .337	0.936 [0.824, 1.064), *p* = .313	1.089 [0.986, 1.202), *p* = .092†	1.001 [0.916, 1.094), *p* = .983
Total trial	0.977 [0.894, 1.067) *p* = .604				0.975 [0.891, 1.067] *p* = .583			

‡Adjusted for proficiency, **p* < .05, †*p* < .1

Table 4-15. Logistic regression models with DSST scores as predictor of PostAux-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	1.110 [1.002, 1.229], *p* = .046*	0.985 [0.903, 1.073], *p* = .727	1.005 [0.923, 1.095], *p* = .908	0.977 [0.893, 1.070], *p* = 0.618	1.107 [0.998, 1.227], *p* = .054†	0.986 [0.904, 1.076], *p* = .759	1.010 [0.925, 1.102], *p* = .829	0.961 [0.872, 1.060], *p* = .427
Regression path	0.992 [0.909, 1.082], *p* = .850	0.967 [0.886, 1.055], *p* = .444	1.067 [0.970, 1.173], *p* = .182	1.003 [0.920, 1.094], *p* = .939	0.991 [0.908, 1.082], *p* = .839	0.967 [0.885, 1.056], *p* = .453	1.084 [0.976, 1.205], *p* = .131	1.007 [0.922, 1.100], *p* = .874
Total fixation	1.059 [0.965, 1.164], *p* = .227	1.001 [0.916, 1.093], *p* = .985	0.994 [0.912, 1.084], *p* = .897	0.969 [0.882, 1.064], *p* = .506	1.055 [0.959, 1.160], *p* = .274	0.998 [0.913, 1.091], *p* = .964	0.992 [0.909, 1.082], *p* = .857	0.962 [0.874, 1.060], *p* = .436
Total trial	0.979 [0.895, 1.072] *p* = .651				0.980 [0.894, 1.074] *p* = .664			

‡Adjusted for proficiency, *$p < .05$, †$p < .1$

Table 4-16. Logistic regression models with IPS factor scores as predictor of PostAux-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	4.210 [1.351, 13.124], *p* = .013*	0.855 [0.408, 1.792], *p* = .679	1.843 [0.813, 4.179], *p* = .143	0.592 [0.255, 1.373], *p* = .222	4.342 [1.396, 13.505], *p* = .011*	0.858 [0.409, 1.803], *p* = .687	1.902 [0.821, 4.407], *p* = .133	0.534 [0.220, 1.296], *p* = .165
Regression path	0.672 [0.307, 1.468], *p* = .318	0.807 [0.385, 1.694], *p* = .571	2.152 [0.899, 5.154], *p* = .085†	0.758 [0.354, 1.624], *p* = .477	0.670 [0.306, 1.466], *p* = .317	0.809 [0.385, 1.698], *p* = .575	2.401 [0.913, 6.314], *p* = .076†	0.760 [0.353, 1.639], *p* = .484
Total fixation	1.403 [0.647, 3.043], *p* = .392	1.013 [0.478, 2.147], *p* = .973	1.660 [0.752, 3.664], *p* = .209	0.778 [0.347, 1.745], *p* = .542	1.390 [0.629, 3.070], *p* = .416	1.005 [0.473, 2.138], *p* = .989	1.657 [0.749, 3.665], *p* = .212	0.762 [0.337, 1.722], *p* = .514
Total trial	0.477 [0.193, 1.183] *p* = .110				0.478 [0.193, 1.184] *p* = 0.111			

‡Adjusted for proficiency, *$p < .05$, †$p < .1$

Table 4-17. Logistic regression models with Trails composite scores as predictor of PostV-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted[‡] odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First Pass	0.964 [0.906, 1.025], *p* = 0.240	1.076 [0.999, 1.160], *p* = 0.053[†]	1.086 [1.004, 1.175], *p* = 0.040*	0.965 [0.909, 0.026], *p* = 0.256	0.962 [0.904, 1.024], *p* = 0.228	1.076 [0.999, 1.160], *p* = 0.054[†]	1.090 [1.006, 1.181], *p* = 0.035*	0.963 [0.906, 1.024], *p* = 0.227
Regression Path	0.867 [0.775, 0.971], *p* = 0.013*	0.998 [0.939, 1.060], *p* = 0.939	1.081 [1.002, 1.167], *p* = 0.046*	1.013 [0.957, 1.013], *p* = 0.656	0.870 [0.777, 0.974], *p* = 0.016*	0.998 [0.939, 1.061], *p* = .952	1.080 [1.000, 1.166], *p* = 0.049*	1.016 [0.959, 1.077], *p* = 0.581
Total Reading Time	0.958 [0.900, 1.020], *p* = 0.181	1.039 [0.959, 1.125], *p* = 0.350	1.030 [0.971, 1.094], *p* = 0.323	0.999 [0.945, 1.057], *p* = 0.975	0.960 [0.902, 1.023], *p* = 0.208	1.025 [0.943, 1.115], *p* = 0.557	1.030 [0.970, 1.093], *p* = 0.335	0.996 [0.941, 1.054], *p* = 0.893
Total Trial	1.048 [0.981, 1.119] *p* = 0.162				1.048 [0.981, 1.120] *p* = 0.165			

[‡]Adjusted for proficiency, $*p < .05$, $^{\dagger}p < .1$

Table 4-18. Logistic regression models with Trails factor scores as predictor of PostV-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted[‡] odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	0.618 [0.278, 1.374], *p* = .238	1.743 [0.775, 3.917], *p* = .179	4.246 [1.261, 14.302], *p* = .020*	0.757 [0.351, 1.633], *p* = .478	0.605 [0.270, 1.357], *p* = .222	1.737 [0.769, 3.927], *p* = .184	4.459 [1.340, 14.835], *p* = .015*	0.726 [0.333, 1.582], *p* = .421
Regression path	0.085 [0.014, 0.511], *p* = .007**	0.840 [0.375, 1.882], *p* = .672	3.556 [1.192, 10.609], *p* = .023*	1.008 [0.480, 2.116], *p* = .984	0.087 [0.014, 0.527], *p* = .008**	0.845 [0.375, 1.905], *p* = .685	3.543 [1.179, 10.648], *p* = .024*	1.061 [0.498, 2.262], *p* = .877
Total fixation	0.564 [0.250, 1.272], *p* = .168	2.085 [0.718, 6.052], *p* = .177	1.759 [0.770, 4.017], *p* = .180	1.040 [0.495, 2.185], *p* = .917	0.582 [0.255, 1.330], *p* = .199	1.756 [0.569, 5.424], *p* = .328	1.748 [0.762, 4.013], *p* = .188	0.989 [0.464, 2.108], *p* = .989
Total Trial	1.858 [0.802, 4.303] *p* = .149				1.862 [0.798, 4.344] *p* = .151			

[‡]Adjusted for proficiency, **p* < .05, ***p* < .01

Table 4-19. Logistic regression models with Trails factor scores as predictor of PostAux-PreV difference RTs, Experiment 2

	Unadjusted odds ratio [95% CI], *p*-value				Adjusted‡ odds ratio [95% CI], *p*-value			
	IA 5	IA 6	IA 7	IA 8	IA 5	IA 6	IA 7	IA 8
First pass	0.849 [0.403, 1.787], *p* = .666	1.054 [0.502, 2.215], *p* = .889	1.469 [0.678, 3.182], *p* = .329	0.490 [0.199, 1.204], *p* = .120	0.807 [0.377, 1.726], *p* = .581	1.072 [0.506, 2.269], *p* = .856	1.535 [0.700, 3.364], *p* = .285	0.416 [0.160, 1.083], *p* = .072†
Regression path	0.710 [0.326, 1.546], *p* = .389	1.138 [0.542, 2.389], *p* = .733	1.917 [0.821, 4.478], *p* = .133	1.177 [0.554, 2.502], *p* = .672	0.704 [0.322, 1.540], *p* = .379	1.149 [0.544, 2.429], *p* = .716	2.116 [0.869, 5.153], *p* = .099†	1.215 [0.565, 2.614], *p* = .618
Total fixation	0.962 [0.449, 2.058], *p* = .920	2.660 [1.021, 6.929], *p* = .045*	1.251 [0.589, 2.654], *p* = .560	1.116 [0.502, 2.479], *p* = .788	0.911 [0.420, 1.977], *p* = .813	2.643 [1.009, 6.925], *p* = .048*	1.236 [0.578, 2.639], *p* = .585	1.078 [0.481, 2.416], *p* = .855
Total Trial	2.166 [0.884, 5.306] *p* = .091†				2.229 [0.896, 5.546] *p* = .085†			

‡Adjusted for proficiency, †$p < .1$, *$p < .05$

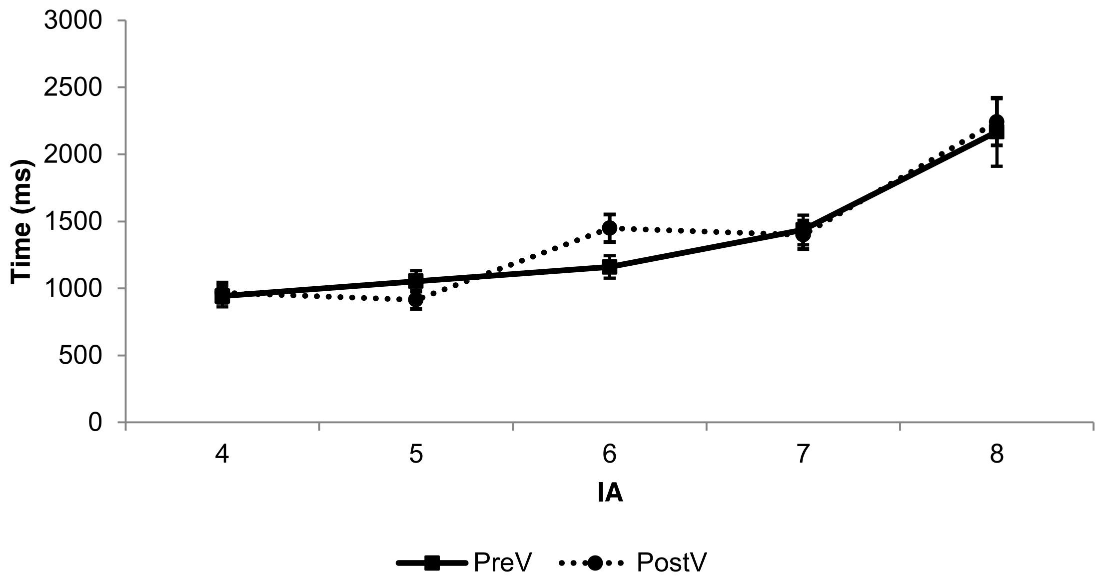


Figure 4-1. Mean subjects regression path RTs and *SE* for Experiment 1.

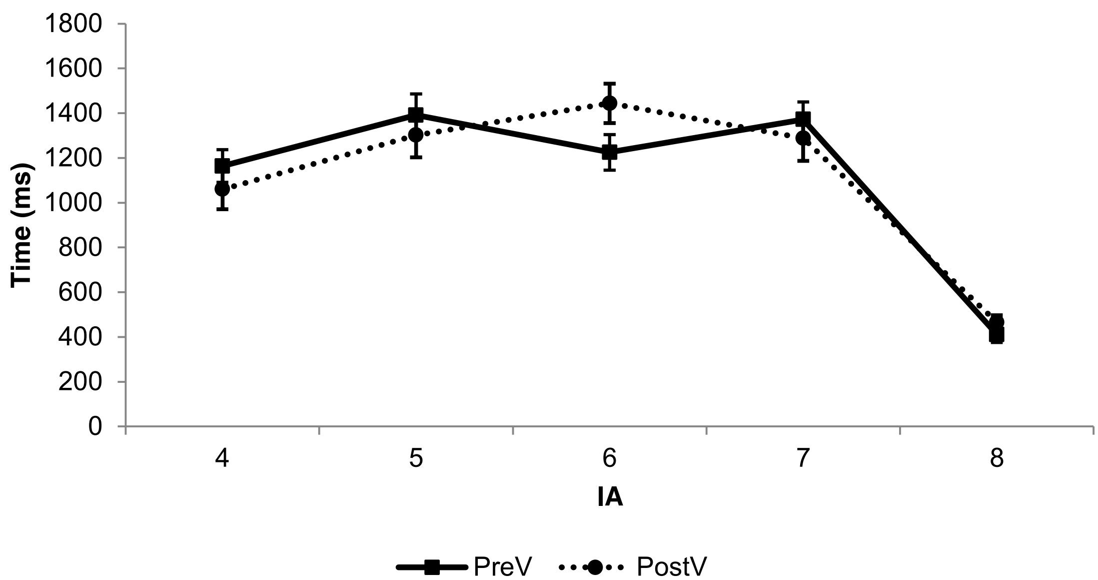


Figure 4-2. Mean subjects total fixation duration RTs and *SE* for Experiment 1.

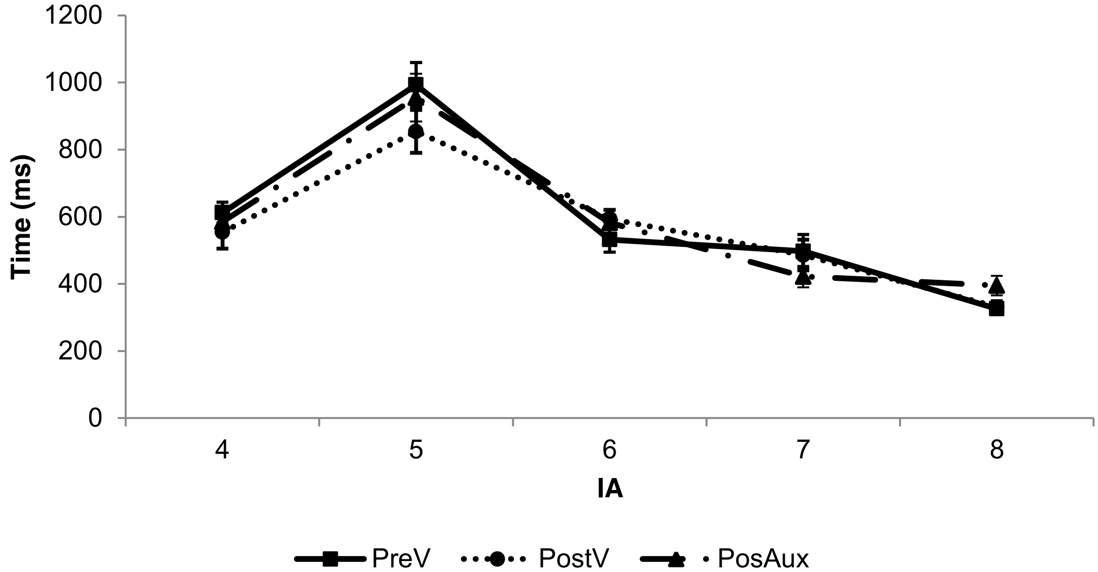


Figure 4-3. Mean subjects first pass RTs and *SE* for Experiment 2.

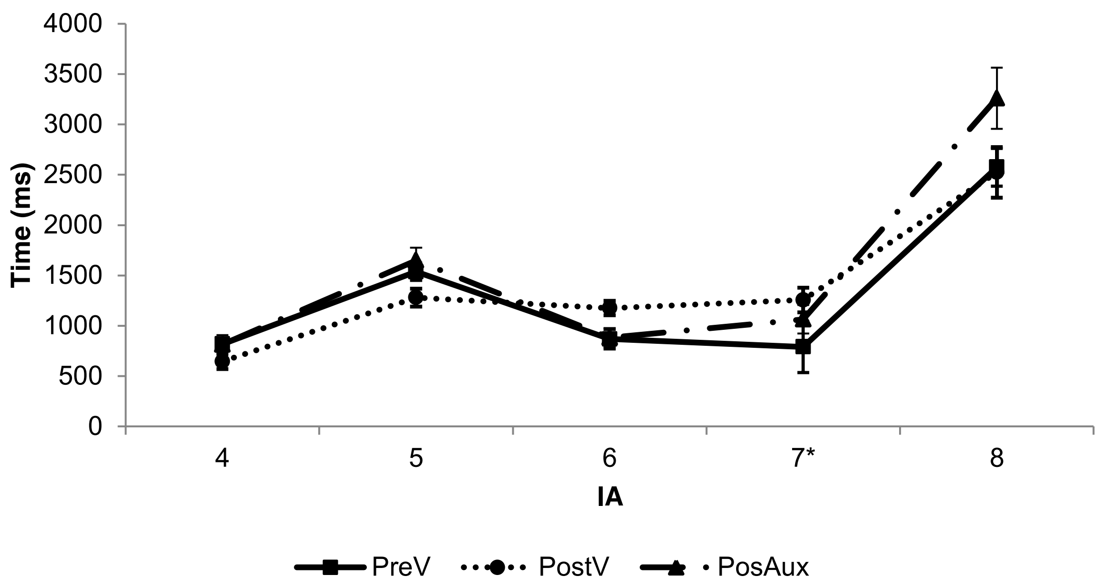


Figure 4-4. Mean subjects regression path RTs and *SE* for Experiment 2.

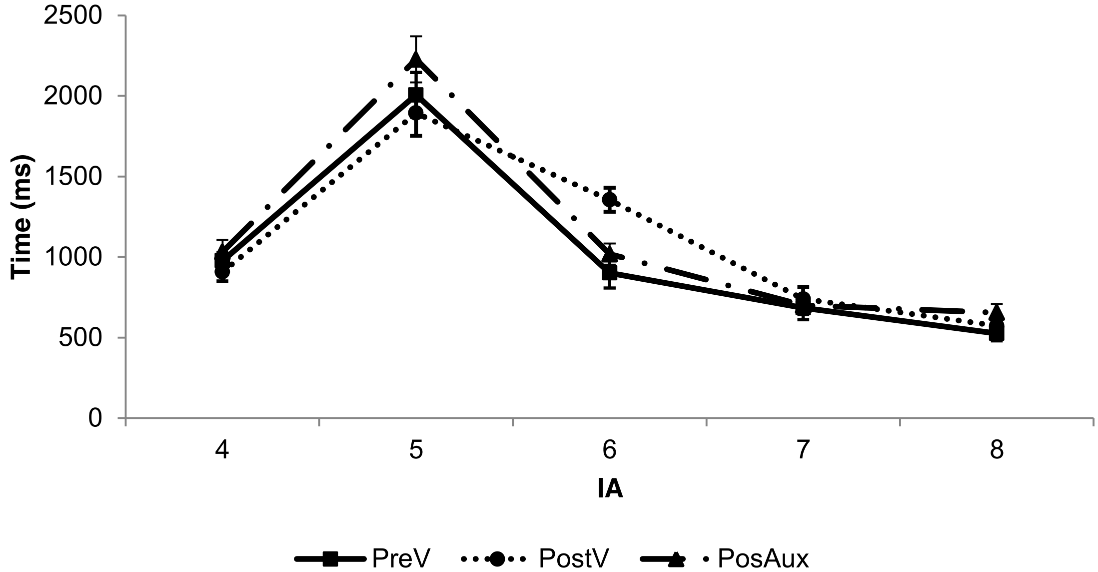


Figure 4-5. Mean subjects total fixation RTs and *SE* for Experiment 2.

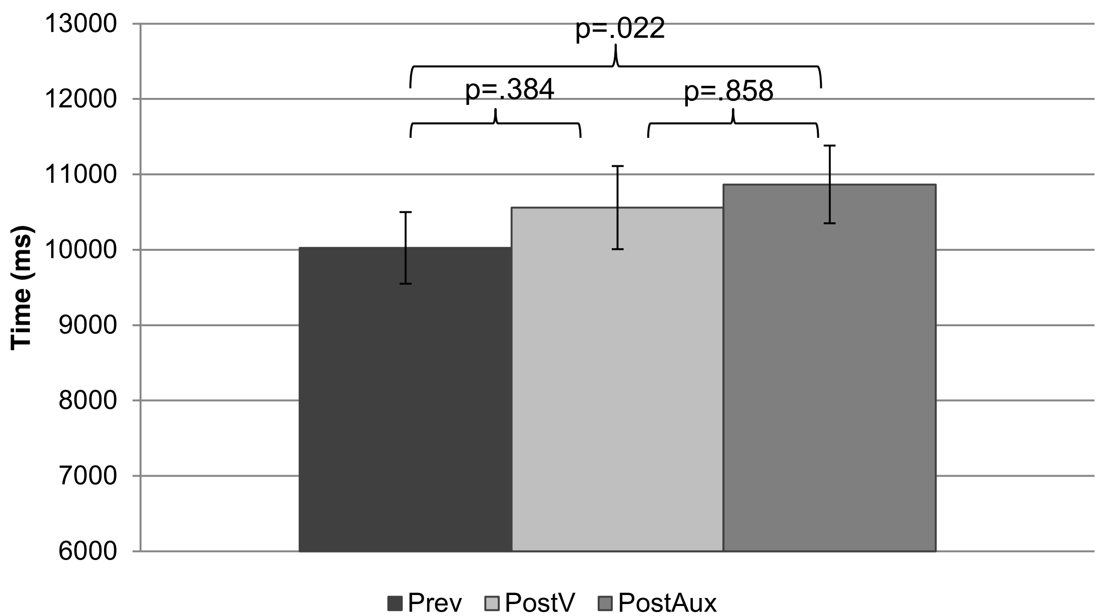


Figure 4-6. Mean subjects trial RTs and *SE* for Experiment 2.

CHAPTER 5
CONCLUDING REMARKS

In this final chapter, the main results of the ANOVA analyses as well as those of the logistic regressions are revisited, with particular emphasis placed on the outcomes that were inconsistent with the initial predictions. Given the complex and somewhat contradictory nature of the results, the present chapter seeks to bring the findings together in a clear and unified account of how WM and EF function during L2 processing. The outcomes are discussed within the cognitive linguistics framework, after which methodological limitations are considered. Finally, some directions for future research are proposed.

The Effect of Ungrammatical Structure on L2 Processing of Morphosyntax

Before examining how the cognitive constructs and VS relate to processing L2 syntactic structures during reading, I will briefly review the results of the ANOVA analyses. The significant findings in Experiment 1 showed increased processing effort with the grammatical condition, which emerged in the regression path measure of the critical region, and spillover effects that showed the opposite pattern: increased processing effort with the ungrammatical condition, becoming evident in the regression path measure of the two words following the critical region. Given that the ungrammatical condition, PostV, is syntactically grammatical in English, this suggests that participants initially processed the text with a more dominant English syntax—which caused the PreV condition to be noted as anomalous—after which the Spanish syntax became more active, reflected in the detection of the non-target structure as information continued to be integrated while reading.

The results of Experiment 2 were slightly more complex, principally because they included a third condition that was ungrammatical in both Spanish and English syntax, the PostAux condition, where the clitic was placed between the auxiliary and main verbs. The significant findings of both subjects and items means showed that, in the critical region, participants experienced fairly early processing difficulties with the PostAux condition. However, there was a lack of distinction between the PreV condition (grammatical in Spanish) and PostV (grammatical in English), and between the PreV and PostAux. The PreV-PostV distinction was found in significant differences in the spillover region, suggesting less immediate ungrammaticality effects for a structure that is ungrammatical in the L2 but grammatical in the L1. The final distinction, PostAux-PreV, was only to be found in RT differences in the final word, as well as in the total trial measure, and only in the subjects means analyses. These last findings suggest that a more comprehensive integration of information, as well as a more dominantly active L2 syntax are necessary to distinguish between two equally ungrammatical structures in the L1, only one of which is grammatical in the L2.

From a Cognitive Grammar standpoint, because English (L1) is the participants' dominant language, the PostV condition can be said to be the most automatized object structure of the three, by virtue of the high frequency of usage events that the cognitive system has experienced with it due to it being an L1 structure. Therefore, PostV has an established schema; that is, the unit—or construction—is entrenched (Croft & Cruse, 2004; Langacker, 2008) and the commonalities of each usage event have been abstracted. Because PreV is an L2 structure, it has not undergone the same degree of entrenchment as PostV has, yet is certainly more automatized than the entirely ungrammatical PostAux. As has been discussed, entrenchment and ensuing abstraction are key to the development of grammar, as abstraction "represents a generalization with the potential to be invoked in subsequent processing" (Langacker, 2008, p. 525). PostV is, then, the most easily invoked schema, followed by PreV. PostAux can be said to have no schema that may be invoked.

In Experiment 1, the competition, so to speak, during processing was between PostV and PreV. PostV, the dominant and most easily invoked construction, was the condition with the shortest RTs in the critical condition. However, the spillover effects indicated that PreV was invoked to some degree, and in fact became more active once information was integrated. In Experiment 2, PostV once again was the most easily invoked schema in the critical region, and the processing difficulties with the PostAux condition speak to the lack of entrenchment and schematization of this structure in either of the participants' grammars. Recall that in the process of categorization, units are assessed for their ability to manifest, the schema: "[t]he categorizing relationship is one of elaboration if the schema is fully manifested, without distortion, in the target; otherwise, it is one of extension" (Langacker, 2008, p. 220). The early processing difficulties with PostAux reflect precisely this assessment and the structure's inability to fully manifest in either of the L1 or L2 schemas. The spillover effects of the PostV ungrammaticality emerged as the L2 schema was invoked with integration of the material, and the structure being processed was deemed as a non-prototype, or less-than-good fit with the prototype.

The effects of ungrammaticality described above serve to show that there is variability with respect to how each condition is processed, and the eye-tracking technique is a useful tool for revealing at which point in time processing difficulties are encountered or resolved, bearing in mind the eye-mind span[1]. However, variability in L2 performance may also be due to individual differences in processing abilities and the size of the participants' established lexical database. Thus, the main goal of this project was to better understand how more general cognitive abilities and VS play a role in L2 processing, particularly in cases of beginning or intermediate stages of acquisition, where structures are less automatized. The following sections look at the results of predictions made for each of the research questions in light of cognitive linguistics theories, and attempt to answer some of the questions that arose in the previous chapter.

The Role of WM in L2 Processing of Morphosyntax

WM is the system, or set of basic mechanisms, responsible for maintaining task-related information active during the performance of a cognitive task (Shah & Miyake, 1999, p.1). During L2 processing, especially in cases with a lack of automatization and entrenchment, the WM system may become quickly taxed. Schneider (1999) remarks that automatization occurs with elements in the WM. A high WM capacity, therefore, could be advantageous for the L2 learner during processing in two ways. First, it could facilitate a greater number of co-occurring elements to be automatized, thereby increasing the number of (entrenched) units in the learner's repertoire. A greater number of units in the grammar may contribute to lowering the amount of taxation on the cognitive system, such that it may attend to other aspects of the task. Secondly, a high WM capacity would also hold more elements active during processing and thus

[1] As a reminder, the eye-mind span refers to the lag between visual and cognitive processing. See Rayner and Sereno (1994).

facilitate comprehension of discourse and therefore noticing of non-target grammatical structures.

The results of Experiment 1 showed that a higher WM capacity predicted a greater likelihood of longer processing times with the ungrammatical condition, with the effects of ungrammaticality showing up in the spillover regions. Crucially, the significant results were not located in any measures of the critical region, showing that the effects of activation of the Spanish (L2) syntax emerged only downstream. Thus, the results of Experiment 1 indicate that a higher WM capacity facilitates detection of the non-target structure, but that, if indeed a higher WM could facilitate earlier structural processing, in this group of learners it was not sufficient to do so.

In the previous chapter's discussion of the results of the WM analyses, it was noted that the nature of the logistic regression analysis allows us to interpret these results from the perspective of lower WM capacity as well. Crucially, it was also previously commented that, following prior work, longer RTs for a given condition have been interpreted in this study as an indication of processing difficulty for that condition with respect to a baseline, counterpart condition. Furthermore, detection of the non-target structure has been operationalized as processing difficulty with the ungrammatical condition. These assumptions were challenged in the results of Experiment 2.

In the first place, WM does not predict any reading time differences between PostV and PreV, where it did so in Experiment 1. Secondly, the PostAux - PreV results suggested that higher WM predicts processing difficulties with the grammatical spillover region, a finding that refutes the predictions and thus, that lower WM predicts detection of the non-target structure, emerging in the spillover regions. Two questions emerge, then: i) Why does WM not predict any PostV-PreV RT differences when this does occur in Experiment 1?; ii) What could explain the fact that the findings that emerge in the spillover regions of the PostAux-PreV analyses contrast from the ones of Experiment 1?

With regards to the first question, a likely possible explanation for the lack of results in WM predicting any PostV-PreV processing differences lies in the verb-object structure used in the Experiment 2 stimuli. The complex finite verb + object structure may be processed differently due to its frequency in the participants' input. While frequency data are not available for the participants in this study, Geeslin and Gudmestad (2010) have found frequency differences in advanced Spanish L2 learners' use of past tense forms, with the simple finite past tense structure (preterit) being more frequent. Their findings may point to similar frequency differences among the participants of the present study. In other words, the lower frequency of the complex finite structure may mean that WM does not facilitate noticing of the non-target structure because all participants were equally (un)likely to detect the it without employing additional WM resources. A second, less feasible possibility is that the small sample size did not allow for any of the statistical models to reach significance. This explanation would have to take into account the fact that the PostV-PreV analyses of Experiment 2 do not show pattern similarity with the analyses of Experiment 1, and was thus discarded.

The second question asked why the results of WM predictions for non-target detection of the PostAux condition in Experiment 2 contrasted with those of Experiment 1, essentially suggesting the opposite of the predictions made at the outset of this investigation. There are two possible explanations for these unexpected findings. The first, and most likely, explanation is to consider longer RTs not only as processing difficulties but also as (voluntary) processing effort. This expanded interpretation allows is to give a more consistent account of the findings, not only of the WM results, but also of the EF ones, as we will see in the next section. In this sense, the results may be revealing that participants with higher WM are investing more processing effort on the grammatical condition. By this account, while the participants with lower WM are possibly experiencing processing difficulties with the non-target structure, the ones with higher WM are likely expending more processing resources on the grammatical condition as they attempt (consciously or unconsciously) to find possible structural errors they have already perceived in the ungrammatical sentences. Having such resources at their availability may provide an opportunity to spend more time reading a given region. Of course, this account should also be able to explain why this same pattern of results does not occur in Experiment 1. This mismatch may be due to the complex structure of the stimuli of Experiment 2, and the fact that the PostAux condition is ungrammatical in both the L1 and the L2. These two notions are discussed shortly.

The second possibility is the least probable of the two: to take the results at face value and explain how a lower WM capacity would predict a greater likelihood of detecting a non-target L2 structure, while a higher WM predicts longer RTs for the target L2 structure. Recall that, in Cognitive Grammar, the anaphorical relationship is conceptualized as a reference point relationship that consists of a dynamic mental scanning in which the reference point is invoked to establish contact with the target. This task is further complicated by the assessment of valence relations with the elements of the complex verb structure in question, along with gender and number features. Given the cognitive load of maintaining active this large amount of information during processing while recognizing that the elements of the verb structure are not in their usual L2 order, it seems unlikely that learners with higher WM would be the ones with difficulties parsing the grammatical, L2 syntax while those with lower WM would be the ones with difficulties parsing, and thereby detecting, the ungrammatical structure.

It seems more logical that participants with higher WM invest more processing effort in the grammatical conditions, perhaps searching for non-target structures, as this interpretation is more consistent with previous studies that have found positive correlations between WM and L2 performance (e.g., Dussias & Piñar, 2010; Havik et al., 2009; McDonald, 2006; Sunderman & Kroll, 2009). Certainly, conflicting results should not be reduced to choosing the most convenient answer, nor the most logical, as unexpected results may reveal more complex workings that are not readily apparent. Therefore, while the results of Experiment 1 do support the predictions made at the onset of this investigation, suggesting that WM capacity does facilitate detection of non-target L2 structures, they also call for further research to resolve the conflicts that they present.

The findings of both experiments would thus show that WM capacity is able to predict detection of non-target L2 structure during reading processing to some extent; however, the relationship is more complex than originally anticipated. With the simple finite verb structures, the ability to maintain a greater amount of information active during processing seemed to work in favour of allowing other cognitive resources, to attend to structural processing of low-saliency cues, such as the clitic pronouns and their placement, which may otherwise go undetected. With the complex finite verb structures, the existence of the ungrammatical structure in the L1 is essential for explaining the findings. The same greater WM capacity was now used by the learners to dedicate additional resources, or processing effort, to the grammatical sentences, possibly reading more carefully in search of previously encountered errors in other stimuli or in the filler items; however, this occurred only in those cases of comparison between the grammatical sentences and the ungrammatical ones that contained a structure not found in the L1 (PostAux). Importantly, the PostAux condition could theoretically be considered easily noticeable by learners due to two factors: first, the present perfect structure has been found to be of low frequency among even advanced Spanish L2 learners, as was found in Geeslin and Gudmestad's (2010) study, and there is good reason to believe this is the case among the participants of this study as well, who are of even lower proficiency; second, the PostAux structure is found neither in the L1 nor in the L2. These two characteristics would make the structure prominent among the others, all of which have some form of representation in the learners' (L1/L2) linguistic system. Perhaps it is this very salience that can explain why participants with high WM were more likely to expend more processing resources on the spillover segment of the grammatical sentence while those with lower WM were more likely to spend a longer time on the same segment of the PostAux ungrammatical sentence. In other words, while the PostAux structure was easily (and equally) noticeable to all learners, the ones with lower WM spent more time processing it, while the ones with higher WM employed the extra resources in processing the grammatical sentence, reading more carefully.

Crucially, the results of this study add important information for the contribution of WM during L2 processing. For example, Havik et al. (2009) noted that their high WM participants, unlike their native group, only showed an advantage in the first of two experiments, where they were required to complete a true/false verification statement that directly measured the participants' interpretation of subject and object relative ambiguous sentences. The authors argued that, in their first experiment, like in other studies of L2 processing, it was the metalinguistic task, which required readers to make a semantic judgment that targeted the region of interest, that was responsible for the findings. In other words, high WM was not found to be an advantage when learners read for meaning alone, as shown in their second experiment. Likewise, other studies of L2 processing have employed grammaticality judgment tests along with online techniques (e.g. Juffs & Harrington, 1995; White & Juffs, 1998). The present study found that WM may indeed prove to be advantageous, even without a metalinguistic task that targets the tested structure. Indeed, while a true/false comprehension statement was included, this was done for all trials, including filler items, and the comprehension statements for the critical items were designed to examine comprehension/retention of other information in the referent sentence, while making no mention of the clitic pronoun. Because of this, however, confirmatory information regarding the participants' accuracy rates in processing the clitics is not available for analysis.

Unfortunately, unlike the study of Havik and colleagues, this investigation did not assess native Spanish speakers' processing and thus cannot make direct comparisons between L1 and L2 processing of the stimuli used herein, a crucial limitation that will be discussed in more detail in the Methodological Considerations and Directions for Future Research section below. Another important difference between this investigation and Havik et al.'s is that their experiment concerned interpretation of subject relative and object relative ambiguous sentences, and thus differences in sentence processing directly affected interpretation. Several studies of L2 processing have looked at the same phenomenon (e.g., Dussias, 2003; Dussias & Sagarra, 2007; Felser, Roberts and Marinis, 2003; Papadopoulou and Clahsen, 2003). In contrast, the stimuli in the present experiment were designed to test for the effect of individual differences in cognitive abilities in the noticing of inverted word order, particularly of constructions containing clitics, which are low-saliency cues and thus may be easily overlooked. In fact, the stimuli presented enough context such that theoretically, meaning could be gleaned by focusing on content words alone. For example, with the referent sentence such as *La doctora buscaba a su hijo en la clínica* 'The (female) doctor was looking for her son in the clinic', the critical item **La enfermera encontró lo en el baño* 'The (female) nurse found him in the bathroom' could be understood without overt processing of the clitic. In this sense, this study focused on the learners' ability to notice the non-target structure as such even while, in the PostV cases, it represented a competing L1 schema and contained low-salience cues.

In sum, the present study showed that higher WM predicted a greater likelihood of noticing non-target L2 structures that exist in the L1 and more dedicated effort to reading grammatical sentences similar to previously-encountered ungrammatical ones that contained obvious non-target structures. These results strongly suggest that, overall, learners with higher WM read the text more carefully. Likewise, they also point to the fact that we cannot assume L2 processing as evidenced in RT is the same as L1. While L1 processing research makes the general assumption that longer RTs mean processing difficulty, the findings of this study show that at lower proficiency levels, L2 learners who have the resources choose to dedicate them to added effort during processing. This is not surprising, given that L1 processing is characterized by a relatively well-established system, both lexically and morphosyntactically, while the low-proficiency L2 system is characterized by instability and a much smaller amount of entrenched units. Certainly, these results are preliminary and would require additional research to be corroborated as is discussed later in this chapter. However, the more elaborate interpretation of longer RTs, as well as the particular characteristics of the present study discussed above, will allow a more consistent account of the findings, as we will continue to see now that we turn to the second research question.

The Role of EF in L2 Processing of Morphosyntax

As we saw in the first chapter, EF is the cognitive system that oversees our ability to create, maintain, and shift mental sets corresponding to reason and the generation of goals and plans, the organization of goals and plans, the maintenance of focus and motivation to follow through with goals and plans, and the goals and plans in response to changing circumstances (Suchy, 2009). The scores of the tests used in the present study loaded onto two separate factors of EF abilities: an IPS factor from the Stroop and DSST scores, which represents inhibition and processing speed abilities, and a Trails factor that denotes sequence maintenance and task switching.

Higher inhibition abilities, as measured by the Stroop task, might be advantageous in the suppression of English verb-object schemas, thereby allowing Spanish schemas, or L2 syntax, to be more dominant and readily invoked for processing. Higher processing speed abilities may prove beneficial during real-time processing, where learners might feel more pressure to comprehend and perform in a timely manner. In addition to processing speed, DSST also measures attention and switching abilities, which may contribute to the selection of the low-salience clitics that may otherwise be overlooked. Likewise, the sequence maintenance and task switching abilities measured in the Trails tests could facilitate noticing of the word order sequence of the schemas and directing attention to pertinent task demands, such as processing low-salience cues.

The main issue with the results of the EF analyses was the apparent contradiction in models that predicted that participants with higher abilities were more likely to experience longer RTs for both (IAs within) ungrammatical and grammatical sentences. The present discussion reinterprets these findings with the alternative explanation for longer RTs provided in the discussion of the WM results above, thereby affording a more uniform account of the role of EF during L2 processing. The following discussion begins with the role of sequence maintenance and task switching, and is then followed by an account of inhibition and processing speed abilities.

In Experiment 1, the apparently contradictory findings were seen in the only significant models, which suggested that greater sequence maintenance and task switching abilities predicted longer RTs for the regression path measure of the grammatical spillover region. If reinterpreted as increased processing effort, rather than difficulties, these findings imply that participants with higher abilities were more likely to spend added processing resources in this region, possibly searching for previously encountered ungrammatical structures in other sentences of the experiment. In other words, these findings likely point to more detailed processing on the part of learners with higher abilities. Crucially, as occurred with the similar results in the WM analyses, this trend occurs consistently in the spillover regions, not the critical. We will see that this is the case in the results of Experiment 2, as well.

In the second experiment, the sequence maintenance and task switching abilities predicted similar findings, with an added notable result. In the PostV analyses, individuals with higher abilities were more likely to detect the non-target structure in the critical region, and also more likely to expend added processing effort in the second spillover region. In the PostAux condition, higher maintenance and task switching abilities only predicted added processing effort in the first spillover region, not the second. An important characteristic about the spillover regions may help present a more unified account of these findings.

Recall that the first spillover region consisted of the first two words following the verb + clitic construction. The second spillover region contained any material between the first spillover and the final word. Because the material that followed the verbal constructions was varied among critical items, some first spillover regions contained two short words such as *en el* 'in the' while others contained longer strings, such as the double adverbial *inmediatamente después* 'immediately after'. Among the critical items there was, therefore, not only a difference in the string length of each spillover region, but also in parts of speech found therein. Thus, little could be said about the differences between results of the first spillover region and those of the second. However, collapsing the results of the spillover regions and keeping them separate from the critical verb + clitic construction offers an interesting reading of the findings. Now, we see that individuals with higher sequence maintenance and task switching abilities were more likely, in both experiments, to invest additional processing effort in the grammatical spillover regions. Interestingly, this finding coincides with all analyses of WM and EF that showed that individuals with higher abilities dedicated increased processing effort in the grammatical items. This finding strongly suggests that these individuals may have had expectations of finding ungrammatical verbal structures and, when not encountered, read the text more carefully. This point is addressed and further discussed in the Concluding Remarks section of this chapter.

Finally, the same higher sequence maintenance and task switching individuals were also more likely to detect the complex PostV structure in the second experiment. Thus, these abilities seem to have been more useful in detecting a low-frequency non-target construction that is schematically represented in their L1, than in noticing its higher frequency counterpart, or a construction that does not exist in either (L1 or L2) linguistic system. This pattern of detection prediction between simple finite PostV, complex finite PostV and complex finite PostAux is discussed further below, in light of the discussion on the results of the inhibition and processing speed abilities, to which we now turn.

Significant models for predictions of inhibition and processing speed abilities and non-target clitic placement were only found in Experiment 2. Here, higher abilities predicted immediate detection of the PostAux non-target structure. Additionally, higher processing speed abilities (as measured in the DSST) predicted longer RTs for the spillover regions of the PostV ungrammatical structure, while higher inhibition abilities (as measured in the Stroop tasks) predicted longer total trial RTs for the PostAux ungrammatical sentences. Again, the alternative meaning of longer RTs now allows us to interpret these findings in a more coherent manner. Participants with a greater capacity for inhibition and processing speed were more likely to detect the non-target structure that is inexistent both in their L1 and L2. In addition, individuals with higher processing speed abilities dedicated more processing effort in the spillover regions of the grammatical sentences, and those with higher inhibition abilities invested added processing effort on the grammatical sentences.

One aspect of these findings merit further discussion: the ease with which PostAux is noticeable with respect to PostV in Experiment 2. As was previously discussed, PostAux should theoretically be easy to notice because the structure has virtually no schematic representation in the learners' linguistic system(s). If this is true, it should not provide any real competition for structures that are represented to some degree. That is to say, it should catch the readers' attention simply because it is new and unknown. Thus, EF abilities, particularly inhibition abilities, should not be as necessary during the processing of this particular structure, as they would be while processing other structures that have different degrees of representation, such as PostV and PreV, and therefore provide direct interference. Indeed, we will recall that several studies of EF during L2 processing found that executive functions of inhibition, attentional control, selection processes, and maintenance of goal-related information acted during processing, not only of lexical items but on syntactic interference as well (e.g., Hernandez & Meschyan, 2006; Rodriguez-Fornells et al., 2006). The question, then, becomes why inhibition and processing speed abilities would predict detection of the PostAux construction and not the PostV one of either Experiment 1 or 2. A preliminary explanation would be that greater EF abilities to processing quickly and accurately, as well as suppress interfering information do indeed work to inhibit the L1 and efficiently process the L2; however, at lower proficiency levels, such as those of the participants in this study, they may not be sufficient to inhibit, in a consistent fashion during L2 processing, non-target L1 schemas that strongly compete against the target L2 structures, especially if these contain easily overlooked low-salience cues.

A second aspect of the EF results as a whole that must be addressed is why no significant findings of non-target structure detection emerged for Experiment 1. Indeed, the only significant results for the first experiment indicated that greater sequence maintenance and task switching predicted a greater likelihood of more processing effort in the spillover regions of the grammatical sentences. The same rationalization as above may to explain this finding as well. That is, perhaps schema competition from the L1 was too strong in Experiment 1 for EF abilities to consistently inhibit the interference, select L2 schemas, and notice and maintain attention on the low-saliency clitics.

The results of the experiments in this study with respect to the role of EF during L2 processing have thus found the following: i) higher inhibition abilities were crucial in the early detection of structures that are inexistent in the L1 and L2; ii) higher sequence maintenance and task switching abilities were crucial in the detection of low-frequency non-target L2 structures that exist in the L1; iii) higher levels of all EF abilities tested in the present study—inhibition, processing speed, and sequence maintenance and task switching—were shown to predict greater invested effort in reading grammatical sentences when ungrammatical ones have been present in the input. This last finding is crucial, in that it provides further support that individuals with higher EF abilities probably did notice the non-target structures more than those with lower abilities did.

The present study, then, contributes important information previous studies that have examined EF and L2 processing. As we saw in chapter 2, Hernandez and Meschyan (2006) found that while less fluent late learned L2 participants named pictures in the L2, brain areas were activated that are known to be active during tasks that require choosing between response alternatives, task switching, active maintenance of context- or goal-related information, and inhibition of irrelevant items. From this, the authors suggested that EF is necessary when processing lexical items in a less proficient L2 because additional attentional effort is required. Rodriguez-Fornells et al. (2006) provided added support for these findings in a study that revealed both behavioural and neurological evidence that executive function processes of inhibitory control and switching were recruited during L2 processing of words that provided either phonological/lemma. Thus, the research has strongly suggested that EF is crucial during L2 lexical processing. Importantly, Rodriguez-Fornells et al. (2006) extended these findings to L2 processing of syntactic features in a task that required gender decision-making, which assessed participants' attachment of proper grammatical gender to discrete words.

Thus, their study provided solid evidence that executive functions are recruited during L2 processing of syntax; however, it was still unknown whether or how EF processes would be used in processing morphosyntactic features in online sentence parsing. The results of this study provide important information in this regard, suggesting not only that EF is indeed used to control L1 interference during processing of L2 schema, but that low-proficiency L2 learners with higher levels of EF abilities make use of these resources by employing them in a more detailed reading/parsing of text in cases where the input has provided unreliable or conflicting instances of syntactic structures.

Additionally, the present study has also differed from several other studies of L2 processing (and EF) in two aspects previously addressed in the WM and EF discussions: first, frequency differences among the simple and complex finite verb structures in the learners' L2 repertoire may have played a critical role in the outcomes we've seen here; second, this investigation has centered on individual differences in the processing of L2 verbal constructions that contain easily overlooked, low-saliency cues, and has manipulated the placement of such cues. In implementing this design, it has shown, as was extensively discussed in the WM section of this chapter, some important differences between L1 and L2 processing. These last three notions are addressed again in the Concluding Remarks of this chapter.

Finally, certain methodological limitations may also have played a role in these results, such as the types of tasks used to assess EF abilities. These are considered in Methodological Considerations and Directions for Future Research, below. We now address the last of the three research questions: the role of VS in the detection of the non-target clitic placement.

The Role of VS in L2 Processing of Morphosyntax

VS has been shown to be a crucial aspect in the acquisition of children's grammar (e.g. Bates & Goodman, 1997). Further, evidence has suggested that, coupled with a high IQ and adequate attentional resources, it is an essential component in the development of L2 grammar through generalization of morphosyntactic patterns (e.g., Brooks, Kempe, & Sionov, 2006). The findings of this previous research point to the possibility that VS also plays a role in online processing; specifically that higher VS facilitates lexical comprehension, therefore affording greater opportunity for non-target syntax to be detected.

As we saw in the previous chapter, the few significant or approaching-significance results that emerged in the analyses were unreliable models, with only two possible interpretations. The first is that VS is not a good predictor of non-target structure detection during sentence parsing; the second, that a larger sample size may reveal more robust patterns. Certainly, we must also consider the whether the test of estimated receptive vocabulary size used to obtain VS scores, the X_Lex v.2.05, was adequate for this study. The range of estimated words for the group of participants in the present study was 1050 to 3150 words, which seems to be an adequate enough range to reveal any predictive patterns. Additionally, the X_Lex v.2.05 was found to be a good measure of VS by Darcy, Mora and Daidone (2013) in a study of individual differences and L2 phonological acquisition. The most probable explanation, then, is that the sample size of this study did not provide an adequate quantity of data to reveal any existing patterns, and that the experiment must be replicated with more participants, and possibly more stimuli. These and other methodological considerations are discussed in the following section.

Methodological Considerations and Directions for Future Research

This section considers some methodological aspects that may have played a role in the results that were found, as well as suggestions for improving the study design in future investigations. In the first place, there may have been insufficient data to yield results that would have enabled us to draw more determinate conclusions. For the logistic regressions, this was taken into consideration by carrying out a separate analysis for each predictor, rather than placing all predictors in the same model, which would have required a greater number of participants. Nonetheless, the 29 participants, 8 stimuli per condition in Experiment 1, and 6 stimuli per condition in Experiment 2 proved to be perhaps too limited to generate enough data for stronger results. Additionally, the two experiments were run as one, with shared filler items, along with the cognitive and vocabulary size tests, in one sitting. This took approximately 2.5 to 3 hours per participant, with a short break if needed, and some participants reported feeling tired by the end of the experimental session. Future experiments with more stimuli would therefore necessitate separate sessions. While this adjustment carries its own challenges in terms of ensuring that participants return for a second experimental session, it seems to be the most adequate way of ensuring sufficient data are collected for more generalizable results.

Another aspect of the experiment that requires modification is the nature of the comprehension statements. For this study, the comprehension statements, as well as the stimuli, were kept short in consideration of the participants' proficiency as well as the length of the experiment. In addition, in order to prevent students from surmising the focus of study, no reference to the clitic pronouns or their function was made. Some participants reported after the experiment that some of the comprehension statements asked about details they did not remember by the time they had finished reading the stimulus and had proceeded to the statement. As such, they began to read more meticulously, despite the instructions stating they should as they would normally read a magazine article, in order to ensure they would remember all details that might be asked in the comprehension statements. This may have contributed to some of the elevated RTs, particularly the regression path and/or total fixation measures.

Similarly, participants also reported that some comprehension statements did not address a specific feature of the stimuli, and thus they had to infer the answer based on the information given. This caused them some uncertainty as to whether they were "doing it right." It is not possible to ascertain whether they were referring to critical items or fillers; however, this may have been a source of some confusion that could have affected how the participants read the stimuli. This potential issue must be addressed in future studies. It is undoubtedly difficult to create appropriate comprehension statements that are short and that avoid targeting the topic of research, especially when the stimuli themselves are short. Recall that one issue with L2 processing studies that assessed comprehension was that metalinguistic tasks seemed affect processing (e.g., Havik et al., 2009). Ideally, comprehension statements should attempt to test knowledge of the general meaning of the critical items and fillers in order to avoid interference with the natural reading processing of the participants.

Along with modifications to the experimental design and/or setup, the analysis of the data may also be expanded. The present study has attempted to be thorough in its investigation; nonetheless, an analysis of other important aspects that were not seen here may give a more complete account of the results. The study focused on three common eye-tracking measurements—first-pass, regression path, and total fixation—in the critical region, as well as all regions following downstream. It also looked at the total trial reading time. These were believed to provide adequate information about the processing of the non-target structure and any spillover or wrap-up effects. In the interest of time and space, other potentially informative measures were not addressed. The first of these measures is the first fixation duration. More commonly used for single words rather than regions, this measures, how long the first fixation lasts (Rayner & Sereno, 1994). The second measure is second pass reading time, which times the duration of re-fixations, or the time spent re-reading a region after the eyes have left it. The third is the probability of a regression, which gives the percentage of regressive eye movements out of a region. Others include: probability of fixating a target word (or region) and number of fixations on the target word (or region) (Rayner, 1998).

Of the measurements that were not analyzed, the second-pass reading time may have given more detailed information about how long participants spent re-reading the critical region; however, it must be noted that this time is also reflected in the total reading time for the region, and thus, any significant differences may have emerged in that measure, as was seen in some cases. Crucially, the probability of regression measure may give important additional information about the differences between the percentage of regressions out of the critical region (and possibly to the antecedent) in the grammatical and ungrammatical conditions. Related to this is the number of fixations in the critical region and the antecedent, as both could provide extra insight into the processing differences of each condition. As the eye tracking data were characterized by frequent and long fixations, these measures should be addressed in the follow-up to this study and in future studies in order to gain a better understanding of non-target structure processing due to clitic placement.

Likewise, while the comprehension statements did not target responses concerning the clitic pronoun, they should be analyzed for accuracy rates. These could shed some light, perhaps not on the learners' metalinguistic knowledge of clitic placement in this study, but of any differences between the overall comprehension of the non-target items as compared to the target ones, as well as any differences between higher cognitive- and lower cognitive-level learners. Additionally, separate data analyses of only the critical items whose comprehension statements were correctly answered might reveal some different results. It should be noted, however, that given one participant's observation that some of the comprehension statements targeted minute details from the referent sentence that were easily forgotten, the comprehension statements are limited in the information they can provide.

Furthermore, the future data analysis could be more detailed. For this particular investigation, critical items were developed such that number, gender and animacy were controlled for. Furthermore, the accusative and dative data were collapsed in order to afford more power to the statistical analyses. However, Spanish clitic pronouns differ somewhat between cases: recall that the accusative pronouns are marked for gender and number, while datives are only marked for number. Thus, any differences in the processing of pronouns of different cases in the non-target structure remain hidden in the analyses carried here, and may have contributed to the ambiguity in some of the results. As such, future work should analyze the dative and accusative data separately in order to determine whether linguistic marking for only one feature (i.e. number) affects processing differently than marking for two features (i.e. gender and number). Schemas containing the possibility of two features rather than one are more complex and may affect the resources needed for their processing.

Likewise, the analyses may be further expanded by calculating and analyzing the RT differences between the PostAux and PostV conditions of Experiment 2. All analyses in the present study were based on two differences: PostV-PreV and PostAux-PreV. That is, difference scores were only calculated between one of the ungrammatical conditions and the grammatical one. They were not calculated between the two ungrammatical ones. These represent one structure that is existent in the L1 (English) and another that is not. Analyzing the difference scores between the two might lend more insight into the results of Experiment 2, and the processing of different kinds of non-target structures in the L2.

In a similar vein, other scores could be calculated for the EF tasks. Recall that both Stroop and Trails tasks contained two portions, the first of which established a baseline of performance. This is means that any individual differences in processing speed are mathematically worked into both the composite and factor scores. Another way of calculating scores, however, could be transforming them using ratios, such as Stroop A / Stroop B, and Trails A / Trails B, or accounting for individual differences in motor and visual scanning speed by transforming the scores by scaling the Part B − Part A difference score by the part A response time ([B − A / A]) (Im-Bolter et al., 2006). Use of these fraction scores in the regression analyses might reveal additional findings.

Moreover, the tasks themselves present some challenge to the interpretation of which abilities are being assessed. Recall, for example, that Miyake et al. (2000) found that some complex EF tasks measure more than one process. Likewise, Im-Bolter et al. (2006) note that the Trails B task they administered the child participants to measure shifting was a complex task that also assessed inhibition. In fact, Sánchez Cubillo et al.

(2009) found that Trails A measures mainly visuoperceptual abilities, while Trails B reflects primarily WM and secondarily task-switching, and that the B − A difference score minimizes the effects of visuoperceptual and WM demands, thereby reflecting more accurately EF abilities. Thus, the composite and factor scores used in the EF tasks in this investigation likely reflected abilities in several concurrent processes. A simple inhibition task, such as the non-verbal antisaccade task (Im-Bolter et al., 2006), might reveal different correlations with L2 processing.

Similarly, as we saw in chapter 2, a distinction has been made between verbal and non-verbal WM. The DSF, DSB and DO used in this study are all verbal WM measures. It would be interesting to administer these tests in the L2 in order to ascertain if and how lower-proficiency learners would be able to carry them out, how they differ from higher proficiency L2ers, and how the scores would correlate to L2 processing as compared with the results found in this investigation.

Future research should include more than one proficiency level and native speakers as well. The participants of the two experiments in this study were third and fourth semester students of Spanish. They may have different processing strategies than more advanced and highly fluent, native-like bilinguals. Inclusion of different proficiency levels and a group of native speakers would allow a comparison between groups in order to determine any processing differences between them that may or may not correlate with individual differences in cognitive abilities and VS. Knowledge of highly proficient processing might also shed some light on the results of the lower proficiency individuals in this study and may provide support or evidence against the expanded definition of longer RTs adopted in this study.

Finally, in light of the results of this investigation, and given Geeslin and Gudmestad's (2010) findings of frequency differences between the use of the preterit and present perfect forms among advanced L2 learners of Spanish, future studies should highlight and investigate the effects of frequency of the structure in question in the L2 input of the learners. Unfortunately, it is often difficult to find frequency information that corresponds to the L2 input, and therefore it is imperative that researchers attempt to create their own corpora. Two ways in which this may be done are to count the occurrences of each form in the textbook(s) used by the participants, or to have them complete an open production task. Neither method is a full-proof reflection of their exposure to the structures or of the level of automatization of each; however, it could provide crucial information to be used in analyses of processing.

Despite the limitations of this investigation, the findings of this study provide important information regarding L2 learners' sentence parsing during reading and, more specifically, how they use their cognitive abilities to facilitate such parsing, especially in view of the fact that research in L2 processing of morphosyntax is not as abundant as that of its L1 counterpart. The next and final section presents the main conclusions from the findings and closes with some theoretical notions to consider.

Concluding Remarks

The findings of the investigation undertaken here were somewhat complex and presented some challenges with regards to their interpretation. The three research questions sought to investigate how well the WM capacity, EF abilities and VS of L2 learners predict detection of non-target L2 structures in the form of non-target clitic placement in finite verb + clitic pronoun constructions during reading processing. It was predicted that learners with higher WM capacity, and greater EF abilities and VS would show a greater likelihood that the non-target structure would be detected during processing. These predictions were made on the theoretical premise that L2 schemas that differ from the L1 are characterized by low levels of entrenchment in the linguistic system of low-proficiency learners such as the group of participants tested in the present investigation. Thus, more entrenched L1 schemas would provide interference during processing and higher cognitive abilities, as well as a larger database of entrenched L2 lexical items, would prove beneficial in processing easily overlooked low-salience morphosyntactic features. The predictions were supported, and some unexpected results brought forth a new issue: how to interpret longer reading times in high cognitive-ability, low-proficiency L2 learners.

The results of both WM and the two components of EF—inhibition and processing speed, and sequence maintenance and task switching—suggested that higher abilities predicted a greater likelihood that the non-target placement of the clitic would be noticed. The findings also showed that low-proficiency L2 learners with higher WM and EF abilities were more likely to spend longer reading spillover regions of the grammatical sentences. Where L1 processing literature generally associates longer reading times with processing difficulty, this interpretation proved inadequate in the present investigation. An expanded interpretation of longer reading times as representative of processing effort allowed us to reinterpret the findings. These now suggested that learners with higher abilities invest added processing effort, or attention, in parsing morphosyntactic features of grammatical text, when ungrammaticality has been detected elsewhere in the input. VS did not prove to be an adequate predictor of processing times for the different conditions, and therefore it was concluded that methodological limitations of the study perhaps did not allow for effects to emerge in the analyses.

The main issue in the interpretation of the findings, thus, was what longer reading times, particularly of regions in grammatical sentences, implied in L2 learners with higher cognitive abilities. The more comprehensive interpretation adopted allowed us to revisit the results and come to conclusions that shed new light on L2 processing. As previously noted, several studies of L2 sentence processing of morphosyntactic features have focused on the interpretation of relative-clause ambiguous sentences (e.g., Dussias, 2003; Dussias & Sagarra, 2007; Felser, Roberts and Marinis, 2003; Papadopoulou and Clahsen, 2003). Others have looked at gender and number agreement (e.g., Keating, 2009, White et al., 2004), and *wh*-movement (e.g., Dussias & Piñar, 2010). The present study differs from these in that it centered on clitic placement (i.e. word order) in the verbal construction rather on its gender and number features. Crucially, then, it tested processing of L2 word order while dealing with L1 word-order competition, in which one of the two words is a low-salience cue. Additionally, the present study focused on individual differences in the processing of this particular structure. These two characteristics allow the present study to contribute unique information to what we know about L2 processing of morphosyntactic phenomena. In cases where the input contains non-target L2 morphosyntactic structures, low-proficiency learners with high WM and EF cognitive abilities not only perceive these structures but also invest more effort in reading subsequent portions of grammatical sentences where the non-target structures are not encountered. This is probably due to predictions made on the non-target structures previously encountered in the input.

In fact, some research in L2 processing has looked at anticipatory processes. Studies that research anticipatory processing focus on the predictive processes that anticipate upcoming information. Kamide (2008) notes that psycholinguistic and computational theories largely agree that sentence comprehension is an incremental process in which meaning is constructed as information is encountered. Research in anticipatory processing seeks to understand how meaning is constructed before information is encountered by predicting what will appear. For L2 processing, this research proves beneficial in understanding whether and how L2 learners anticipate information during processing and how they compare to native speakers. For example, in a visual world paradigm eye tracking study, Hopp (2012) found that late L2 speakers of German vary in their predictive use of gender agreement in real-time sentence comprehension. L2 learners displaying low accuracy rates in production of German gender assignment showed low levels of predictive use of gender agreement during aural comprehension of sentences that contained gender-marking determiners before nouns. On the contrary, individuals with high accuracy in assignment of gender production showed clear and robust effects of predictive gender processing. In a similar study, Dussias, Valdés Kroff, Guzzardo Tamargo and Gerfen (2013) found evidence that highly proficient L2 Spanish speakers, like natives, used gender features encoded in articles to facilitate processing of upcoming nouns, while low-proficiency learners did not display the same pattern.

These findings may provide support for the conclusions drawn in the present study. The learners' L1 (English) and L2 (Spanish) are both characterized as SVO languages. Thus, in general, SVO word order should predicted because it is the default order (see VanPatten, 1984). One exception is the verb + clitic construction in Spanish, which violates the rule, so to speak. Thus, learners can potentially make two predictions with respect to the critical items used in this study. The first is at the subject, the second is at the verbal construction. At the subject, SVO would be the prediction due to the congruence between the two languages, and therefore a verb would be anticipated. Two predictive scenarios may occur here. For grammatical items, lack of activation of the Spanish (L2) syntax may cause the clitic to either be overlooked because it is of low-salience or noticed for being incongruent with the L1 word order. Activation of the Spanish syntax, though inconsistent with the predictions, would have learners recover (more quickly). Thus, learners with higher cognitive abilities are predicted to recover more efficiently when morphosyntactic predictions are not met during processing. For the ungrammatical items, the predictions are met, and therefore effects the clitic's appearance after the verb are dependent on whether and how it is processed.

At the verbal construction, two added predictive scenarios may unfold. For grammatical items, lack of activation of the Spanish (L2) syntactic schema would cause an object (or pronoun) to be anticipated after the verb, especially if the clitic was overlooked. Activation of the Spanish (L2) syntactic schema would have readers process the clitic pronoun and thus not anticipate an object after the verb. For ungrammatical items, lack of activation of the Spanish schema would have learners anticipate an object, which they may interpret the clitic to be, if it is processed. Activation of the Spanish schema would have learners predict an object after the verb. Upon encountering the clitic, effects of ungrammaticality would be manifest. Thus, learners with higher cognitive abilities were predicted to experience activation of Spanish syntax and thus notice that the predictions were not met.

Crucially, a backward compatibility check is expected to be performed upon encountering the clitic pronoun, and mental scanning of previous elements in the discourse to establish contact with the antecedent (see chapter 1). Learners with higher cognitive abilities may have added predictions of encountering a clitic pronoun in the critical items by virtue of having a greater ability to maintain active information in their WM and having thus retained more information from the referent sentence.

A fourth predictive possibility arises in this experiment, which may explain the outcomes in terms of anticipation. While L1 schemas are said to be deeply entrenched with respect to L2 schemas, the leaners' linguistic system may be (further) destabilized by input that presents alternating schemas. L2 learners with higher cognitive abilities may have been more sensitive to this input and probably formed predictions based on the ungrammatical items encountered. Thus, the presence of ungrammatical sentences likely triggered their anticipation of them, and consequently, the added processing effort emerging in the spillover regions of the grammatical items when their predictions (of ungrammaticality) were not met in the critical regions.

Importantly, as previously noted, in all cases but one, the additional processing effort on the part of high-ability learners emerges in various measures of the spillover regions. In one instance, it is evidenced in the total trial measure. The fact that most findings occur within sentence limits provides support for the eye tracking method employed in this study. First, total reading times for the sentences are not different among participants in the group; however, high-ability learners processed differently than low-ability ones. Additionally, some findings were revealed in regression path and total fixation measures, which distinguish themselves from the first pass measure in being indicators of less immediate processing behaviour. Furthermore, this method revealed that more highly entrenched (in the L1) non-target L2 structures were detected later, as effects showed up in the spillover regions, while lower-frequency or inexistent structures were detected immediately, as evidenced by results of first pass measures and in the critical regions. The eye tracking method, therefore, proved to be fundamental in understanding how L2 learners process word order involving low-saliency cues, like the Spanish clitic pronouns, during online reading comprehension, by providing measures that other methods cannot.

In the first chapter, the Spanish clitic pronoun system was contrasted with the English one and it was shown that the two differ considerably in terms of inventory and behaviour. Because the Spanish system is complex, specifically with regards to (the meaning of) dative constructions, placement of pronouns with respect to verb finiteness, and structures that display clitic doubling, and clitic left dislocation, the present investigation narrowed its scope in looking uniquely at past tense structures that contained one finite verb and one clitic. The only manipulated feature was clitic placement, and thus number and gender features were always congruent with the antecedent. This allowed us to draw specific conclusions with respect to how Spanish clitics are processed by low-proficiency L2 learners when they occupy the object position in the structures and thus represent interfering L1 syntax.

Previous research in Spanish L2 clitic processing and acquisition has shown that learners display variability, such that clitics may be perceived as both words and affix-like elements (Liceras, 1984). In addition, it has been found that, while clitics are low-saliency cues which may be easily overlooked during L2 processing, when learners do perceive them they make use of L1 word order strategies in their comprehension and production (see Klee, 1989 and VanPatten, 1984), which may lead to non-target interpretation. Importantly, the literature has also shown that more advanced learners may indeed use clitics to abstract grammatical regularities of gender, number and animacy, and extend these to new constructions during schema creation (see Zyzik, 2006a and 2006b), and that they are able to display some knowledge of clitic placement despite interfering L1 properties (e.g., Duffield, Montrul, Bruhn de Garavito, & White, 1998). These findings point to an unstable L2 system with regards to constructions containing clitic pronouns, either due to their position in the path of developmental sequences, L1 influence or interference from other L2 verbal structures that provide confounding input. The present study adds crucial information to what we know about the L2 processing and acquisition of Spanish clitic pronouns, in revealing that higher abilities in WM and EF prove to be advantageous in mitigating L1 interference from constructions with strong pronouns that display a reverse word order. In addition, we showed that low-proficiency learners with higher abilities are sensitive to input and use their additional cognitive resources to more carefully attend to clitic constructions when the input is conflicting and, thus, unreliable.

These findings have important implications for research in SLA. In their review on studies of individual differences in the acquisition of second languages, Dörnyei and Skehan (2003) observe that, after a period of relative disinterest in the topic, research in individual differences has begun gaining popularity again. The authors make a strong case for the contributions this area of investigation makes to our understanding of learner variability in L2 processing and acquisition. The present investigation has indeed shown that individual differences in cognitive abilities such as WM and EF lead to significant differences in processing among a group of learners that share the same level of proficiency. We thus echo Dörnyei and Skehan's judgment and advocate for continued research in the effect of individual differences in L2 processing and development.

The findings in this study are preliminary and certainly, additional research is needed to corroborate the results, and to further investigate whether and how VS affects L2 processing (of Spanish clitics). Nevertheless, we have provided strong evidence for two notions. First, individual differences in cognitive abilities predict differences in how L2 learners process morphosyntactic phenomena during reading. Second, contrary to common assumptions in L2 processing literature, longer reading times are not always and uniquely indicative of processing difficulty. Researchers must therefore be careful when comparing L1 and L2 processing patterns. Due to differences in L2 levels of entrenchment, L2 learners may not always display inferior knowledge during processing; they may actually invest their cognitive resources differently than native speakers.

APPENDIX A
FOREIGN LANGUAGE BACKGROUND FORM

Study: ___________   Participant Code:____________
Group:____________

- Gender: ☐ Male ☐ Female
- Age: ☐☐
- Your current rank at UF is (circle one, if applicable):
  Freshman   Sophomore   Junior   Senior   Graduate
- When writing, I am…   Right-handed   Left-handed
- Do you need some visual aids when reading from a computer screen or a printed material (circle one)?
  No   Yes, I need contact lenses   Yes, I need glasses
- Do you have any known learning disabilities (circle all that apply)?
  - ☐ None
  - ☐ Dyslexia
  - ☐ Dysgraphia
  - ☐ Auditory and/or processing disorders
  - ☐ ADHD (attention deficit/hyperactivity disorder)
  - ☐ Other. Please, specify ____
- What is your native(s) language(s)?
  ____
- Have you ever studied Spanish in a formal instruction setting before entering the University of Florida?
  ☐ Yes ☐ No
  - If yes: Where? ____
    For how many years? ________________________________
- Do you usually socialize with anyone outside the class (friends or family members) who only speaks Spanish with you?
  ☐ Yes ☐ No
  - If yes: How often? ____
    Where do they live? ________________________________
- Have you lived in a Spanish-speaking country?

☐ Yes ☐ No

➢ If yes: Where? (country/s) ______________________________

For how many months/years? ___________________________

- After this class, do you have plans to continue studying Spanish (if applicable)?

  ☐ Yes ☐ No

- How would you rate your Spanish proficiency in the following skills (circle one option for each skill according to the scale):

	very poor	poor	low	average	good	advanc.	highly proficient
Spanish listening	1	2	3	4	5	6	7
Spanish reading	1	2	3	4	5	6	7
Spanish speaking	1	2	3	4	5	6	7
Spanish writing	1	2	3	4	5	6	7
Spanish vocabulary	1	2	3	4	5	6	7
Spanish grammar	1	2	3	4	5	6	7

- Thinking <u>only</u> about English <u>and</u> Spanish, what language(s) do you use the most in the following contexts (circle one for each context)?

At current home:	only Engl.	mostly Engl.	mostly Span.	only Span.
At school:	only Engl.	mostly Engl.	mostly Span.	only Span.
At work (if applicable):	only Engl.	mostly Engl.	mostly Span.	only Span.
With friends:	only Engl.	mostly Engl.	mostly Span.	only Span.
With family:	only Engl.	mostly Engl.	mostly Span.	only Span.

- Have you:

  Studied/worked in Spanish on a daily basis for the last 10 consecutive years?
  ☐ Yes ☐ No

  OR

  Been exposed to spoken and written Spanish and write/read/speak it on a daily basis for the last 10 consecutive years? ☐ Yes ☐ No

  ➢ If yes to either one:

  Where?____

  What kind of work/exposure to Spanish?

  ____

➢ If no: How long have you been studying/working in Spanish?

____

Did you stop for any period of time? ☐ Yes ☐ No

➢ If yes: For how long? _______________

- Are you studying any other languages? ☐ Yes ☐ No
  ➢ If yes: Which language(s)?

  ____

  What level are you studying? ____

- Are you fluent in any other languages besides English? ☐ Yes ☐ No
  ➢ If yes: Which language(s)?

  ____

  Are you fluent in (circle all that apply):

  Reading? Writing? Speaking? Listening comprehension?

APPENDIX B
STIMULI FOR EXPERIMENT 1

Table B-1. Stimuli for Experiment 1

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	Comp. Statement
1-ACC	La madre compró el helado en el supermercado.	El niño lo comió por la tarde porque tenía hambre.	El niño comió lo por la tarde porque tenía hambre.	El niño comió un tomate.
2-ACC	La doctora buscaba a su hijo en la clínica.	La enfermera lo encontró en el baño.	La enfermera encontró lo en el baño.	La doctora no podía encontrar a su hijo.
3-ACC	La profesora anunció la tarea por la tarde.	El estudiante la empezó inmediatamente porque era mucho trabajo.	El estudiante empezó la inmediatamente porque era mucho trabajo.	La profesora dio mucha tarea.
4-ACC	El señor perdió a su niña durante la fiesta.	La mamá la buscó por una hora pero no estaba en ninguna parte.	La mamá buscó la por una hora pero no estaba en ninguna parte.	La niña estaba en el baño.
5-ACC	El abuelo trajo unos libros a casa.	Su nieta los leyó en una semana porque eran muy buenos.	Su nieta leyó los en una semana porque eran muy buenos.	A la chica no le gustaron los libros.
6-ACC	El director pidió tres nuevos actores para la película.	La asistente los llamó inmediatamente porque debían filmar la película.	La asistente llamó los inmediatamente porque debían filmar la película.	El director quería tres actores.
7-ACC	El hombre mostró diez nuevas computadoras en su tienda.	El cliente las miró por mucho tiempo porque eran buenas.	El cliente miró las por mucho tiempo porque eran buenas.	Había sólo viejas computadoras en la tienda.

Table B-1. Continued

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	Comp. Statement
8-ACC	El padre alquiló dos películas para la semana.	La hija las vio en la misma noche porque tenía mucho tiempo libre.	La hija vio las en la misma noche porque tenía mucho tiempo libre.	La hija vio dos películas.
9-DAT	Toda la clase miró a la alumna que llegó tarde otra vez.	El profesor le habló seriamente después de la clase.	El profesor habló le seriamente después de la clase.	El profesor estaba contento.
10-DAT	El presentador anunció la nueva organización académica de la universidad.	Un miembro rico le dio mucho dinero para los programas de investigación.	Un miembro rico dio le mucho dinero para los programas de investigación.	La organización era de la universidad.
11-DAT	El amigo saludó al chico en su fiesta de cumpleaños.	Su tía le regaló un reloj azul de Batman que él quería.	Su tía regaló le un reloj azul de Batman que él quería.	El regalo era para la Navidad.
12-DAT	El senador inauguró un nuevo hospital porque había muchos enfermos en la ciudad.	Una señora rica le escribió un cheque para las camas.	Una señora rica escribió le un cheque para las camas.	El hospital era necesario para los enfermos.
13-DAT	La empleada vio a dos señoras en la tienda.	La muchacha les recomendó unas faldas coloradas para un baile.	La muchacha recomendó les unas faldas coloradas para un baile.	Las faldas eran para en trabajo.
14-DAT	La compañía abrió dos nuevas agencias de viaje en la ciudad.	Un representante les llevó algunas revistas de nuevos hoteles.	Un representante llevó les algunas revistas de nuevos hoteles.	Las agencias recibieron nuevas revistas.

Table B-1. Continued

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	Comp. Statement
15-DAT	El jefe llamó a los hermanos para una reunión.	Su papá les prestó su coche para ir a la oficina.	Su papá prestó les su coche para ir a la oficina.	Los hermanos tenían que ir a clase.
16-DAT	El cocinero preparó los huevos con una receta nueva.	Su asistente les añadió queso porque no teníán sabor.	Su asistente añadió les queso porque no teníán sabor.	El cocinero nunca concinó los huevos con esta receta.

APPENDIX C
STIMULI FOR EXPERIMENT 2

Table C-1. Stimuli for Experiment 2

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	PostAux Condition	Comp. Statement
1-ACC	La clase tiene un proyecto final para el curso.	El estudiante lo ha hecho bien según el profesor.	El estudiante ha hecho lo bien según el profesor.	El estudiante ha lo hecho bien según el profesor.	El profesor no piensa que el proyecto sea bueno.
2-ACC	El cliente no encuentra la cuchara en ninguna parte.	El camarero la ha traído a la mesa inmediatamente.	El camarero ha traído la a la mesa inmediatamente.	El camarero ha la traído a la mesa inmediatamente.	El cliente buscaba el tenedor.
3-ACC	La clase observa al chico durante la lección.	La profesora lo ha llamado tres veces sin respuesta.	La profesora ha llamado lo tres veces sin respuesta.	La profesora ha lo llamado tres veces sin respuesta.	El chico no responde a la profesora.
4-ACC	El grupo ve a la actriz famosa en la calle.	Una mujer la ha conocido ayer en un centro comercial.	Una mujer ha conocido la ayer en un centro comercial.	Una mujer ha la conocido ayer en un centro comercial.	La actriz estaba en el centro comercial.
5-ACC	La abuela quiere sus mejores platos para la fiesta.	Su nieta los ha puesto en la mesa ya.	Su nieta ha puesto los en la mesa ya.	Su nieta ha los puesto en la mesa ya.	Los platos están en la mesa.
6-ACC	El jugador quiere sus bananas antes del partido.	Su amigo las ha dejado en el coche.	Su amigo ha dejado las en el coche.	Su amigo ha las dejado en el coche.	Las bananas están en el autobús.

Table C-1. Continued

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	PostAux Condition	Comp. Statement
7-ACC	La mamá no ve a sus niños en el parque.	El papá los ha perdido entre los árboles.	El papá ha perdido los entre los árboles.	El papá ha los perdido entre los árboles.	La familia está en un supermercado.
8-ACC	El hotel tiene cuatro recepcionistas sólo en la tarde.	El hombre las ha visto toda la semana.	El hombre ha visto las toda la semana.	El hombre ha las visto toda la semana.	No hay cuatro recepcionistas en la mañana.
9-ACC	La chica necesita su pasaporte para el viaje.	Su hermanito lo ha botado en la basura.	Su hermanito ha botado lo en la basura.	Su hermanito ha lo botado en la basura.	El pasaporte está encima de una mesa.
10-DAT	El centro tiene un nuevo museo de arte local.	Una artista le ha vendido todas sus pinturas.	Una artista ha vendido le todas sus pinturas.	Una artista ha le vendido todas sus pinturas.	El museo tiene las pinturas del artista.
11-DAT	La organización tenía una constitución vieja.	El presidente le ha añadido artículos nuevos.	El presidente ha añadido le artículos nuevos.	El presidente ha le añadido artículos nuevos.	La organización necesitaba una nueva constitución.
12-DAT	La mujer siempre ve al hombre irresponsable en el coche rojo.	El policía le ha dado una multa esta mañana.	El policía ha dado le una multa esta mañana.	El policía ha le dado una multa esta mañana.	El hombre es muy prudente.

Table C-1. Continued

Item Num.-Case	Referent Sentence	PreV Condition	PostV Condition	PostAux Condition	Comp. Statement
13-DAT	Nadie ve a la mujer en su fiesta de cumpleaños.	Su esposo le ha escrito un email hace un rato.	Su esposo ha escrito le un email hace un rato.	Su esposo ha le escrito un email hace un rato.	La mujer está en la fiesta.
14-DAT	La secretaria ha mencionado tres países pobres en África.	La institución les ha llevado pastillas.	La institución ha llevado les pastillas.	La institución ha les llevado pastillas.	Los países son ricos.
15-DAT	El mundo tiene algunas monarquías todavía.	La gente les ha mostrado mucho respeto en los últimos años.	La gente ha mostrado les mucho respeto en los últimos años.	La gente ha les mostrado mucho respeto en los últimos años.	No existen monarquías en el mundo.
16-DAT	El chico no encuentra a sus tíos en el aeropuerto.	Su hermana les ha mandado un mensaje en el teléfono celular.	Su hermana ha mandado les un mensaje en el teléfono celular.	Su hermana ha les mandado un mensaje en el teléfono celular.	El chico está en el aeropuerto.
17-DAT	La recepcionista busca a las enfermeras en el comedor.	El doctor les ha comprado flores para su aniversario.	El doctor ha comprado les flores para su aniversario.	El doctor ha les comprado flores para su aniversario.	Es el aniversario de las enfermeras.
18-DAT	La agencia ha invitado al turista a una excursión.	El guía le ha enseñado un castillo medieval.	El guía ha enseñado le un castillo medieval.	El guía ha le enseñado un castillo medieval.	El turista ha visto una iglesia.

APPENDIX D
FILLER ITEMS

Table D-1. Filler items

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
1-Grammatical	Luisa no ha llegado a tiempo al trabajo esta semana.	El despertador de su esposo Pablo no funciona.	Luisa no está usando el despertador de Pablo.
2-Grammatical	Pedro vive en el sexto piso de su edificio.	Durante el verano él tiene que abrir la ventana por el calor.	Pedro no vive en la planta baja.
3-Grammatical	Elena no estaba muy contenta con su esposo.	David quería dormir hasta el mediodía los sábados.	David hacía muchas actividades los sábados por la mañana.
4-Grammatical	Lola es una mujer con mucha energía que no toma café.	Prefiere hacer ejercicio para comenzar su día.	Lola no bebe café por la mañana.
5-Grammatical	Alfonso y Paula tenían que ir a una fiesta de cumpleaños.	Alfonso decidió comer algo antes de ir a la fiesta.	Alfonso y Paula iban a ir a una boda.
6-Grammatical	La clase de biología hizo planes para ir al partido de fútbol americano.	Marisol fue al partido con su prima.	Marisol vio el partido de fútbol americano.
7-Grammatical	Cecilia sabe tocar muy bien la guitarra y la trompeta.	Ella quiere aprender a tocar otro instrumento.	Cecilia quiere aprender a tocar la guitarra.
8-Grammatical	Fernando y su familia viven en un lugar con muchos insectos.	Fernando siempre lava los platos.	Fernando quiere una cocina limpia.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
9-Grammatical	Los compañeros de cuarto han decidido dividir los quehaceres.	Alex va a preparar la comida todos los martes.	Alex va a limpiar el baño.
10-Grammatical	El mes pasado Julia fue al doctor porque tenía muchos dolores de cabeza.	Ahora ella duerme diez horas cada noche.	Julia no estaba bien antes de su visita.
11-Grammatical	Jorge fue al mercado para comprar mariscos para la cena del sábado.	La gente del mercado fue muy amable.	Jorge quería jamón.
12-Grammatical	El grupo de turistas tenía cinco horas de tiempo libre en la tarde.	Guadalupe y Miguel tomaron un café en la plaza.	Miguel estuvo en la plaza.
13-Grammatical	Los jóvenes hicieron planes para un viaje a Europa.	Susana y Mirta van a dormir en un hotel barato.	Susana y Mirta van a ir a Brasil.
14-Grammatical	Felipe y Eduardo querían ver el partido de básquetbol pero Felipe no quería salir.	Él vio el partido en la televisión.	Felipe miró el partido.
15-Grammatical	Berta tuvo que ir a la sala de urgencias inmediatamente después de clase.	Su prima tenía dolor de garganta y estómago.	Berta estaba enferma.
16-Grammatical	Isabel está limpiando la casa para la celebración de esta noche.	Su madre ha preparado tapas para cincuenta personas.	Hay mucha comida en casa de Isabel.
17-Grammatical	El viernes empiezan las vacaciones de primavera.	Es dudoso que Beatriz estudie este fin de semana.	Es verano.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
18-Grammatical	Nicolás dice que su esposa Lola está embarazada.	Es increíble que ella coma galletas con tomates.	Nicolás va a ser padre.
19-Grammatical	El gobierno recomienda muchas cosas para salvar la naturaleza.	Es bueno que la gente no bote basura en los ríos.	El gobierno no habla de la naturaleza.
20-Grammatical	Son las once de la noche y los padres están enojados.	Los niños todavía están viendo la televisión en la sala.	Según los padres los niños deben dormir.
21-Grammatical	Guillermo y su hermano estudian en condiciones diferentes.	Guillermo puede hacer su tarea con música fuerte.	Guillermo necesita silencio para estudiar.
22-Grammatical	Manuela estudia arquiterctura en la Universidad de Florida.	Ella conoce bien la arquitectura de Barcelona.	Manuela estudia en los Estados Unidos.
23-Grammatical	Esta tarde Ana tiene una cita con el director del banco nacional.	Ella necesita dinero para pagar una cuenta.	Ana tiene el dinero para pagar su cuenta.
24-Grammatical	Los alumnos de Perú estaban muy felices de su viaje a Nueva York.	Carolina vio una exposición de arte ayer.	Carolina estaba en Nueva York ayer.
25-Grammatical	Mateo encontró un nuevo trabajo en IBM.	Después de un mes él gastó mucho en una nueva motocicleta.	Mateo compró un nuevo coche.
26-Grammatical	Sofia dedica mucho tiempo al trabajo de voluntario.	Los domingos ella visita una residencia de ancianos.	Sofia visita a los viejos durante el fin de semana.
27-Grammatical	La semana pasada Débora encontró a Teresa llorando.	Teresa tiene que buscar una profesión sin estrés.	Teresa está muy contenta con su trabajo.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
28-Grammatical	Después de diez años Daniel y Mónica se van a celebrar su boda.	Elena compró un vestido elegante para el aniversario.	Daniel es el esposo de Mónica.
29-Grammatical	La clase de ecología paticipó en una competición.	Ricardo y sus amigos ganaron el primer lugar por limpiar el lago.	Ricardo limpió un río.
30-Grammatical	La presidenta creó un proyecto para proteger el medio ambiente.	El proyecto no va a tener éxito sin el apoyo del gobierno.	El proyecto va a ayudar al medio ambiente.
31-Grammatical	El profesor Ochoa ha encontrado trabajo en la Universidad de Wyoming.	Su esposa no quiere vivir en las montañas.	El profesor Ochoa no ha buscado trabajo.
32-Grammatical	El famoso actor comía en el restaurante El Vino Blanco los sábados.	Él siempre dejaba una buena propina en la mesa.	Mucha gente conocía al actor.
33-Grammatical	Manuela y sus amigas van a salir con dos compañeros de clase.	Ellas nunca han ido a un parque de atracciones.	Manuela va al museo.
34-Grammatical	Los jóvenes de la iglesia hablan de sus pasatiempos.	Antonio y su hermana coleccionan tarjetas postales.	Antonio tiene un pasatiempo.
35-Grammatical	Estefanía estaba buscando a su hermanita por toda la casa.	Juana estaba jugando en el baño con un amiguito.	La hermanita estaba en su cuarto.
36-Grammatical	Julián está explorando los grupos de música local en su nueva ciudad.	Él fue a un concierto hace tres semanas.	Julián vive en un lugar nuevo.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
37-Grammatical	La clase de literatura tenía que leer un libro durante las vacaciones.	Marina leyó un libro de su autor favorito.	Marina leyó el libro para la clase de periodismo.
38-Grammatical	Marisol y Tomás van a ir a California para la Navidad.	Tomás ha reservado los boletos para Los Ángeles.	Marisol y Tomás van a viajar en dicimebre.
39-Grammatical	El presidente quería celebrar el aniversario de la compañía.	Miguel llevó unos pantalones negros a la cena.	La celebración era para el cumpleaños del presidente.
40-Grammatical	Gregorio es un nuevo estudiante en la universidad.	Sus clases más difíciles son matemáticas y negocios.	Gregorio tiene clases díficiles este semestre.
41-Ungrammatical	Chris va a salir con unos amigos nuevos mañana.	Ellos conocen los mejor restaurantes de la ciudad.	Hace mucho tiempo que Chris conoce a sus amigos.
42-Ungrammatical	Todos los fines de semana los chicos salen a bailar.	Tim va a llevar una camiseta azules esta noche.	Tim va a bailar esta noche.
43-Ungrammatical	La familia tenía que ir a la playa hoy.	Jorge y Julia está tristes porque llueve afuera.	Jorge y Julia iban a ir al museo hoy.
44-Ungrammatical	Cuando era niña los hermanos de Victoria hacían mucho ruido en casa.	La chica iban a la biblioteca todos los días.	Victoria no podía estudiar en casa.
45-Ungrammatical	Mario y Pepe no tienen tiempo para almorzar hoy.	Pepe ha comprado unas manzana para comer en clase.	Mario y Pepe van a almorzar en un restaurante.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
46-Ungrammatical	El profesor de inglés da muchísima lectura.	Pablo necesita leer dos libro para la clase de mañana.	Pablo tiene que leer para la clase de inglés.
47-Ungrammatical	Esta es una foto de las chicas del equipo de fútbol.	La chica más alta es las hermana mayor de Eduardo.	La hermana de Eduardo no está en el equipo.
48-Ungrammatical	Alejandro y Ana desayunan juntos todos los días.	Los amigos pidieron el huevos picantes esta mañana.	Alejandro y Ana pidieron la misma comida.
49-Ungrammatical	De todos los actores famosos en el mundo Tina prefiere Brad Pitt.	Ella cree que esos actor es fantástico.	Tina cree que Brad Pitt no es un buen actor.
50-Ungrammatical	Maribel y Sandra siempre escuchan la música de salsa.	Ellas dicen que esta canciones son muy apasionadas.	La chicas piensan que la salsa es emocionante.
51-Ungrammatical	La señora Álvarez tiene una familia grande con cinco hijos.	Amanda es una niña muy simpático y paciente.	La señora Álvarez tiene dos hijos.
52-Ungrammatical	Sandra y su novio fueron al centro comercial.	Él vio unas sandalias cómodos en la tienda de deportes.	Las sandalias estaban en el centro comercial.
53-Ungrammatical	Los chicos estaban muy emocionados por la fiesta de gradución.	Ricardo condujo el coche nueva de su padre anoche.	Ricardo compró un coche para la graduación.
54-Ungrammatical	Yolanda y su familia cenan en un restaurante todos los sábados.	Ella prefiere comer las papas fritos esta noche.	Yolanda está cenando con su familia.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
55-Ungrammatical	La profesora González necesitaba algo para escribir el número de teléfono.	Mario tenía una bolígrafo en su mochila.	Mario encontró un lápiz.
56-Ungrammatical	Todas las semanas los amigos salen para ir al cine del centro.	Ana prefiere ver los películas de acción.	Ana y sus amigos van al centro para ver la película.
57-Ungrammatical	Los amigos hablan sobre la familia que tienen en otros países.	Jorge tiene una primo y unos tíos en España.	Jorge tiene unos tíos en Ecuador.
58-Ungrammatical	Juan y Pepa no pueden comprar la casa nueva que quieren.	Ellos tienen poca dinero en el banco.	La casa es cara para Juan y Pepa.
59-Ungrammatical	Gloria vio su tienda de ropa favorita en la calle Universidad.	Ella dobló en ese calle para estacionar el coche.	Gloria no estaba manejando.
60-Ungrammatical	El señor Díaz está con su hija en el supermercado.	La niña quiere comer estos galletas con leche.	El padre y la niña están en el supermercado.
61-Ungrammatical	Los diputados están llamando a mucha gente importante.	Ellos necesitan un avión por el dictador.	El dictador quiere viajar por tren.
62-Ungrammatical	Este semestre Martina decidió estudiar la política.	Durante el curso compartió sus ideas a mucha gente.	Martina tiene opiniones sobre la política.
63-Ungrammatical	Nina tiene náusea y dolor de cabeza, estómago y garganta.	No puede salir la casa esta semana.	Nina no está enferma.

Table D-1. Continued

Item Num.-Grammaticality	Context Sentence	Main Sentence	Comp. Statement
64-Ungrammatical	Paula necesita ayuda en la cocina pero su compañero de cuarto está ocupado.	Martín está hablando en el teléfono.	Martín no puede ayudar a Paula.
65-Ungrammatical	Los chicos miraron la televisión todo el fin de semana.	Rafael vio un programa en su actor favorito.	Rafael no miró la televisión durante el fin de semana.
66-Ungrammatical	Los padres han preparado la cena pero no saben dónde están sus hijos.	Ángela y Luis están visitando con sus amigos.	Los hijos no están en casa.
67-Ungrammatical	Samuel está en el hospital con una herida en el brazo.	Verónica está esperando por su novio en una sala.	Samuel es el primo de Verónica.
68-Ungrammatical	Carlos nunca escucha a su novia cuando ella habla.	En este momento él está pensando sobre su futuro.	Carlos no está escuchando a su novia.
69-Ungrammatical	Todas las personas estaban en la plaza para escuchar al alcalde.	Él habló para más de media hora.	La gente estaba en la calle.
70-Ungrammatical	Los paparazzi sacaron muchas fotos para las revistas.	El presidente comió a su restaurante favorito ayer.	Los paparazzi sacaron fotos del presidente.
71-Ungrammatical	El grupo de amigos hablaba sobre las vacaciones del año pasado.	Juan iba a Costa Rica con su familia.	Los amigos hablaban de las vacaciones de este año.
72-Ungrammatical	Después de una semana difícil Luis decidió descansar en el sofá.	Mientras él miró la televisión alguien llamó.	Luis tuvo una semana dura.

Table D-1. Continued

Item Num.- Grammaticality	Context Sentence	Main Sentence	Comp. Statement
73- Ungrammatical	Los hermanos fueron a la recepción de la graducación anoche.	Sara y Manolo pedían la carne de res.	Sara y Manolo son novios.
74- Ungrammatical	Todas las noches los niños hacían su tarea para las clases.	Ellos normalmente estudiaron después de la cena.	Los niños hacían la tarea después de comer.
75- Ungrammatical	En el picnic de ayer todos trajeron algo de beber: refrescos, jugo y vino.	Los dos primos bebían todo el jugo.	No había vino en el picnic.
76- Ungrammatical	Los bosques tienen mucha contaminación.	Es importante que los jóvenes respetan la naturaleza.	Los jóvenes no deben botar basura en el bosque.
77- Ungrammatical	Mañana la familia va a la montaña pero hoy está nublado.	Es posible que ellos pueden evitar la nieve si salen esta noche.	La familia va a la playa.
78- Ungrammatical	Paco recibió los resultados de su análisis de sangre y tiene diabetes.	Es mejor que no come tanto chocolate.	Paco no debe comer dulces.
79- Ungrammatical	Mariela bota todo en la basura.	Es preferible que ella recicla el vidrio, el papel y el aluminio para salvar la naturaleza.	Mariela hace mucho reciclaje.
80- Ungrammatical	El gobierno ha hecho muchos planes menos uno.	Es necesario que protege los animales en peligro de extinción.	El gobierno no está protegendo a los animales.

APPENDIX E
SAMPLE ITEMS FROM THE PROFICIENCY TEST[1]

Instructions and sample items of Part 1

Instrucciones: Cada una de las siguientes oraciones contiene un espacio en blanco ___ indicando que se omitió una palabra o una frase. De las cuatro opciones dadas, elija la mejor opción para completar la oración.

23. Permaneció un gran rato abstraído, los ojos clavados en el fogón y el pensamiento _____ . a. en el bolsillo b. en el fuego c. lleno de alboroto d. Dios sabe dónde	**24**. En vez de dirigir el tráfico estabas charlando, así que tú mismo _____ del choque. a. sabes la gravedad b. eres testigo c. tuviste la culpa d. conociste a las víctimas

Instructions and sample items of Part 2

Instrucciones: El cuento *El sueño de Juan Miró* contiene varios espacios en blanco. Primero, lea el cuento entero para entenderlo. Después, léalo de nuevo escogiendo la palabra correcta para cada espacio en blanco de la lista de palabras abajo. Trace un círculo alrededor de la palabra correcta.

Estos talleres también se cederán periódicamente a distintos artistas contemporáneos, __________ (15) se busca que el "Territorio Miró" _________ (16) un centro vivo de creación y difusión del arte a todos los __________ (17).

15. a. ya que	16. a. será	17. a. casos
b. así	b. sea	b. aspectos
c. para	c. es	c. niveles

[1] See White, Valenzuela and Kozlowska-MacGregor & Leung (2004) and Slabakova, Kempchinsky and Rothman (2012).

APPENDIX F
SAMPLE ITEMS FROM THE WORKING MEMORY TASKS

Digit Span Forward: sets of 7 digits

5	8	1	7	4	2	9
3	1	6	9	2	8	5

Digit Span Backward: sets of 7 digits[1]

8	1	2	9	3	6	5
4	7	3	9	1	2	8

Digit Ordering: sets of seven digits[2]

4 – 10 – 3 – 7 – 2 – 5 – 1

6 – 1 – 4 – 8 – 10 – 3 – 5

3 – 9 – 4 – 2 – 5 – 10 – 7

8 – 1 – 7 – 5 – 3 – 4 – 9

[1] The digit span forward and digit span backward are from the Wechsler Memory Scale (Wechsler, 1987).

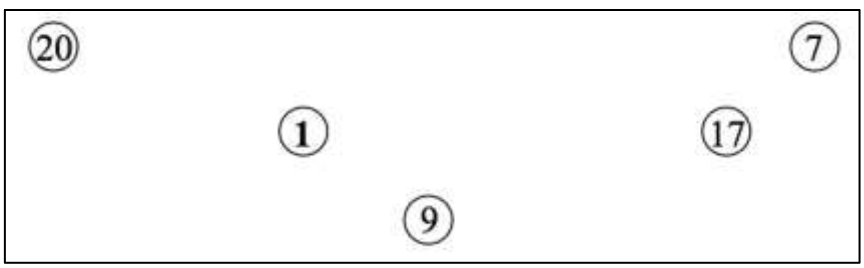
[2] See Hoppe et al. (2000) and Werheid et al. (2002).

APPENDIX G
SAMPLE ITEMS FROM THE EXECUTIVE FUNCTION TASKS

Stroop Color Xs		Stroop Color Words	
XXXXX	XXXXX	GREEN	GREEN
XXXXX	XXXXX	BLUE	RED
XXXXX	XXXXX	GREEN	BLUE
XXXXX	XXXXX	RED	GREEN

Figure G-1. Sample items from the Stroop Color Xs and Stroop Color Words test[1]

Trails Making A



Trails Making B

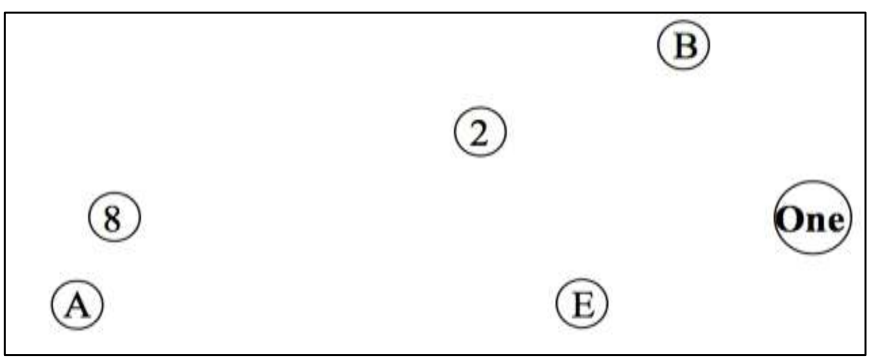


Figure G-2. Sample items from the Trails Making A and B test[2]

---

[1] See Rinne et al. (2000).

[2] See Spreen and Strauss (1998).

DSST

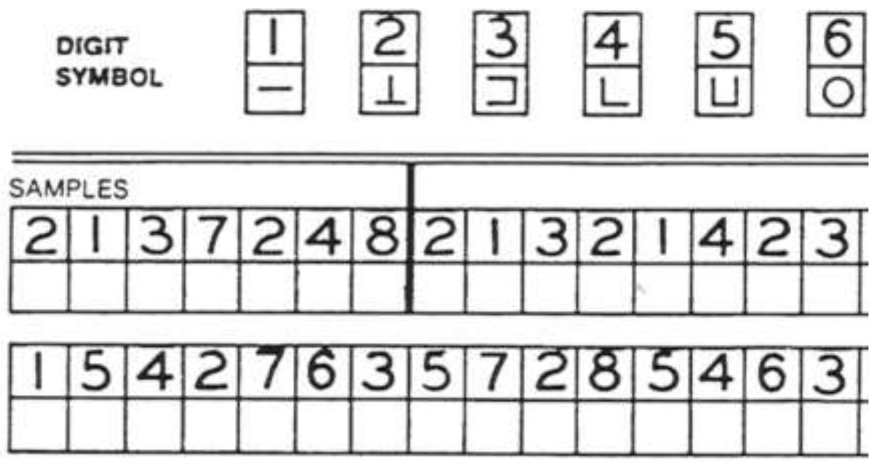


Figure G-3. Sample items from the DSST[3]

[3] See Lezak, Howieson, Loring, Hannay, & Fischer (2004).

APPENDIX H

VOCABULARY SIZE TEST INTERFACE[1]

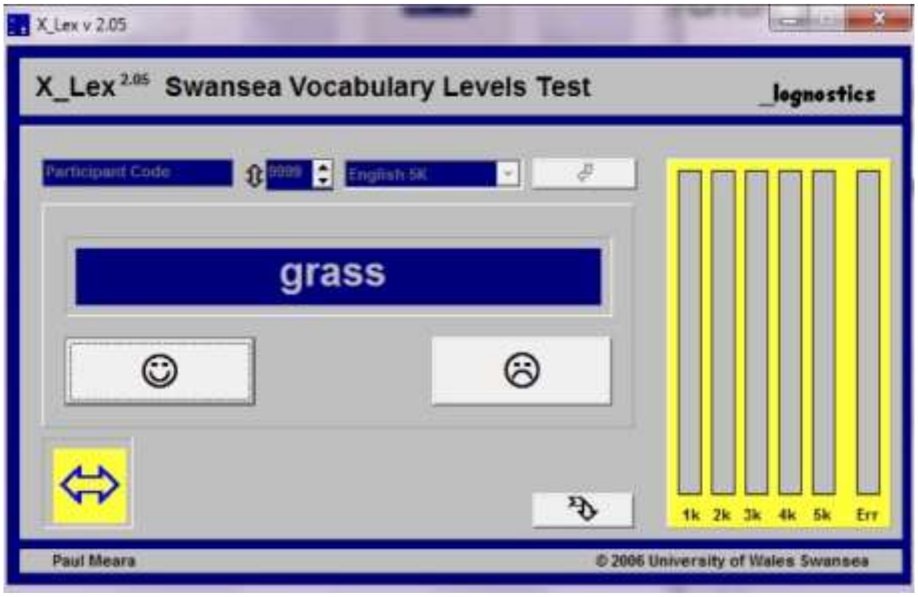


Figure H-1. Vocabulary size test interface

[1] Test may be downloaded at: http://www.lognostics.co.uk/tools/index.htm

APPENDIX I
INFORMED CONSENT FORM

University of Florida
Consent to Act as a Research Subject

As a member of the University of Florida community, you are being asked to participate in a research study of language performance, conducted in the Language & Cognition laboratory under the direction of Dr. Wind Cowles. If you agree to participate, then you will read sentences on a computer screen and be asked to answer a comprehension question based on each sentence while the movement of your eyes is monitored and their position recorded. In addition, you will look at a set of drawings on a computer screen and be asked to complete a sentence based on what is occurring in the drawings. The experiment should take two hours or less.

There are no known risks involved in this experiment, apart from those involved in everyday life. If you were recruited from the LIN-SLHS Participant pool, you will receive one half-hour of course credit for each 30 minutes of participation (rounded up). If you were recruited from a Spanish class offered by the Spanish and Portuguese Studies department, you will be given the option of adding one point to your lowest test grade or replace a 0 on a homework assignment.

There will be no direct benefit to you for participating in this experiment (apart from the educational experience), although the experiment should help the scientific community and the public at large to gain an increased understanding of the human ability to use language.

Participation in this research is entirely voluntary. You may refuse to participate or withdraw at any time without any penalty. You do not have to answer any question you do not wish to answer. The data that are collected are kept confidential; only lab personnel will have direct access to data from individual participants in this study. No data is stored with personally identifying information. Your identity will be kept confidential to the extent provided by law.

If you have any questions or research-related concerns about this study, you can reach Maria Fionda at (352) 872-8164, or at mfion@ufl.edu. Questions or concerns about research participants' rights may also be addressed to the UF IRB office, Box 112250, University of Florida, Gainesville FL 32611-2250.

The experimenter has explained this study to you and answered your questions. You agree to participate in the procedure and have received a copy of this consent document to keep.

________________________ ______________________ ______________

Subject's signature Witness Date

APPENDIX J
INSTRUCTIONS FOR THE EYE TRACKING EXPERIMENT

In this experiment you will be asked to read 114 short passages in Spanish. Read each passage as you would normally read a book or newspaper article. Once you have read the passage, you will press a button and be asked to answer a "Cierto o Falso" (True or False) statement about it.

Each passage will work like this:

First, you will see “¿Listo?” (Ready?) on the screen. When you are ready, press the right shoulder button on the control.

Next, the passage will appear in the middle of the screen. Read this passage and press the right button again when you are finished.

Finally, the "Cierto o Falso" statement will appear in the middle of the screen. Read the statement and decide if it is "Cierto" (True) or "Falso" (False).

- If you think it is "Cierto" press the left shoulder button on the control.
- If you think it is "Falso" press the right shoulder button on the control.

That’s it! If you have any questions, please ask the experimenter now. Otherwise, let the experimenter know you are ready to start
You will have a chance to practice with a few sample passages before the experiment begins.

APPENDIX K
PROTOCOL

□ Arrive 15 minutes early to the lab to ensure all is functioning properly.

□ Have the participant sign in the green binder. Fill in participant sheet on hanging clipboards.

□ Place "Experiment in Progress" sign on the door.

□ Give 2 consent forms and the language background (LB) form on the clipboard to the participant. Have them read and sign both consent forms. They keep one, the other goes in the CL documents box. Make sure the LB is completed and file it in the CL documents box.

□ Production Experiment: Subject code: CLProdL_L#_P## (for learners; L# = List#), CLProd-B_L#_P## (for bilinguals). If necessary, have them use one of the other experiment rooms. Explain that they are to complete the sentences using the appropriate verbal form specified in the instructions.

□ Comprehension Experiment:

- On the main computer, hit t+enter to start EyeLink
- On the participant computer use EyeLinkII (with the password “Dfa15p,p.” to log in)
- Go to Shortcut to Experiments, then Maria
- Click on appropriate list
- Subject code: CLLL#P## (for learners; L# = List#), CLBL#P## (for bilinguals)
- Write this code along with the production codes on the IRB
- When the participant sits in the comfy chair, be sure to have the feet of the chair lined up with the tape on the ground
- Instruct the participant to read the instructions on the screen and about the controller
- Go to the calibration page on the main computer, and have the participant press the button once more
- Click image-remote to get the image on the participant’s screen
- Explain the eyetracker equipment and be sure to get feedback while adjusting – ie, is it too tight, too loose, uncomfortable, etc.
- Adjust the threshold using arrow keys. To calibrate, press “calibrate” on the main computer, then validate. Finally, “Accept” on the main computer

□ Spanish Vocabulary Test (X_Lex): on eye tracking computer

□ WM Tests:

- Digits Forward: Say the sets of numbers out loud and have the participant repeat them back. Stop when both lines in a set are mistaken by the participant.

- Digits Backward: Have the participant repeat the numbers in reverse order. Stop when both lines of a set are mistaken.
- Ordering: Explain the instructions with examples. Stop when the participant makes 2 orders at a given level. Levels are separated by bold lines.

□ Executive Function Tests:

- Stroop: Have the participant read the color of print out loud. Allot 45 seconds and record how far they get. Check off responses on own answer sheet as they go. There are two sides to the Stroop test.
- TrailsA: Have the participants connect the dots in numeric order from 1-25. Time how long it takes for them to complete. The participant may not lift his pen from the paper.
- TrailsB: Using numbers 1-13 and letters A-L, have the participant connect the dots in the order 1-A-2-B-3-C… and time how long they take to complete.

□ Speed of Processing Test:

- Digit-Symbol Substitution: Explain the instructions and have the participant fill in the samples. Time them for 90s to see much they can complete.

□ English Vocabulary Test (Shipley): It is not a timed test. Instruct the participant not to leave any blank.

□ Spanish Proficiency Test: pen and paper

□ Thank and dismiss the participant. Take the sign off the door, and record all your data. Save the computer data to three places: on the participant computer in the results folder of the respective list's folder, on the external hard drive located in the drawer closest to the eye tracking room, and on the large iMac in the main room in the MARIA folder-RESULTS in Documents, including the list number. On the iMac on the desktop go to Keys then Participants to log information. Note any comments or problems then check off in the log binder. Score the tests. Exit EyeLink completely and turn off the computers.

LIST OF REFERENCES

Acheson, D. J., & MacDonald, M. C. (2009). Twisting tongues and memories: Explorations of the relationship between language production and verbal working memory. *Journal of Memory and Language, 60*(3), 329-350.

Alameda, J.R., & Cuetos, F. (1995). *Diccionario de las unidades Lingüísticas del Castellano*. Oviedo: Servicio de publicaciones de la Universidad de Oviedo.

Almela, R. (2005). *Frecuencias del español: Diccionario y estudios léxicos y morfológicos*. Madrid: Universitas.

Anderson, S.R. (1993). Wackernagel's revenge: Clitics, morphology, and the syntax of second position. *Language, 69*(1), 68-98.

Anderson, S.R. (2005). *Aspects of the Theory of Clitics*. Oxford: Oxford University Press.

Anderson, S.R. (2008). The English group genitive is a special clitic. *English Linguistics, 25*(1), 1-20.

Anderson, R.C., & Freebody, P. (1981). Vocabulary knowledge. In J.T. Guthrie (Ed.), *Comprehension and teaching*: *Research Reviews*. (pp. 77-117). Newark, DE: International Reading Association.

Ardila, A. (2008). On the evolutionary origins of executive functions. *Brain and Cognition, 68*(1), 92-99.

Aron, A. R. (2008). Progress in executive-function research: From tasks to functions to regions to networks. *Current Directions in Psychological Science (Wiley-Blackwell), 17*(2), 124-129.

Baddeley, A. (2003a). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience, 4*(10), 829-839.

Baddeley, A. (2003b). Working memory and language: an overview. *Journal of Communication Disorders, 36*(3), 189-208.

Baddeley, A. (2010). Working memory. *Current Biology, 20*(4), R136-R140.

Baddeley, A. D., & Logie, R. H. (1999). Working memory: The multiple-component model. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 28-61). New York, NY: Cambridge University Press.

Badre, D., Poldrack, R.A., Paré -Blagoev, E.J., Insler, R.Z., & Wagner, A.D. (2005). Dissociable controlled retrieval and generalized selection mechanisms in ventrolateral prefrontal cortex. *Neuron, 47*, 907-918.

Bates, E., Devescovi, A., & Wulfeck, B. (2001). Psycholinguistics: A cross-language perspective. *Annual Review of Psychology, 52*, 369-396.

Bates, E., & Goodman, J.C. (1997). On the inseparability of grammar and the lexicon: evidence from acquisition, aphasia, and real-time processing. *Language and Cognitive Processes, 12*(5/6), 507-584.

Beckner, C., Blythe, R., Christianson, M.H., Croft, W., Ellis, N.C., Holland, J., Ke, J., Larsen-Freeman, D., & Schoenemann, T. (2009). Language is a complex adaptive system: Position Paper. *Language Learning, 59*(1), 1-26.

Bermúdez-Otero, R., & Payne, J. (2011). There are no special clitics. In A. Galani, G. Hicks, & G. Tsoulas (Eds.), *Morphology and its Interfaces*. Linguistik Aktuell/Linguistics Today, 178. Philadelphia, PA: John Benjamins.

Bialystok, E., Craik, F. I. M., & Luk, G. (2008). Lexical access in bilinguals: Effects of vocabulary size and executive control. *Journal of Neurolinguistics, 21*(6), 522-538.

Bialystok, E., & Feng, X. (2009). Language proficiency and executive control in proactive interference: Evidence from monolingual and bilingual children and adults. *Brain and Language, 109*(2-3), 93-100.

Biegler, K. A., Crowther, J. E., & Martin, R. C. (2008). Consequences of an inhibition deficit for word production and comprehension: Evidence from the semantic blocking paradigm. *Cognitive Neuropsychology, 25*(4), 493-527.

Brey-Vroman, R.W., Felix, S.W., & Ioup, G.L. (1988). The accessibility of universal grammar in adult language learning. *Second Language Research, 4*, 1-32.

Brooks, P. J., Kempe, V., & Sionov, A. (2006). The role of learner and input variables in learning inflectional morphology. *Applied Psycholinguistics, 27*(2), 185-209. Butt, J., & Benjamin, C. (2004). *A New reference Grammar of Modern Spanish* (4th ed). New York, NY: Oxford University Press.

Bybee, J. L. (2006). From usage to grammar: The mind's response to repetition. *Language, 82*(4), 711-733.

Butt, J., & Benjamin, C. (2004). *A New Reference Grammar of Modern Spanish* (4th ed.). New York, NY: McGraw-Hill.

Bybee, J. L. (2008). Usage-based grammar and second language acquisition. In N. C. Ellis & P. Robinson (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition.* (pp. 216-236). New York, NY: Routledge.

Bybee, J.L., & McLelland, J. (2005). Alternatives to the combinatorial paradigm of linguistic theory based on domain general principles of human cognition. The Linguistic Review, 22, 381-410.

Camps, J. (1998). *Attention to form and meaning in second language acquisition: object clitic pronouns in Spanish*. (Doctoral dissertation). Retrieved from ProQuest Dissertations. (UMI No. 9810258)

Carstairs, Andrew. (1981). *Notes on Affixes, Clitics, and Paradigms*. Bloomington, IN: Indiana University Linguistics Club.

Chambers, C.G., & Cooke, H. (2009). Lexical competition during second-language listening: Sentence context, but not proficiency, constrains interference from the native lexicon. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35*(4), 1029-1040.

Chaudron, C. (2003). Data collection in SLA research. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 762-828). Malden, MA US: Blackwell Publishing.

Clahsen, H., & Felser, C. (2006). How native-like is non-native language processing? *Trends in Cognitive Sciences, 10*(12), 564-570.

Clark, H.H. (1973). The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. *Journal of Verbal Learning and Verbal Behaviour, 12*, 335-359.

Conway, A. R. A., Kane, M. J., & Engle, R. W. (2003). Working memory capacity and its relation to general intelligence. [Review]. *Trends in Cognitive Sciences, 7*(12), 547-552.

Cowan, N. (1999). En embedded-processes model of working memory. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 62-101). New York, NY US: Cambridge University Press.

Croft, W. & Cruse, D.A. (2004). *Cognitive Linguistics*. New York, NY: Cambridge University Press.

Darcy, I., Mora, J. C. & Daidone, D. (2013). Phonological attention control, inhibition, and second language speech learning [PDF document]. Retrieved from http://www.iub.edu/~psyling/papers/Darcy_Mora_Daidone_NewSounds2013_Webversion.pdf

Denckla, M.B. (1996). A theory and model of executive function: A neuropsychological perspective. In G. Reid Lyon & N.A. Krasnegor (Eds.), *Attention, Memory, and Executive Function*. (pp. 263-278). Baltimore, MA: Paul H. Brookes Publishing Co.

Dixon, R. M. W. (2007). Clitics in English. *English Studies, 88*(5), 574-600.

Dörnyei, Z. & Skehan, P. (2003). Individual differences in second language learning. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 589-630). Malden, MA US: Blackwell Publishing.

Doughty, C. J. (2003). Instructed SLA: Constraints, compensation, and enhancement. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 256-310). Malden, MA US: Blackwell Publishing.

Duffield, N., Montrul, S., Garavito, J. B. d., & White, L. (1998). Determining L2 knowledge of Spanish clitics on-line and off-line. *Proceedings of the Annual Boston University Conference on Language Development*, *22*(1), 177-188.

Duffield, N., Prevost, P., & White, L. (1997). A psycholinguistic investigation of clitic placement in second language acquisition. *Proceedings of the Annual Boston University Conference on Language Development 21*(1), 148-159.

Duffield, N., & White, L. (1999). Assessing L2 knowledge of Spanish clitic placement: converging methodologies. *Second Language Research, 15*(2), 133-160.

Dussias, P. E. (2003). Syntactic ambiguity resolution in L2 learners: Some effects of bilinguality on L1 and L2 processing strategies. *Studies in Second Language Acquisition, 25*, 529-557.

Dussias, P.E., Valdés Kroff, J. R., Guzzardo Tamargo, R. E., & Gerfen, C. (2013). When gender and looking go hand in hand: Grammatical gender processing in L2 Spanish. *Studies in Second Language Acquisition, 35*, 353-387.

Dussias, P. E., & Piñar, P. (2010). Effects of reading span and plausibility in the reanalysis of *wh*-gaps by Chinese-English second language speakers. *Second Language Research, 26*(4), 443-472.

Dussias, P. E., & Sagarra, N. (2007). The effect of exposure on syntactic parsing in Spanish-English bilinguals. *Bilingualism: Language and Cognition, 10*(1), 101-116.

Ellis, N. C. (2003). Constructions, chunking, and connectionism: The emergence of second language structure. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 63-103). Malden, MA US: Blackwell Publishing.

Ellis, N. C. (2008a). The dynamics of second language emergence: Cycles of language use, language change, and language acquisition. *The Modern Language Journal, 92*(2), 232-249.

Ellis, N. C. (2008b). Usage-based and form-focused language acquisition: The associative learning of constructions, learned attention, and the limited L2 endsate. In N.C. Ellis & P. Robinson (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition*. (pp. 372-405). New York, NY: Routledge.

Ellis, N. C., & Cadierno, T. (2009). Constructing a Second Language: Introduction to the Special Section. *Annual Review of Cognitive Linguistics, 7*(1), 111-139.

Ellis, N. C., & Collins, L. (2009). Input and second language acquisition: The roles of frequency, form, and function. Introduction to the special issue. *Modern Language Journal, 93*(3), 329-335.

Ellis, N. C., & Larsen-Freeman, D. (2009). Constructing a second language: Analyses and computational simulations of the emergence of linguistic constructions from usage. *Language Learning, 59*(Suppl 1), 90-125.

Ellis, N. C., & Robinson, P. (2008). An introduction to cognitive linguistics, second language acquisition, and language instruction. In N.C. Ellis & P. Robinson (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition*. (pp. 3-24). New York, NY: Routledge.

Ellis, R. (1984). Formulaic speech in early classroom second language development. In J. Handsome, R. Orem & B. Taylor (Eds.), *On TESOL '83: The Question of Control*. (pp. 57-71). Washington, DC: TESOL.

Ericsson, K. A., & Delaney, P. F. (1999). Long-term working memory as an alternative to capacity models of working memory in everyday skilled performance. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 257-297). New York, NY US: Cambridge University Press.

Escudero, P., Hayes-Harb, R., & Mitterer, H. (2008). Novel second-language words and asymmetric lexical access. *Journal of Phonetics, 36*, 345-360.

Felser, C., Roberts, L., Marinis, T., & Gross, R. (2003). The processing of ambiguous sentences by first and second language learners of English. *Applied Psycholinguistics, 24*(3), 453-489.

Foucart, A., & Frenck-Mestre, C. (2012). Can late L2 learners acquire new grammatical features? Evidence from ERPs and eye-tracking. *Journal of Memory and Language, 66*, 226-248.

Freebody, P., & Anderson, R.C. (1983). Effects of vocabulary difficulty, text cohesion, and schema availability on reading comprehension. *Reading Research Quarterly, 18*(3), 277-294.

Gass, S. M. (2003). Input and interaction. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 224-255). Malden, MA US: Blackwell Publishing.

Gass, S. M., & Mackey, A. (2002). Frequency effects and second language acquisition: A complex picture? *Studies in Second Language Acquisition, 24*, 249-260. Retrieved from http://eprints.lancs.ac.uk/59843/1/S0272263102002097a.pdf

Gast, V. (2007). I gave it him — on the motivation of the 'alternative double object construction' in varieties of British English. *Functions of Language, 14*(1), 31-56.

Geeslin, K. L., & Gudmestad, A. (2010). An exploration of the range and frequency of occurrence of forms in potentially variable structures in second-language Spanish. *Studies in Second Language Acquisition, 32*, 433-463.

Gerlach, B. (2002). *Clitics between Syntax and Lexicon*. Linguistik Aktuell/Linguistics Today, 51. Philadelphia, PA: John Benjamins.

Gerwin, J. (2013). Give it me!: pronominal ditransitives in English dialects. *English Language and Linguistics, 17*(3), 445-463. doi:10.1017/S1360674313000117.

Gollan, T.H., Montoya, R.I., & Werner, G.A. (2002). Semantic and letter fluency in Spanish-English bilinguals. *Neuropsychology, 16*, 562-576.

Haiman, J. (1994). Ritualization and the development of language. In W. Pagliuca (Ed.), *Perspectives on Grammaticalization*. (pp. 3-28). Amsterdam: John Benjamins.

Harris, J. (1995). The morphology of Spanish clitics. In H. Campos (Ed.), *Evolution and Revolution in Linguistic Theory*. (pp. 168-197). Washington, DC: Georgetown University Press.

Havik, E., Roberts, L., van Hout, R., Schreuder, R., & Haverkort, M. (2009). Processing subject-object ambiguities in the L2: A self-paced reading study with German 2 learners of Dutch. *Language Learning, (59)*1, 73-112.

Hernandez, A. E., & Meschyan, G. (2006). Executive function is necessary to enhance lexical processing in a less proficient L2: Evidence from fMRI during picture naming. *Bilingualism: Language and Cognition, 9*(2), 177-188.

Holtzer, R., Goldin, Y., & Donovick, P.J. (2009). Extending the administration time of the letter fluency test increases sensitivity to cognitive status in aging. *Experimental Aging Research, 35*(3), 317-326.

Hopp, H. (2012). Grammatical gender in adult L2 acquisition: Relations between lexical and syntactic variability. *Second Language Research, 29*(1), 33-56.

Hoppe, C., Müller, U., Werheid, K., Thöne, A., & von Cramon, D. Y. (2000). Digit ordering test: Clinical, psychometric, and experimental evaluation of a verbal working memory test. *The Clinical Neuropsychologist, 14*(1), 38-55.

Hopper, P.J., & Traugott, E.C. (2008). *Grammaticalization*. Cambridge, UK: Cambridge University Press.

Im-Bolter, N., Johnson, J., & Pascual-Leone, J. (2006). Processing limitations in children with specific language impairment: The role of executive function. *Child Development, 77*(6), 1822-1841.

Imbo, I. & Vandierendonck, A. (2010). Instruction and load effects on high-skill and low-skill individuals: A study in the domain of mental arithmetic. *European Journal of Cognitive Psychology, 22*(6), 964-989.

Iverson, P., Kuhl, P. K., Akahane-Yamada, R., Diesch, E., Tohkura, Y., Kettermann, A., & Siebert, C. (2003). A perceptual interference account of acquisition difficulties for non-native phonemes. *Cognition, 87*, B47-B57.

Johnson, J.S. & Newport, E.L. (1991). Critical period effects on universal properties of language: The status of subjacency in the acquisition of a second language. *Cognition, 39*, 215-258.

Juffs, A. (2006). Working Memory, second language acquisition, and low-educated second language and literacy learners. In I. van de Craats, J. Kuvers & M. Young-Scholten (Eds.), *Low Educated Adult Second Language Learners and Literacy Acquisition.* LOT Occasional Papers. (pp. 89-105). Netherlands Graduate School of Linguistics.

Juffs, A., & Harrington, M. (1995). Parsing effects in L2 sentence processing: Subject and object asymmetries in *wh*-extraction. *Studies in Second Language Acquisition, 17*, 483-516.

Juffs, A., & Harrington, M. (1996). Garden path sentences and error data in second language processing. *Language Learning, 46*(2), 283-326.

Kamide, Y. (2008). Anticipatory processes in sentence processing. *Language and Linguistics Compass, 2*, 647-670.

Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The generality of working-memory capacity: A latent-variable approach to verbal and visuo-spatial memory span and reasoning. *Journal of Experimental Psychology. General, 133*, 189–217.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *Boston Naming Test.* Philadelphia: Lea & Febiger.

Kaushanskaya, M., & Marian, V. (2007). Bilingual language processing and interference in bilinguals: Evidence from eye tracking and picture naming. *Language Learning, 57*(1), 119-163.

Keating, G.D. (2009). Sensitivity to violations of gender and agreement in native and nonnative Spanish: An eye-movement investigation. *Language Learning, 59*(3), 503-535.

Kieras, D. E., Meyer, D. E., Mueller, S., & Seymour, T. (1999). Insights into working memory from the perspective of the EPIC architecture for modeling skilled perceptual-motor and cognitive human performance. In A. Miyake & P. Shah

(Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 183-223). New York, NY US: Cambridge University Press.

Kintsch, W., Healy, A.F., Hegarty, M., Pennington, B.F., & Salthouse, T.A. (1999). In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 412-441). New York, NY US: Cambridge University Press.

Klavans, J. L. (1985). The independence of syntax and phonology in cliticization. *Language, 61*(1), 95-120. Retrieved from http://babel.ucsc.edu/~hank/mrg.readings/klavans1985.pdf

Klee, C. A. (1989). The acquisition of clitic pronouns in the Spanish interlanguage of Peruvian Quechua speakers. *Hispania, 72*(2), 402-408.

Kohnert, K. J., Hernandez, A. E., & Bates, E. (1998). Bilingual performance on the Boston Naming Test: Preliminary norms in Spanish and English. *Brain and Language, 65*(3), 422-440.

Langacker, R.W. (1987a). *Foundations of Cognitive Grammar* (Vol. 1 Theoretical Prerequisites). Stanford: Stanford University Press.

Langacker, R.W. (1999). Assessing the cognitive linguistic enterprise. In T. Janssen & G. Redeker (Eds.), *Cognitive Linguistics: Foundations, Scope, and Methodology,* (pp. 13-59). Cognitive Linguistics Research Series 15. New York: Mouton de Gruyter.

Langacker, R. W. (2000). A dynamic usage-based model. In M. Barlow & S. Kemmer (Eds.), *Usage based models of language*. (pp. 1-63). Stanford, CA: CSLI Publications.

Langacker, R.W. (2008). *Cognitive Grammar. A Basic Introduction*. New York, NY: Oxford University Press.

Langacker, R. (2010). Cognitive Grammar. In D. Geeraerts & H. Cuyckens (Eds.), *The Oxford Handbook of Cognitive Linguistics*, (pp. 421-462). New York, NY: Oxford University Press.

Laufer, B. (1992). Reading in a foreign language: How does L2 lexical knowledge interact with the reader's general academic ability? *Journal of Research in Reading, 15*(2), 95-103.

Levin, B. & Rappaport Hovav, M. (1995). *Unaccusativity: At the Syntax-Lexical Semantics Interface*. Cambridge, MA: MIT Press.

Lezak, M.D., Howieson, D.B., Loring, D.W., Hannay, H.J., & Fischer, J.S. (2004). *Neuropsychological Assessment* (4^{th} ed.). New York, NY: Oxford University Press.

Liceras, J. M. (1985). The value of clitics in non-native Spanish. *Second Language Research, 1*(2), 151-168.

Lightbown, P. M., & Spada, N. (2013). *How Languages Are Learned* (4th ed.). Oxford: Oxford University Press.

Luo, L., Luk, G., & Bialystok, E. (2010). Effect of language proficiency and executive control on verbal fluency performance in bilinguals. *Cognition, 114*(1), 29-41.

Maldonado, R. (1993). Dynamic construals in Spanish. *Studi Italiani di Linguistica Teorica e Applicata, 22*(3), 531-566.

Maldonado, R. (1999). Espacios mentales y la interpretación del *se* impersonal. In F. Colombo Airoldi (Ed.), *El Centro de Lingüística Hispánica y la lengua española: Volumen conmemorativo del 30 aniversario de su fundación*, (pp. 205-227). Mexico City, Mexico: Instituto de Investigaciones Filológicas, UNAM.

Maldonado, R. (2002). Objective and subjective datives. *Cognitive Linguistics, 13*(1), 1-65.

Marian, V. & Spivey, M. (2003a). Bilingual and monolingual processing of competing lexical items. *Applied Psycholinguistics, 24*, 173-193.

Marian, V. & Spivey, M. (2003b). Competing activation in bilingual language processing: Within- and between-language competition. *Bilingualism: Language and Cognition, 6*(2), 97-115.

Marinis, T. (2003). Psycholinguistic techniques in second language acquisition research. *Second Language Research, 19*(2), 144-161.

Martin, R. C., & Allen, C. M. (2008). A disorder of executive function and its role in language processing. *Seminars in Speech and Language, 29*(3), 201-210.

Martin, R.C., Lesch, M.F., & Bartha, M.C. (1999). Independence of input and output phonology in word processing and short-term memory. *Journal of Memory and Language, 41*, 3-29.

Martin, R. C., Shelton, J. R., & Yaffee, L. S. (1994). Language processing and working memory: Neuropsychological evidence for separate phonological and semantic capacities. *Journal of Memory and Language, 33*(1), 83-111.

Martohardjono, G. & Gair, J. (1993). Apparent UG inaccessibility in second language acquisition: Misapplied principles in principles misapplications? In F.R. Eckman (Ed.), *Confluence: Linguistics, Second Language Acquisition and Speech Pathology*. (pp. 79-103). Amsterdam: John Benjamins.

Mazuka, R., Jincho, N., & Oishi, H. (2009). Development of executive control and language processing. *Language and Linguistics Compass, 3*(1), 59-89.

McDonald, J.L. (2006). Beyond the critical period: processing-based explanations for poor grammaticality judgment performance by late second language learners. *Journal of Memory and Language, 55*, 381-401.

Meara, P.M. X_Lex (Version 2.05) [Software]. Available from http://www.lognostics.co.uk/tools/index.htm

Meara, P.M. (1990). Some notes on the Eurocentres vocabulary tests. In J. Tommola (Ed.), *Foreign language comprehension and production*. (pp. 103-113). Turku: AFinLa Yearbook.

Miller, G. A. (1956). The magical number seven, plus or minus two. Some limits on our capacity for processing information. *Psychological Review, 101*(2), 343-352. Retrieved from http://www.psych.utoronto.ca/users/peterson/psy430s2001/Miller%20GA%20Magical%20Seven%20Psych%20Review%201955.pdf

Miyake, A., & Shah, P. (1999) Toward unified theories of working memory: Emerging general consensus, unresolved theoretical issues, and future research directions. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 442-481). New York, NY: Cambridge University Press.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49-100.

Montrul, S. (2010). How similar are adult second language learners and Spanish heritage speakers: Spanish clitics and word order. *Applied Psycholinguistics, 31*, 167-207.

Moreno, E.M., & Kutas, M. (2005). Processing semantic anomalies in two languages: an electrophysiological exploration in both languages of Spanish-English bilinguals. *Cognitive Brain Research, 22*, 205-220.

Muysken, P. (1981). Quechua Word Structure. In F. Heny (Ed.), *Binding and Filtering*. (pp. 279-327). Cambridge, MA: MIT Press.

Nishida, C. (1994). The Spanish reflexive clitic *se* as an aspectual marker. *Linguistics, 32*, 425-458.

Noyer, R. (2001). Clitic sequences in Nunggubuyu and PG convergence. *Natural Language and Linguistic Theory, 19,* 751-826. Retrieved from http://www.linguistics.ucla.edu/people/hayes/205/Readings/NoyerNungubuyu2001.pdf

Odlin, T. (2003). Cross-linguistic influence. In C.J. Doughty & F.J. Long (Eds.), *The Handbook of Second Language Acquisition* (pp. 436-486). Malden, MA: Blackwell Publishing.

Osterhout, L., McLaughlin, J., Pitkänen, I., Frenck-Mestre, C., & Molinaro, N. (2006). Novice learners, longitudinal designs, and event-related potentials: A means for exploring the neurocognition of second-language processing. *Language Learning, 46*(Suppl 1), 199-230.

Papadopoulou, D., & Clahsen, H. (2003). Parsing strategies in L1 and L2 sentence processing. *Studies in Second Language Acquisition, 25*, 501-528.

Penn, C., Frankel, T., Watermeyer, J., & Russell, N. (2010). Executive function and conversational strategies in bilingual aphasia. *Aphasiology, 24*(2), 288-308.

Perlmutter, D. M. (1971). *Deep and Surface Structure Constraints in Syntax*. New York: Holt, Reinhart & Winston.

Ravizza, S. M., & Carter, C. S. (2008). Shifting set about task switching: Behavioral and neural evidence for distinct forms of cognitive flexibility. *Neuropsychologia, 46*(12), 2924-2935.

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124*(3), 372-422.

Rayner, K., & Sereno, S.C. (1994). Eye movements in reading. Psycholinguistic Studies. In M.A. Gernsbacbacher (Ed.), *Handbook of Psycholinguistics*. (pp. 57-81). San Diego, CA: Academic Press.

Rell, A.B. (2005). *The Role of the First Language (L1) in the Second Language (L2) Classroom* (Doctoral dissertation). Retrieved from ProQuest Dissertations. (UMI No. 3175179)

Rinne, J. O., Portin, R., Ruottinen, H., Nurmi, E., Bergman, J., Haaparanta, M., & Solin, O. (2000). Cognitive impairment and the brain dopaminergic system in Parkinson disease: [^{18}F] Fluorodopa positron emission tomographic study. *Archives of Neurology, 57,* 470–475.

Robinson, P. (2003). Attention and memory during SLA. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 631-678). Malden, MA: Blackwell Publishing.

Robinson, P., & Ellis, N. C. (2008). Conclusion: Cognitive linguistics, second language acquisition and L2 instruction--Issues for research. In P. Robinson & N. C. Ellis (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition*. (pp. 489-545). New York, NY: Routledge.

Rodriguez-Fornells, A., van der Lugt, A., Rotte, M., Britti, B., Heinze, H-J., & Münte, T.F. (2005). Second language interferes with word production in fluent bilinguals: Brain potential and functional imaging evidence. *Journal of Cognitive Neuroscience, 17*(3), 422-433.

Rodriguez-Fornells, A., De Diego Balaguer, R., & Münte, T. F. (2006). Executive Control in Bilingual Language Processing. *Language Learning, 56*(Suppl 1), 133-190.

Rodríguez Prieto, J.P. (2009). *Verbal Morphology in Second Language Spanish Acquisition: The Roles of Declarative and Procedural Memory Systems*. (Unpublished doctoral dissertation). University of Florida, Gainesville, FL.

Salaberry, M. R. (1997). The role of input and output practice in second language acquisition. *Canadian Modern Language Review, 53*(2), 422-451.

Sánchez-Cubillo, I., Periáñez, J. A., Adrover-Roig, D., Rodríguez-Sánchez, J. M., Ríos-Lago, M., Tirapu, J., & Barceló, F. (2009). Construct validity of the Trail making Test: Role of task-switching, working memory, inhibition/interference control, and visuomotor abilities. *Journal of the International Neuropsychological Society, 15*, 438-450.

Schachter, J. (1989). Testing a proposed universal. In S. Gass & J. Schachter (Eds.), *Linguistic Perspectives on Second Language Acquisition*. (pp. 73-88). Cambridge, UK: Cambridge University Press.

Schachter, J. (1990). Grammaticality judgments: Why does anyone object to subject extraction? *Studies in Second Language Acquisition, 12*(4), 379-392.

Schneider, W. X. (1999). Visuo-spatial working memory, attention, and scene representation: A neurocognitive theory. *Psychological Research, 62*, 220-236.

Shah, P., & Miyake, A. (1996). The separability of working memory resources for spatial thinking and language processing: An individual differences approach. *Journal of Experimental Psychology: General, 125*(1), 4-27.

Shah, P., & Miyake, A. (1999). Models of working memory: An introduction. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control.* (pp. 375-411). New York, NY US: Cambridge University Press.

Slabakova, R, Kempchinsky, P., & Rothman, J. (2012). Clitic-doubled left dislocation and focus fronting in L2 Spanish: A case of successful acquisition at the syntax–discourse interface. *Second Language Research, 28*(3), 319-343.

Snodgrass, J.G., & Vanderwart, M. (1980). A standardized set of 260 pictures: nouns for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory, 6*(2), 174-215.

Spivey, M.J. & Marian, V. (1999). Cross talk between native and second languages: Partial activation of an irrelevant lexicon. *Psychological Science, 10*(3), 281-284.

Spreen, O., & Strauss, E. (Eds.). (1998). *A compendium of neuropsychological tests: Administration, norms, and commentary* (2nd ed.). New York: Oxford University Press.

Sturt, P. (2003). The time-course of the application of binding constraints in reference resolution. *Journal of Memory and Language, 48*, 542-562. Retrieved from http://ling.umd.edu/~ellenlau/courses/ling440/Sturt_2003.pdf

Suchy, Y. (2009). Executive functioning: Overview, assessment, and research Issues for non-neuropsychologists. *Annals of Behavioral Medicine, 37*(2), 106-116.

Sunderman, G., & Kroll, J.F. (2009). When study-abroad experience fails to deliver: The internal resources threshold effect. *Applied Psycholinguistics, 30*, 79-99.

Suñer, M. (1982). On null subjects. *Linguistic Analysis, 9*, 55-78.

Sylvester, C-Y.C., Wager, T.D., Lacey, S.C., Hernandez, L., Nichols, T.E., Smith, E.E., & Jonides, J. (2003). Switching attention and resolving interference: fMRI measures of executive functions. *Neuropsychologia, 41*, 357-370.

Taylor, J.R. Prototypes in cognitive linguistics. (2008). In N.C. Ellis & P. Robinson (Eds.), *Handbook of Cognitive Linguistics and Second Language Acquisition*. (pp. 39-65). New York, NY: Routledge.

Tesnière, L. (1959). *Élements de syntaxe structurale*. Paris: Klincksieck.

Turley, J.S. (1999). The creation of a grammaticalization chain: The Spanish decausative, passive, and indeterminate reflexive constructions. *Southwest Journal of Linguistics, 18*, 101-138.

Unsworth, N., Heitz, R., Schrock, J.C., & Engle, R.W. (2005). An automated version of the operation span task. *Behavior Research Methods, 37*(3), 498-505.

Van Berkum, J.J.A., Brown, C.M., Hagoort, P., & Zwitserlood, P. (2003). Event-related brain potentials reflect discourse-referential ambiguity in spoken language comprehension. *Psychophysiology, 40*, 235-248.

VanPatten, B. (1984). Learners' comprehension of clitic pronouns: More Evidence for a Word Order Strategy. *Hispanic Linguistics, 1*(1), 57-67.

VanPatten, B. (2007). Input processing in adult second language acquisition. In B. VanPatten & J. Williams (Eds.), *Theories in Second Language Acquisition: An Introduction*. (pp. 115-135). New York, NY: Routledge.

VanPatten, B., & Cadierno, T. (1993). Explicit instruction and input processing. *Studies in Second Language Acquisition, 15*, 225-241.

VanPatten, B., & Sanz, C. (1995). From input to output: Processing instruction and communicative tasks. In F. Eckman, D. Highland, P. Lee, J. Mileham, & R. Rutkowski (Eds.), *Second Language Acquisition: Theory and Pedagogy* (pp. 169-185.) Mahwah, NJ: Erlbaum.

Was, C.A. (2010). Individual differences in reading are more than just working memory: The case for available long-term memory. *Individual Differences Research, 8*(3), 132-139.

Weber, A. & Cutler, A. (2004). Lexical competition in non-native spoken-word recognition. *Journal of Memory and Language, 50*, 1-25.

Wechsler, D. (1987). *Wechsler Adult Intelligence Scale - Third Edition (WAIS-III)*. San Antonio: Psychological.

Weinert, R. (1994). Some effects of a foreign language classroom on the development of German negation. *Applied Linguistics, 15*, 76-101.

White, L. (2003) On the nature of interlanguage representation: Universal Grammar in the second language. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition*. (pp. 19-42). Malden, MA US: Blackwell Publishing.

White, L. & Juffs, A. (1998). Constraints on *wh-movement* in two different contexts of nonnative language acquisition: competence and processing. In S. Flynn, G. Martohardjono & W. O'Neil (Eds.), *The Generative Study of Second Language Acquisition* (pp. 111-129). Mahwah, NJ: Lawrence Erlbaum Associates.

White, L., Valenzuela, E., Kozlowska-MacGregor M, & Leung, Y. K. (2004) Gender and number agreement in nonnative Spanish. *Applied Psycholinguistics, 25*, 105–33.

Ye, Z., & Zhou, X. (2008). Involvement of cognitive control in sentence comprehension: Evidence from ERPs. *Brain Research, 1203*, 103-115. Retrieved from http://www.psy.pku.edu.cn/~zhouxiaolin/2008%20Ye%20&%20Zhou%20Brain%20Research.pdf

Ye, Z., & Zhou, X. (2009a). Executive control in language processing. *Neuroscience and Biobehavioral Reviews, 33*(8), 1168-1177.

Ye, Z., & Zhou, X. (2009b). Conflict control during sentence comprehension: fMRI evidence. *NeuroImage, 48*, 280-290. Retrieved from http://www.klmp.pku.edu.cn/Paper/UsrFile/873.pdf

Zwicky, A.M. (1977). *On clitics*. Bloomington, IN: Indiana University Linguistics Club. Retrieved from http://www.stanford.edu/~zwicky/

Zwicky, A.M. (1982). Stranded *to* and phonological phrasing in English. *Linguistics, 20*, 3-57. Retrieved from http://www.stanford.edu/~zwicky/

Zwicky, A.M. (1985). Clitics and particles. *Language, 61*(2), 283-305.

Zwicky, A.M. (1994). What is a clitic? In J.A. Nevis, B.D. Joseph, D. Wanner & A.M. Zwicky (Eds.), *Clitics: A Comprehensive Bibliography 1892-1991* (pp. xii-xx). Philadelphia, PA: John Benjamins. Retrieved from http://www.stanford.edu/~zwicky/

Zwicky, A.M. & Pullum, G.K. (1983). Cliticizaton vs. inflection: English *n't*. *Language, 59*(3), 502-513.

Zyzik, E. C. (2004). Encoding meaning with polyfunctional forms: The acquisition of clitics in L2 Spanish. *Dissertation Abstracts International, A: The Humanities and Social Sciences, 65*(6), 2184-A-2185-A.

Zyzik, E. (2006a). Learners' overgeneralization of dative clitics to accusative contexts: evidence for prototype effects in SLA. In C.A. Klee & T.L. Face (Eds.), *Selected Proceedings of the 7th Conference on the Acquisition of Spanish and Portuguese as First and Second Languages* (pp. 122-134). Somerville, MA: Cascadilla Proceedings Project.

Zyzik, E. (2006b). Transitivity alternations and sequence learning: Insights from L2 Spanish production data. *Studies in Second Language Acquisition, 28*(3), 449-485.

BIOGRAPHICAL SKETCH

Maria Ida Fionda is a first-generation Italian Canadian born and raised in Montreal. Her interest in linguistics was sparked as a child while growing up in a multilingual environment that included standard Italian, the Calabrese dialect, English and French. In 2003, she earned a B.A. with an honours in Spanish and a major in Italian from Concordia University in Montreal, Canada. In 2008, she completed her M.A. at the University of Florida, where she also taught beginning and intermediate Spanish language. Her curiosity on the nature of mental linguistic representations was influential in her decision to pursue a Doctor of Philosophy (Ph.D.) in Spanish linguistics at the University of Florida. As a graduate student, she taught a variety of Spanish language courses, including a Foreign Languages Across the Curriculum course entitled Trade and Investment in Latin America, and acted as a weekly discussion leader for an Introduction to Hispanic Linguistics course, in the capacity of teaching assistant.

Dr. Fionda is currently Assistant Professor at the University of Mississippi, where she is pedagogical director of the basic Spanish program and has taught Spanish Advanced Grammar and Composition, Introduction to Spanish Linguistics, and a graduate seminar titled Research and Practice In Classroom Second Language Acquisition.

Throughout her graduate and professional career, she has been awarded several travel and research funds, and received the Cooperative Leadership in Teaching Spanish Award in 2010. She has also co-authored a publication in *Linguistics* and a chapter in *The Handbook of Spanish Second Language Acquisition*. Her main areas of interest lie in psycholinguistics and (general) cognitive processes in second language processing and acquisition, and bilingualism.