THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF FRENCH AND FRANCOPHONE STUDIES

PROCESSING L2 TENSE:
A CROSS-LINGUISTIC INVESTIGATION

JACQUELINE M. GAUTHIER
Fall 2011

A thesis
submitted in partial fulfillment
of the requirements
for baccalaureate degrees
in French and Francophone Studies and Spanish
with honors in French and Francophone Studies

Reviewed and approved* by the following:

Nuria Sagarra
Visiting Assistant Professor, Carnegie Mellon University
Thesis Supervisor

Willa Silverman
Professor of French and Jewish Studies
Honors Adviser

Marc Authier
Associate Professor of French and Linguistics
Faculty Reader

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

Adults have persistent difficulty processing morphology in a second language (L2). The Associative-Cognitive Theory (Ellis, 2007) attributes this difficulty to linguistic characteristics (cue salience and reliability), language experience (cues previously learned in the L1 and the L2 affect later learned cues), and working memory limitations. To test this theory, adult native speakers of Romanian (morphologically rich language) and English (morphologically poor language) read sentences in L2 Spanish, which contained lexical (adverbs) and morphological (verb inflections) cues of temporal reference, and after judged the grammaticality of the sentences. There is mounting evidence to suggest that English native speakers rely on adverbs first to assign tense in morphologically rich L2s such as Romance languages, and verbal inflections later (Jiang et al., 2008, 2011; Lee, 2002; LaBrozzi, 2010; Leeser, 2004; Musumeci, 1989; Rossomondo, 2003; Sagarra & Ellis, 2010). Some theories (like the Shallow Structure Hypothesis; Clahsen & Felser, 2006) claim that there is a general tendency for beginning learners to focus on lexical cues, and other theories (usage-based models, such as the Associate-Cognitive Theory and the Unified Competition Model) attribute it to transfer. The results reveal that the English-Spanish learners relied more heavily on the adverbs, supporting the Associative-Cognitive Theory, and also show a general trend for the English and Romanian learners to rely more on the adverb at the beginning stages of acquisition.

Table of Contents

Acknowledgment

There have been a great number of faculty and staff at Penn State who have shaped my educational career; however, there is one person without whom I would not be where I am today. I would like to thank Dr. Nuria Sagarra for introducing me to the world of applied linguistics, and helping me realize my true potential at Penn State through the variety of opportunities she created for me. You took me under your wing, and I will be forever grateful.

I would also like to thank my family for being unconditionally supportive and loving throughout this journey.

List of Tables

Chapter 1: Introduction

There is no question that adult second language acquisition (L2A) is difficult; some attribute this difficulty to biological factors (e.g., Hawkins & Chan, 1997; Franceschina, 2005), others to external factors (e.g., Krashen, 1994; Lantolf, 2000; Long, 1996; Swain, 2000), and some to internal factors (e.g., VanPatten, 2004; Clahsen & Felser, 2006; Ellis, 2006a). Ellis (2006a) develops a usage-based model called the Associative-Cognitive theory. This theory states that a person's attention to specific L2 cues, both in the short-term (blocking) and in the long-term (transfer), is determined by that learner's selective attention (the effect of previously learned cues on ones learned later on). Ellis (2006a) believes that adults struggle to acquire (or cannot acquire) morphological cues, such as verbal inflections, when their first language (L1) is morphologically poorer than the L2 being learned (e.g., going from L1 English to an L2 Romance Language); because the learner is used to relying more heavily on lexical cues (nouns, adjectives, adverbs, etc.) in the L1.

Several studies, using both online and offline techniques, have reported native speakers of English (morphologically poor) relying more on lexical cues (adverbs) than morphological cues (verbal inflections) when processing sentences in a morphologically rich L2 such as Spanish or Italian, even though both cues relay the same temporal information (e.g., online techniques: Ellis & Sagarra, 2010; Sagarra, 2007; offline techniques: Bardovi-Harlig, 1992; Cadierno et al, 1991; Lee, 1999, 2002; Lee et al, 1997; Leeser, 2004; Musumeci, 1989; Rossomondo, 2003; VanPatten, 1996, 2004). A question that remains open is whether these findings are due to a default strategy, where all L2 learners prefer lexical cues over morphological ones at early stages of acquisition, or to L1 transfer effects (English has poor morphology and therefore relies heavily on lexical cues).

Adult learners are also constrained by the limitations of their working memory. Research shows that classroom learners with a higher working memory are able to process redundant morphological cues better than those with a low working memory (see Sagarra, forthcoming, for a review). Working memory limitations are more obvious in the processing of L2 morphological cues at the low proficiency level than the high proficiency level (e.g., Foote, 2011; Sagarra, 2007, 2008; Sagarra & Ellis, in progress; Sagarra & Herschensohn, 2010). Research also shows that instructors hinder the L2A of learners in the classroom by the typical overuse of lexical items (Dracos, 2009) and underuse of morphological ones (Goodall, 2008). Dracos (2009) found that L1 Spanish instructors explicitly use subject pronouns more in the classroom than in natural conversation, and Goodall (2008) found that the use of reflexive verbs in the classroom is significantly less than in natural conversation.

While there are studies on the affects learned attention, and on the affects of working memory on L2 learning, there is little knowledge of how these two factors work together in the processing of L2 morphological cues. This study aims to determine the roles of both learned attention (L1 effects on L2) and working memory on the processing of redundant lexical (adverb) and morphological (verbal inflections) cues. We examine the effect of these factors on how adult English (poor morphology) and Romanian (rich morphology) learners of Spanish (rich morphology) use temporal adverbs and verbs to assign temporal reference in a sentence, using grammaticality judgments.

Chapter 2: Background

According to the Associative-Cognitive theory (Ellis, 2007), adult language acquisition is modified by both linguistic (cue salience and reliability) language experience (with the L1 and the L2), and cognitive factors.

Factors Affecting L2 Morphological Learning

Linguistic factors affecting L2 morphological learning.

Adult L2A is characterized by the predominant use of semantically rich items like nouns, verbs and adverbs. Closed class items (semantically poor), particularly grammatical morphemes and prepositions are rarely used, or not at all (Bardovi-Harlig, 1992; Clahsen & Felser, 2006; Meisel, 1987; Noyau et al., 1995; Sagarra, 2001; VanPatten, 1996, 2004). In Romance languages like French, Romanian and Spanish, temporal reference can be indicated by both lexical cues (e.g. temporal adverbs) and morphological cues (verbal inflections) (Evans, 2003). Although children use both types of cues successfully in their L1, numerous studies conducted with adult Anglophone learners of L2 Spanish and Italian indicate that they prefer lexical over morphological cues to determining L2 tense (see Ellis & Sagarra, 2010, for a review).

This preference for lexical over morphological cues can be explained in terms of cue reliability, cue salience, and cue redundancy. A cue's reliability is its power to predict a certain outcome; for instance, temporal verbal morphology cues (verbal inflections) have low reliability because they carry more than one piece of information (e.g., person, tense, and mood), and temporal lexical cues (adverbs) have high reliability because they only carry information about the time of the action. Salience refers to how marked a cue is and is subjective (varies between people). In English, L2 learners sometimes do not perceive the past tense verbal morphology

because it is not orally salient; some people cannot hear the difference between "talk" and "talked." Finally, if a cue is redundant it carries the same meaning as one or more cues in the sentence; for example in English, "yesterday I learned," the adverb 'yesterday' and the verbal inflection '–ed' are redundant because they both convey an action in the past tense. Verbal inflections are less reliable and salient than temporal adverbs (and other lexical cues), which are often overused in the L2 classroom. These linguistic factors obstruct the learning of morphological cues in both L1A and L2A. Therefore, there has to be something else to account for the continued difficulty that older learners experience in acquiring grammatical morphemes. Thus, the following sections examine the role of language experience and working memory on L2 morphological acquisition in adults.

Language experience factors affecting L2 morphological learning.

The Associate Learning Theory states that once a person associates a certain stimulus with an outcome, it is difficult to acquire another stimulus predicting the same outcome (Krunschke, 2006). This phenomenon is called *overshadowing* and attention switches caused by language experience are known as *learned attention.* If there are two cues (an adverb and a verbal inflection), and one is seen as more salient than the other (adverb), the second cue tends to go unnoticed, or is overshadowed. Overshadowing can lead to *blocking.* Blocking is the learner's ability to acquire a new cue that predicts the same outcome (in this case temporal reference) as a previously learned cue associated with that same outcome. Since it is more common than not that cues appear in pairs, learners have to select the cue which best predicts the outcome.

Beginner learners of L1 and L2 generally process one cue at a time, focusing instead on the most available (salient) cue and not the most reliable (acquisition of artificial languages:

Blackwell, 1995; MacWhinney & Bates, 1989; Matessa & Anderson, 2000; McDonald & MacWhinney, 1991; L1 acquisition: MacWhinney, Pléh & Bates, 1985; L2 acquisition: VanPatten, 1996, 2004; Lee, 1999, 2002; Lee et al, 1997). However, more cues are selected and processed as proficiency in the language increases (Ellis, 2006c, d) and learners' L2 cue settings progress from matching the L1 cue settings to the L2 (Ellis, 2006c; Bardovi-Harlig, 1992; Parodi, Schwartz, & Clahsen, 2004; Bordag & Pechmann, 2007).

Cognitive individual factors affecting L2 morphological learning

Working Memory

Working memory refers to the cognitive resources needed to temporarily store and process information during complex cognitive actions (Baddeley, 2003, 2007). WM is limited (Just & Carpenter, 1992), and tasks that deplete a person's working memory capacity can result in less storage and slower processing (e.g., Mackey et al, 2002). Learning a language as an adult is a difficult task that consumes a great amount of cognitive resources (Hasegawa, Carpenter, & Just, 2002; Walter, 2004) and these processing demands affect knowledge and implementation of linguistic information. Thus, it is not surprising that working memory has been associated with many different L2 areas (see Sagarra, forthcoming, for a review on the effects of working memory on L2 learning) including: comprehension (e.g., Alptekin & Erçetin, 2010; Harrington & Sawyer, 1992; Leeser, 2007), production (e.g., Kormos & Safar, 2008), the ability to benefit from explicit instruction (e.g., Ando, Fukunaga, Kurachachi, Suto, Nakano, & Kage, 1992; Jaemyung, 2010; Roehr, 2008), the ability to make intentional generalizations of morphosyntactic rules (e.g., Brooks, Kempe, & Sionov, 2006; Kempe & Brooks, 2008; Robinson, 2005), the ability to notice recasts as corrective feedback (Mackey et al, 2002; Mackey, et al, 2010; Sagarra, 2007; Sagarra & Abbuhl, forthcoming), and even the ability to

benefit from studying abroad (e.g., LaBrozzi, 2011; Sunderman & Kroll, 2009; Tokowicz, Michael, & Kroll, 2004). Working memory has also been found to modify L2 syntactic processing (e.g., Dussias & Piñar, 2010; Havik, Roberts et al, 2009; Miyake & Friedman, 1998; but see Juffs & Harrington, 2011, for evidence of the contrary). Most importantly for the present study, working memory affects the L2 processing of verbal (adverb-verb) and nominal (noun-adjective) agreement. In effect, Sagarra (2008) and Sagarra & Herschensohn (2010) reported that only high WM span beginning learners are sensitive to tense and gender agreement violations, and those high working memory span intermediate learners are more sensitive to these violations than their low WM span counterparts. Next, studies focusing on the processing of L2 *verbal* agreement are described. Michael & Gollan (2005) explain that both working memory and inhibitory control are important factors for processing an L2. Similarly, Ellis (2006d, 2007) states that the final level of L2 processing is dictated by what information is processed, and what information is blocked (inhibited).

Inhibitory control

Higher inhibitory control facilitates the processing of L2 morphological cues. Inhibitory control is a person's ability to suppress auxiliary information while focusing on task-specific information. A person's overall cognitive capability (memory failure, working memory span, reading comprehension, and problem solving) has been linked to their inhibitory control (Friedman & Miyake, 2004). Inhibitory control may be linked to preventing L1 transfer effects by inhibiting L1 cue processing methods, and focusing on L2 cue processing methods. That is to say, those with a higher inhibitory control will be better at preventing L2 processing errors from L1 processing biases. The groups were screened for WM and inhibitory control homogeneity.

Studies on L2 Morphological Learning in Romance Languages

There have been several studies in the lab and in the classroom setting which investigate learners' processing of L2 temporal cues in Romance languages. Ellis (2007) and Ellis & Sagarra (2010) investigated the short and long term effects of learned selective attention in speakers with various L1 backgrounds (English, Chinese, Korean, Russian) learning temporal reference in a morphologically rich L2 (a subset of Latin and Spanish). For the Latin experiments, participants were randomly assigned to adverb pre-training, verb pre-training, or control groups. After being exposed to adverbs, verbs or nothing (control), participants matched the adverbs or verbs to the English equivalents and received feedback. Then participants completed an interpretation task where they saw combinations of adverbs, verbs, and adverb-verbs and verb-adverbs: some of the combinations were incongruent (e.g., with the adverb in the future and the verb in the past) and their task was to indicate whether the action took place in the past, present or future. Finally, participants completed a production task that consisted of translating sentences from English to Latin. The results for both the interpretation and the production tasks showed that the adverb pre-training group relied more on the adverbs, the verb pre-training group more on the verbs, and the control group relied more on the adverbs or the verbs depending on the L1. Thus, Chinese learners (Chinese has no morphology) were more "lexical" than Russian and Spanish learners (Russian and Spanish have a rich morphological system). This suggests that in the short-term, L2 learners rely more heavily on the cue (lexical or morphological) that they were exposed to in the first stages of acquisition, and block the later cues, and that L1 transfer affects the learning of L2 morphology.

For the Spanish experiment, Ellis and Sagarra (2010) examined how beginning and intermediate English learners of Spanish, and English and Spanish monolinguals (control groups)

processed adverb-verb and verb-adverb agreement/disagreement, while their eye movements were recorded. For the eyetracking task the participants read sentences containing adverb-verb/verb-adverb agreement/disagreement and answered a comprehension question. The data revealed that the beginners were insensitive to the agreement violations, but an earlier study (Sagarra, 2008) showed that sensitivity to adverb-verb agreement violations is modulated by working memory at early stages or acquisition: beginning learners with high working memory capacity are sensitive to these violations whereas those with low working memory capacity are not. The intermediate learners relied more on the adverb and the Spanish monolinguals relied more on the verb when there were adverb-verb/verb-adverb agreement violations. This study is not alone in its' findings as L1 English learners' tendency to rely on lexical cues has also been shown in offline studies with adult learners of L2 Spanish and Italian (Bardovi-Harlig, 1992; Cadierno, Glass, Lee, & VanPatten, 1991; Lee, 1999; Lee et al., 1997; Musumeci, 1989; Rossomondo, 2003; VanPatten, 1996, 2002).

All of these studies focus on native speakers of a morphologically poor language (English) learning a morphologically rich language (Spanish, or Italian); thus, we cannot determine whether the learners' preference for lexical cues over morphological ones is a default strategy, or is as a result of their L1. To fill this information gap, Jiang (2004, 2007) asked Chinese speakers to read L2 English sentences word by word. The sentences contained disagreements of the English plural morpheme 's', and found that they were not sensitive to the disagreement. However, in a follow-up study with Russian-English and Japanese-English learners, Jiang et al (2011) reported that the Japanese learners were not sensitive to the plural errors but the Russian speakers were.

While acknowledging the important influence of the L1 on L2 learning, Jiang et al suggest that a cross-linguistic similarity (between the L1 and the L2) affects L2 morphological processing. ERP and fMRI data confirm this claim (see Tolentino & Tokowicz, 2011, for a comprehensive review of ERP and fMRI evidence of cross-linguistic similarity effects on L2 morphological processing). Tokowicz and MacWhinney (2005), and Tolentino and Tokowicz (2010) found that differences between L1 and L2 processing were attributed to the constructions that were cross-linguistically different or unique to the L2; in contrast, the processing of cross-linguistically similar constructions produced no differences in brain activity between the L1 and the L2. The present study was focused on L1-L2 similar constructions (adverb-verb agreement).

Chapter 3: The Present Study

There is little dispute over the difficulty of acquiring grammatical morphemes (tense, number, gender) for adult L2 learners. However, there is mounting evidence that English native speakers prefer lexical cues (adverbs) to morphological cues (verbal inflections) when processing adverb-verb agreement. However, it is not clear whether this preference is due to a default strategy or to L1 transfers effects (English has poor morphology). To address this question, the current study examines how native speakers of a morphologically poor language (English) and a morphologically rich language (Romanian) process temporal reference in a morphologically rich L2 (Spanish) in constructions involving adverb-verb/verb-adverb agreement/disagreement. Romanian, like Spanish, has verbal inflections, which convey multiple pieces of information (person, number, tense, and mood). The participants (English, Spanish, and Romanian monolinguals, and L1 English and L1 Romanian learners of L2 Spanish) completed two eyetracking tasks, a grammaticality judgment task, and two tests of cognitive individual differences. This study focuses on the grammaticality test (the data from the eyetracking tasks and the cognitive tests are reported elsewhere). Following the Associate-Cognitive theory, and previous studies on the topic, when the adverb-verb or verb-adverb phrases are incongruent, the hypotheses are:

1. The English monolinguals will tend to rely on lexical cues (adverb).
2. The Spanish monolinguals will tend to rely on morphological cues (verb).
3. The English learners will rely more on lexical cues.
4. The Romanian learners will rely more on morphological cues.

Chapter 4: Method

Participants

The sample pool consisted of 240 participants: 63 low proficiency learners (31 English-Spanish, 32 Romanian-Spanish), 66 high proficiency learners (31 English-Spanish, 35 Romanian-Spanish), and 111 monolinguals (40 English, 35 Romanian, 36 Spanish). The data for the Spanish monolinguals was collected in Teruel, Spain, and the data for the English learners and English monolinguals was collected in two large universities in the United States. All participants were educated (they needed to have completed at least a high school diploma) and received extra credit (low proficiency English learners) or monetary compensation for completing all tasks of the study. A series of one-way ANOVAs revealed no between-group differences in the working memory test ($F(6,236) = 1.174$, $p > .05$) or the inhibitory control test: accuracy inhibition effects ($F(6,238) = 2.442.$, $p > .05$), accuracy facilitation effects ($F(6,238) = .854$, $p > .05$), RT inhibition effects ($F(6,238) = .758.$, $p > .05$), RT facilitation effects ($F(6,238) = 1.199$, $p > .05$). The means are not shown because the statistical analyses of the cognitive tests are reported elsewhere, and the *n* is lower in the working memory (237) and Flanker (239) tests than the rest (240) because the computer froze.

All of the monolinguals were native speakers living in their native countries (English learners lived in the United States, and Romanian learners lived in Romania) and had never traveled abroad for more than 4 months, and had little or no knowledge of any other language. Both groups of learners had started learning L2 Spanish after age 14 and had little or no knowledge of other morphologically rich languages (except L1 Romanian learners who knew Romanian) to filter for transfer effects. In addition, both groups took a Spanish proficiency test

and had to score between 40 and 65% (low proficiency) or between 50 and 95% (high proficiency). A one-way ANOVA ($F(3,128) = 137.964$, $p < .01$) revealed non-significant differences in proficiency levels between the low proficiency groups (English-Spanish: 53.20(8.09); Romanian-Spanish : 56.78(7.18) and the high proficiency groups (English-Spanish: 80.90(7.58); Romanian-Spanish : 81.19(6.36) (all $p > .05$), suggesting that they are homogeneous, and significant differences between the low and the high groups (all $p < .01$), showing that the low proficient learners had a different level from the high ones. The learners were also required to complete a vocabulary test and score 90% or higher to ensure the learners were aware of the words being used in the tasks, and were not negatively affected because of lack of comprehension.

Procedure

After signing the consent form, participants completed a language background questionnaire (5minutes) and a proficiency test in Spanish for L2 learners and in English for Romanian and Spanish monolinguals (10-20 minutes). Then the L2 learners studied a vocabulary list with basic vocabulary that appeared in the eyetracking tasks (10minutes). Afterwards, all participants completed the first eyetracking task, two cognitive tests--a Flanker test and a letter-number sequence test to assess inhibitory control and working memory, respectively (about 10 minutes per task)--and the second eyetracking task. Each participant completed a reading eyetracking task (20-40 minutes) and a listening eyetracking task (15-20 minutes). Half of the participants in each group completed the reading eyetracking task first and the other half the listening eyetracking task first, to control for possible practice effects. Following the second eyetracking task, participants completed a grammaticality judgment task (10-15 minutes). Finally, the L2 learners were given a vocabulary test (5 minutes) and a grammar test (5-10

minutes) in Spanish. Depending on which tasks the participants had to complete, the total duration of the study ranged from one hour and fifteen minutes to three hours. Next, we describe each task in detail. Since this thesis focuses on the data of the grammaticality judgment task the sections of Scoring and Results will focus on this task.

Materials

Language background questionnaire

The first task was a language background questionnaire that was given to all participants (except English monolinguals). In the first section, the participants gave their name, age, and sex, along with the language(s) that they spoke for the first five years of their life, the language they felt most comfortable with, and the language(s) studied in High School and/or College/University. The participants were also asked to give any language(s) spoken at home, with friends, at school, or at work, as well as what language(s) they could a) read b) write c) speak. The second section is based on the participant's contact with Spanish, including at what age they started speaking Spanish, how many days per week they hear Spanish being spoken, and any experiences abroad (where, when, and for how long).

Proficiency tests

The participants were given a Spanish proficiency test with multiple sections totaling 60 items (basic, intermediate, and advanced grammar, as well as reading and listening comprehension) that were based on the Diploma de Español como Lengua Extranjera (DELE) exam. The learners were separated in to two proficiency groups of approximately the same size, and had to score between 40 and 65% (low proficiency) or between 50 and 95% (high proficiency). A similar 20-item English proficiency test was given to all learners except L1

English participants. The test was based on the Test of English as a Foreign Language (TOEFL) and participants needed to score lower than 89% to be included in the study.

Cognitive tests

The participants were given a working memory letter-number sequencing task and a Flanker (inhibitory control) task. The working memory test was adapted from a subset of the revised version of the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1997). A non-linguistic working memory test was used because the study compared participants of different L1 backgrounds. In the working memory task participants were asked to remember a series of letters and numbers that appeared one-by-one in the center of the screen. At the end of the sequence "RECALL" appeared, and the participants had to re-enter the letters and numbers using the keyboard: putting the numbers first (in numerical order) and the letters second (in alphabetical order). The participants were allowed to BACKSPACE to change their answers, but once they were satisfied with the final answer they hit the ESCAPE to end the trial, and hit the SPACEBAR to prompt the next trail.

The Flanker test was given to measure the participant's inhibitory control. In each trial the participants were shown a row of four arrows on the screen (three black, one red), and they had to click the button on the mouse corresponding to the direction the red arrow was pointing. For example, if the red arrow was pointing to the right, the participant clicked the right button. Several trials also had diamonds incorporated in the group of arrows, the participants were told to only focus on the red arrow, and block out everything else. Since this task was part of a larger study, the data will be reported elsewhere.

Eyetracking tasks

The eyetracking data was collected on SR Research's EyeLink1000 machine. The participants rested their chin on a chin rest that was located 55 centimeters from the camera, and 75 centimeters from the monitor. Before each participant began a task (and after any break or movement of the head), the machine was calibrated and validated. Each participant completed a reading task and a listening task. For the reading task the participants were given a sentence in the corresponding language (English for English monolinguals, Spanish for Spanish monolinguals and English-Spanish and Romanian-Spanish learners, and Romanian for Romanian monolinguals). Before each trial the participants were asked to focus on a black dot appearing on the left hand side of the screen at the level of the sentence, to ensure proper calibration. Once they read the sentence they had to look in a grey box that appeared in the lower right hand of the screen; this automatically prompted four pictures to appear on the screen. The participants clicked on the picture that best corresponded to the sentence they just read using the mouse.

The second eyetracking task was a listening task where the participants listened (via headphones) to a sentence in the assigned language (English for the English monolinguals, Spanish for the Spanish monolinguals and English-Spanish and Romanian-Spanish learners, and Romanian for the Romanian monolinguals). Again, before each trial the participants were asked to focus on a black dot in the center of the screen to ensure proper calibration. While the sentence was being listened to there were four pictures on the screen; the participants were asked to click on the picture which best corresponded to the sentence they just heard using the mouse.

The participants read and listened to 85 sentences (per task), including five practice sentences, 32 experimental sentences (evenly divided in to four conditions), and 48 filler sentences. The sentences were randomized using a Latin square design to ensure that

experimental sentences would not appear together. The experimental sentences were controlled for length (9 to 15 words), vocabulary and grammar (appropriate level). Half of the experimental sentences were adverb-verb tense agreement sentences, the other half were adverb-verb tense disagreement.

Grammaticality judgment test

This task was completed on paper, and the participants were asked to determine whether they thought a sentence was grammatically correct or not by circling "yes" or "no". There were 32 sentences: half experimental and half fillers. The experimental sentences were divided in to four conditions (4 sentences per condition), and ranged from 11-13 words in length (including 2-letter words such as prepositions and articles) depending on whether the past adverbs were one or three letters long. There were eight sentences with adverbs in the past: "la semana pasada" (k=2), "ayer" (k=2), "anoche" (k=1), "el año pasado" (k=1), "el mes pasado" (k=1), "anteayer" (k=1), and eight sentences with adverbs in the present: "ahora" (k=8). Because some adverbs in the present would be grammatically correct even when paired with a verb in the past (e.g., *hoy el chico comió su helado*→ Today the boy ate his ice cream), "ahora" (right now) was the only present adverb used. To prevent L1 lexical priming, 80-100% of the words of all the sentences (experimental and fillers) were not cognates. Finally, no verb or noun was used more than twice in the entire experiment.

If the participants found the sentence to be incorrect, they were asked to cross out the incorrect word and indicate where the error was (that is, the participants weren't required to change the verb or adverb to a grammatically correct form; they were only required to indicate where the change needed to be made). The test included 32 sentences, 16 of which were fillers, and 16 were experimental sentences with adverb-verb/verb-adverb temporal

congruencies/incongruencies (same conditions as in the eyetracking tasks). The first condition (C1) was grammatically correct (agreement between tense and adverb) with the adverb coming before the verb in the sentence. Similarly the third condition (C3) was also grammatically correct with the verb coming before the adverb in the sentence. The second condition (C2) was grammatically incorrect (no agreement between the tense and adverb) with the adverb coming before the verb in all 4 sentences, and the verb being in the present in 2 sentences and in the past in 2 sentences. The fourth condition (C4) was also grammatically incorrect with the verb coming first in the present in 2 sentences, and the in the past in 2 sentences, followed by the adverb in all 4 sentences. See examples below:

The experimental sentences had four conditions (// indicates the break onto the next line):

(C1) adverb-**verb congruent / (C2) *adverb-verb incongruent:**

Spanish: *Creen que ayer el chico cocinó/cocina algo para//la fiesta*

English: *They believe that yesterday the boy cooked/cooks something for//the party*

Romanian: *Ei cred că ieri băiatul găti/găteşte unele pentru//petrecere*

(C3) verb-adverb congruent / (C4) *adverb-verb incongruent:

Spanish: *Creen que el chico cocinó/cocina algo ayer para//la fiesta*

English: *They believe that the boy cooked/cooks something yesterday for//the party*

Romanian: *Ei cred că băiatul găti/găteşte unele ieri pentru//petrecere*

The sentences were scored on an all or nothing scale. In addition, for the 8 C2 and C4 sentences it was recorded whether the participant changed the adverb or the verb for each sentence. For incorrect sentences, there were no points awarded when the participant changed something other than the verb or adverb.

Vocabulary test

The L2 Spanish participants were asked as a final task to complete a 122 item vocabulary test (40 items for verbs, 8 for adverbs, and 74 for nouns that appeared both in the experimental and the filler sentences). The test had no time limit, and the test was used to demonstrate that the subjects had knowledge of the vocabulary seen on the eyetracking and grammaticality judgment tests. The participants were required to match a Spanish noun with the according translation (English for English learners, and Romanian for Romanian learners) (e.g. dinero→ 'money').

Grammar test

This 32-item test asked the learners to match Spanish verbs with their translation (English for English learners, Romanian for Romanian learners) (e.g. comprar→ 'to buy'). For the second part the learners matched a Spanish conjugated verb with the according translation (e.g. como→ 'I eat'). The verbs appeared in the simple past and present tenses in the first, second, and third personal singular and plural.

Scoring

This thesis uses WM and inhibitory control data as screening tests for the participants, and on the results of the grammaticality judgment test; therefore, I will focus on the scoring method for these tests. For the WM test, participants received 1 point per correct series recalled, totaling a maximum of 21 points, and the Flanker test elicited four scores: inhibitory effects (incongruent minus neutral conditions) for accuracy and RTs, and facilitory effects (congruent minus neutral conditions) for accuracy and RTs. For the grammaticality judgment test, participants received 1 point if they correctly identified grammatical sentences as grammatical. To receive 1 point on ungrammatical sentences, they had to both identifie the sentence as

ungrammatical and indicate that the error was either in the adverb or the verb. The participants were given 1 point for each correct answer, and 0 for each incorrect answer for the all-or-nothing score. For the C2 and C4 sentences, it was recorded whether the participants indicated the adverb or the verb as the error. Furthermore, it was recorded whether the participant changed the verb/adverb when the verb/adverb was in the present/past tense.

Chapter 5: Results

The means and standard deviations for each score divided into group and condition can be found in Table 1.

Table1. Accuracy on grammaticality judgments reported in percentages.

		Adv-V		**Adv-V**		**V-Adv**		**V-Adv**	
	N	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
L2 Spanish learners:									
English low	31	95.97	9.35	82.26	24.32	95.97	13.07	74.19	27.75
Romanian low	32	94.53	13.82	82.81	24.13	94.53	12.27	85.16	25.39
English high	31	97.58	7.51	91.13	15.21	96.77	8.52	75.81	23.70
Romanian high	35	94.29	12.26	95.00	10.15	94.29	14.96	87.14	19.56
Monolinguals:									
English	40	93.75	13.58	83.12	22.92	92.50	14.10	83.13	21.48
Romanian	35	91.43	15.98	90.71	14.96	94.29	14.96	86.43	16.43
Spanish	36	92.36	15.61	87.50	16.37	92.36	15.61	88.19	16.35

Note - $k = 16$

A repeated-measures ANOVA with a 2 (Adverb Location) x 2 (Correctness) x 7 (Group) factorial design carried out on the accuracy scores of the grammaticality judgment test showed an effect for Adverb Location, $F(1,233) = 7.031$, $MSE = 1220.696$, $p < .05$, Correctness $F(1,233) = 45.027$, $MSE = 19921.478$, $p < .001$, an interaction of Adverb Location x Correctness, $F(1,233) = 9.190$, $MSE = 1347.179$, $p < .005$, Adverb Location x Correctness x Group, $F(6,233) = 2.255$, $MSE = 330.640$, $p < .05$, and Correctness x Group, $F(6,233) = 2.202$, $MSE = 974.185$, $p < .05$, but there was no effect of Group, $F(6,233) = 1.071$, $MSE = 452.632$, and no interaction of

Adverb Location x Group, $F(6,233) = 1.966$, $MSE = 341.284$, $p < .05$. Bonferroni posthoc tests revealed that the English-Spanish learners were less accurate at classifying sentences with verb-adverb disagreement than agreement both at low ($p < .005$) and high ($p < .001$) proficiency levels, but they were equally accurate at classifying sentences with adverb-verb agreement and disagreement, indicating that they rely more on adverbs than verbs (they have more difficulty detecting tense violations when the first cue is morphological rather than lexical). The findings that the high proficiency English-Spanish learners were also less accurate at classifying sentences with verb-adverb disagreement (when the first cue is morphological) than those with adverb-verb disagreement (when the first cue is lexical) further corroborate the previous findings. In contrast, the Romanian-Spanish learners were equally accurate at classifying sentences with tense incongruencies than congruencies regardless of adverb location and proficiency level, suggesting that having a morphologically rich L1 facilitates attention to L2 morphological information. Finally, there were no differences across conditions in the Spanish monolingual groups probably due to ceiling effects.

To better understand what factors (adverb location, cue type, verb tense) modulate learners' processing of sentences with tense incongruencies, a repeated-measures ANOVA with a 2 (Adverb Location) x 2 (Cue Corrected: adverb, verb) x 7 (Group) factorial design was performed on the percentage of times participants accurately corrected *incorrect* sentences. The means and standard deviations can be found in Table 2.

Table 2. Accuracy on identifying incorrect sentences reported in percentages.

		Adv-V		Adv-V		V-Adv		V-Adv	
	N	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
L2 Spanish learners:									
English low	31	5.65	14.01	76.62	24.10	5.65	14.01	68.55	28.11
Romanian low	32	4.69	19.51	76.56	31.07	8.59	20.68	75.78	29.43
English high	31	4.03	13.07	87.10	19.23	12.90	19.23	62.90	32.19
Romanian high	35	9.29	19.26	86.43	21.30	18.57	25.97	70.00	30.80
Monolinguals:									
English	40	1.88	6.67	81.88	21.92	6.25	13.58	75.63	26.24
Romanian	35	3.57	10.75	83.57	23.44	5.71	14.96	78.57	22.80
Spanish	36	4.17	12.68	84.03	19.96	8.33	16.90	79.86	22.22

Note - k=8

The results showed an effect for Adverb Location, $F(1,233) = 10.941$, $MSE = 1255.298$, $p < .001$, Cue Corrected, $F(1,233) = 1110.051$, $MSE = 1186902.277$, $p < .001$, an interaction of Adverb Location x Cue Corrected, $F(1,233) = 37.532$, $MSE = 11585.589$, $p < .001$, Adverb Location x Group, $F(1,233) = 2.624$, $MSE = 301.048$, $p < .05$, and Adverb Location x Cue Corrected x Group, $F(6,233) = 3.129$, $MSE = 965.816$, $p < .01$, but there was no effect of Group, $F(6,233) = 2.001$, $MSE = 668.037$, and no interaction of Cue Corrected x Group, $F(6,233) = .801$, $MSE = 856.638$. Bonferroni posthoc tests revealed a general trend for all participants to correct the verb more often than the adverb both in adverb-verb and verb-adverb incongruent sentences (all $p < .001$). That is, adverb location did not predict how often participants corrected the verb in incongruent sentences, with the sole (and interesting) exception of the two high proficiency groups, which corrected the verb significantly more often when it appeared before than after the adverb. In the rare occasions when adverbs were corrected, for all participants, adverb location

also proved to be irrelevant (i.e., adverbs that preceded verbs were not corrected more often than those following verbs). While statistically non-significant, there was a trend for Romanian-Spanish learners (low: M = 75.78%; high: M = to change the verb in verb-adverb incongruent sentences more often than English-Spanish learners: in these sentences, Romanian-Spanish low proficiency learners changed the verb 75.78% of the time vs. 68.54% for English-Spanish low proficiency learners; Romanian-Spanish high proficiency learners changed the verb 70% of the times vs. 62.90% for English-Spanish high proficiency learners. Because the general accuracy means were high for the four learner groups (see Table 1), the lack of statistical significant differences could be the result of ceiling effects.

Chapter 6: Discussion

This thesis focuses on the long-term effects of learned attention on the acquisition of lexical and morphological cues for temporal reference of L1 Romanian and L1 English learners of L2 Spanish. The learners have different morphological backgrounds in their native languages (Romanian has high morphology and English has low morphology), and they were also separated into two proficiency groups (low and high). The subjects each completed a grammaticality judgment test which first asked the learners to detect grammar violations (tense conflicts), and then indicate where the error occurred. The overall results show that both the English-Spanish learners (high and low proficiency) rely more on lexical cues, the Spanish monolinguals rely more on morphological cues, and the Romanian-Spanish learners were better able to identify the incongruent sentences than the English-Spanish learners.

The high and low proficiency English-Spanish learners relied more on adverbs than verbs, and have more difficulty detecting tense conflicts when the morphological cue comes before the lexical cue. The English-Spanish learners were better able to detect temporal conflicts when the adverb came first in the sentence; thus confirming a stronger dependence on the lexical cue. In English, the lexical item almost always precedes the verb; therefore the English-Spanish learners were relying on L1 sentence processing, and were less able to identify tense conflicts. The Romanian-Spanish (both high and low proficiency) learners were able to identify both correct and incorrect (tense conflict) sentences, regardless of the position of the lexical cue. This suggests that a morphologically rich L1 facilitates cue processing in a morphologically rich L2.

There was a general trend for the English-Spanish low proficiency and Romanian-Spanish low proficiency learners to change the verb in the sentences (regardless of adverb position in the sentence) with tense conflicts. This is further evidence for the Shallow Structure

Hypothesis, Clahsen & Felser, 2006) which claims that there is a general tendency for beginning learners to focus on lexical cues in the L2, regardless of their morphological background. However, the two high proficiency groups corrected the verb more often in tense conflicts when the verb came before the adverb. Further research needs to be conducted (eyetracking, and ERPs) to determine whether this is due to semantic processing or syntactic processing.

A grammaticality judgment test is an offline technique, meaning that we cannot know how the participant processes the sentence in real time. For example, an offline technique does not show where the participant was surprised (e.g., by an incongruency), or which parts of the sentence caused the most problems. The data used for this experiment was part of a larger study involving eyetracking (an online technique), which subsequently might be able to answer certain questions (such as semantic versus syntactic processing) in regards to assigning temporal reference to morphological and lexical cues.

Chapter 7: Conclusion

The results of the grammaticality judgment test confirm that adults have difficulty processing L2 morphology. It is also clear that English-Spanish learners rely more heavily on the lexical cue than the morphological cue when assigning temporal reference, as explained by the linguistic characteristics (cue salience and reliability) and language experience (cues previously learned in the L1 and the L2 after later learned cues) in the Associative-Cognitive Theory (Ellis, 2007). There is also evidence to support the Shallow Structure Hypothesis (Clahsen & Felser, 2006), which claims that there is a general tendency for beginning L2 learners to rely on lexical cues: both the English and Romanian learners changed the verb more often in incongruent sentences (thus relying on the adverb).

References

Alptekin, C., & Erçetin, G. (2010). The role of L1 and L2 working memory in literal and inferential comprehension in L2 reading. *Journal of Research in Reading, 33*(2), 206-219.

Ando, J., Fukunaga, N., Kurahashi, J., Suto, T., Nakano, T., & Kage, M. (1992). A comparative study on the two EFL teaching methods: The communicative and the grammatical approach. Japanese Journal of Educational Psychology, 40, 247-256.

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

Baddeley, AD. (2007). Working memory, thought and action. Oxford: Oxford University Press.

Bardovi-Harlig, K. (1992). The telling of a tale: Discourse structure and tense use in learners' narratives. *Pragmatics and Language Learning, 3*, 144-161.

Blackwell, A. (1995). Artificial languages/virtual brains. Unpublished doctoral dissertation, University of California, San Diego.

Bordag, D., & Pechmann, T. (2007). Factors influencing L2 gender processing. *Bilingualism: Language and Cognition, 10* (3), 299-314.

Brooks, P. J., Kempe, V., & Sionov, A. (2006). The role of learner and input variables in learning inflectional morphology. *Applied Psycholinguistics, 27*, 185–209.

Cadierno, T., Glass, W., Lee, J. and VanPatten, B. (1991). *Processing Tense in Second Language Input: Lexical Cues Versus Grammatical Cues*. The University of Illinois at Urbana-Champaign.

Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics, 27*, 3-42.

Dracos, M. (2009). On the use of Spanish subject personal pronouns by instructors of Spanish as a second language. Unpublished manuscript, The Pennsylvania State University, University Park.

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, 443-472.

Ellis, N. (2006a). The Associative-Cognitive CREED. In B. VanPatten, J. Williams & A. F. Williams (Eds.), Theories in second language acquisition: An introduction. Mahwah NJ: Erlbaum.

Ellis, N. (2006c). Language acquisition as rational contingency learning. *Applied Linguistics, 27*(1), 1-24.

Ellis, N. (2006d). Selective attention and transfer phenomena in L2 acquisition: Contingency, cue competition, salience, interference, overshadowing, blocking, and perceptual learning. *Applied Linguistics 27*(2), 164-194.

Ellis, N. (2007). Learned attention in language acquisition: Blocking, salience, and cue competition. In EuroCogSci07, *Proceedings of the second European cognitive science conference, Delphi, Greece*, 119-124.

Ellis, N. C. (2005). At the interface: Dynamic interactions of explicit and implicit language knowledge. Studies in Second Language Acquisition, 27, 305–352.

Ellis, N., Sagarra, N. (2010) Learned Attention Effects in L2 Temporal Reference: The First Hour and the Next Eight Semesters. *Language Learning* (60), 85–108.

Evans, V. (2003). *The Structure of Time: Language, Meaning and Temporal Cognition.* Amsterdam: John Benjamins.

Foote, R. (2011). Integrated knowledge of agreement in early and late English-Spanish bilinguals. *Applied Psycholinguistics, 32*, 187-220.

Franceschina, F. (2005). Fossilized Second Language Grammars: The acquisition of grammatical gender. *Language Acquisition & Language Disorders (38)*.

Friedman, N.P., & Miyake, A. (2004). The relations among inhibition and interference cognitive functions: A latent variable analysis. Journal of Experimental Psychology: General, 133, 101–135.

Goodall, G. (2008). *Poverty/richness of the stimulus in instructed L2 acquisition of Spanish*. Paper presented at the Hispanic Linguistics Symposium, Université de Laval, Quebec.

Harrington, M., & Sawyer, M. (1992). L2 working memory capacity and L2 reading skill. *Studies in Second Language Acquisition, 14*, 25-38.

Hasegawa, M., Carpenter, P. A., & Just, M. A. (2002). An fMRI study of bilingual sentence comprehension and workload. NeuroImage, 15, 647–660.

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 L2 learners of Dutch. *Language Learning, 59*(1), 73-112.

Hawkins, R., & Chan, C. Y.-h. (1997). The partial availability of Universal Grammarin second language acquisition: The "failed functional features hypothesis." Second Language Research, 13, 187–226.

Jaemyung, G. (2010) Working Memory and Reactivity, *Language Learning (60)4*, 712–752.

Jiang, N. (2004). Morphological insensitivity in second language processing. *Applied Psycholinguistics, 25*, 603-634.

Jiang, N. (2007). Selective integration of linguistic knowledge in adult second language learning. *Language Learning, 57*(1), 1-33.

Jiang, N., Novokshanova, E, Masuda, K, & Wang, X. (2011). Morphological Congruency and the Acquisition of L2 Morphemes. *Language Learning, 61(*3), 940-967.

Jiang, N., Novokshanova, E., Masuda, K., & Wang, X. (2008). *Morphological insensitivity in L2 processing: A universal or L1-specific phenomenon?* Paper presented at the American Association for Applied Linguistics, Denver, Colorado.

Juffs, A. & Harrington, M.W. (2011). Aspects of working memory in L2 Learning. Language Teaching: Reviews and Studies, 42, 2, 137-166.

Just, M., & Carpenter, P. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review, 99*(1), 122-149.

Kempe, V., & Brooks, P. J. (2008). Second language learning of complex inflectional systems. *Language Learning, 58*, 703–746.

Kormos, J., & Sáfár, A. (2008) Phonological short term-memory, working memory and foreign language performance in intensive language learning. Bilingualism : Language and Cognition, 11 (2). pp. 261-271.

Krashen, S. (1994). The input hypothesis and its rivals. In N. Ellis (Ed.), *Implicit and explicit learning of languages* (pp. 45-77). London: Academic Press.

Kruschke, J. K. (2006). Learned Attention. Presentation at the Fifth International Conference on Development and Learning, Indiana University May 31-June 3, 2006

Labrozzi, B. (2011). Processing of Lexical and Morphological Cues in a Study Abroad Context. Doctoral dissertation, The Pennsylvania State University, University Park, PA.

Lantolf, J. (2000). Introducing sociocultural theory. In J.P. Lantolf (Ed.), *Sociocultural theory and second language learning* (pp. 1-26). Oxford: Oxford University Press.

Lee, J. (1999). On levels of processing and levels of comprehension. In J. Gutiérrez-Rexach & F. Martínez-Gil (Eds.), *Advances in Hispanic linguistics* (pp. 42-59). Somerville, MA: Cascadilla Press.

Lee, J. (2002). The incidental acquisition of Spanish future morphology through reading in a second language. *Studies in Second Language Acquisition, 24,* 55-80.

Lee, J., Cadierno, T., Glass, W., & VanPatten, B. (1997). The effects of lexical and grammatical cues on processing past temporal reference in second language input. *Applied Language Learning, 8*, 1-23.

Leeser, M. (2004). The effects of topic familiarity, mode, and pausing on second language learners' comprehension and focus on form. *Studies in Second Language Acquisition, 26,* 587-615.

Leeser, M. (2007). Learner-based factors in L2 reading comprehension and processing grammatical form: topic familiarity and working memory. *Language Learning, 57*(2), 229-270.

Long, M. (1996). The role of the linguistic environment in second language acquisition. In W. Ritchie & T. K. Bhatia (Eds.), *Handbook of language acquisition: Vol. 2: Second language acquisition* (pp. 413-468). San Diego, CA: Academic Press.

Mackey, A., Adams, R., Stafford, C., & Winke, P. (2010). Exploring the relationship between modified output and working memory capacity. *Language Learning, 60*(3), 501-533.

Mackey, A., Philp, J., Fujii, A., Egi, T., & Tatsumi, T. (2002). Individual differences in working memory, noticing of interactional feedback and L2 development. In P. Robinson & P. Skehan (Eds.), Individual differences in L2 learning (pp. 181-208). Philadelphia: John Benjamins.

MacWhinney, B. (2005). A unified model of language acquisition. In J. F. Kroll & A. M. B. de Groot (Eds.), Handbook of bilingualism: Psycholinguistic approaches (pp. 49-67). New York: Oxford University Press.

MacWhinney, B., & Bates, E. (1989). *The crosslinguistic study of sentence processing*. Cambridge: Cambridge University Press.

MacWhinney, B., Pléh, C., & Bates, E. (1985). The development of sentence interpretation in Hungarian. *Cognitive Psychology, 17*(2), 178-209.

Matessa, M., & Anderson, J. (2000). Modeling focused learning in role assignment. *Language and Cognitive Processes, 15*(3), 263-292.

McDonald, J., & MacWhinney, B. (1991). Levels of learning: A microdevelopmental study of concept formation. *Journal of Memory and Language, 30*, 407-430.

measures of second-language processing: The role of cross-language similarity . Manuscript submitted for publication .

measures of second-language processing: The role of cross-language similarity . Manuscript submitted for publication.

Meisel, J. (1987). Reference to past events and actions in the development of natural second language acquisition, in Pfaff (ed.) 1987b.

Michael, E., & Gollan, T.H. (2005). Being and becoming bilingual: Individual Differences and consequences for language production. In J.F. Kroll & A.M.B. de Groot (Eds.), The handbook of bilingualism: Psycholinguistic approaches (pp. 389-407). New York: Oxford University Press.

Miyake, A., & Friedman, N. (1998). Individual differences in second language proficiency: Working memory as language aptitude. In A.F. Healy & L.E. Bourne, Jr. (Eds.), *Foreign language learning: Psycholinguistic studies on training and retention* (pp. 339-364). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Musumeci, D. (1989). The ability of second language learners to assign tense at the sentence level: A cross-linguistic study. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign.

Noyau, C., Et-Tayeb Houdaïfa, M.-T. Vasseur & D. Véronique. 1995. "The acquisition of French". In The acquisition of temporality in a second language, R. Dietrich, W. Klein & C. Noyau (eds.). John Benjamins, Amsterdam.

Parodi, T., Schwartz, B., & Clahsen, H. (2004). On the L2 acquisition of the morphosyntax of German nominals. *Linguistics*, *42*(3), 669-705.

Robinson, P. (2005). Cognitive abilities, chunk-strength, and frequency effects in implicit artificial grammar and incidental L2 learning: Replications of Reber, Walkenfeld and Hernstadt (1991) and Knowlton and Squire (1996) and their relevance for SLA. Studies in Second Language Acquisition, 27, 235–268.

Roehr, K. (2008). Metalinguistic knowledge and language ability in university-level L2 learners. *Applied Linguistics*, *29*(2), 173-199.

Rossomondo, A. (2003). The role of lexical temporal indicators in the incidental acquisition of the Spanish future tense. Unpublished doctoral dissertation, Indiana University.

Sagarra, N. (2001). What remains after comprehension: Meaning, form, or both? Paper presented at the conference *Form-Meaning Connections in Second Language Acquisition*. The University of Illinois at Chicago, IL, February 2001.

Sagarra, N. (2007). Working memory and L2 processing of redundant grammatical forms. In Z. Han (Ed.), *Understanding second language process* (pp. 133-147). Clevedon, UK: Multilingual Matters.

Sagarra, N. (2008). From CALL to face-to-face interaction: The effect of computer-delivered recasts and working memory on L2 development. In A. Mackey (Ed.), *Conversational Interaction in Second Language Acquisition* (pp. 229-248). Oxford: Oxford University Press.

Sagarra, N. (Forthcoming, 2013). Working memory in second language acquisition. In C.A. Chapelle (Ed.), *The Encyclopedia of Applied Linguistics.* Oxford, UK: Wiley-Blackwell.

Sagarra, N. and Ellis, N. (In progress). Processing L2 tense: Language experience and working memory effects. *Special issue "Morphological Processing" (Eds. M. Carreiras, J. Rueckl, & R. Frost). Language and Cognitive Processes.*

Sagarra, N. and Herschensohn, J. (2010). The role of proficiency and working memory in gender and number agreement processing in L1 and L2 Spanish. *Lingua, 20*, 2022-2039.

Sagarra, N., & Abbuhl, R. (forthcoming). Optimizing the noticing of face-to-face recasts via computer-delivered feedback: Evidence that oral input enhancement and working memory help L2 learning. *The Modern Language Journal*.

Sagarra, N., & Ellis, N. C. (2010). Learned attention and blocking in the acquisition of L2 Spanish tense. Bilingualism: Language and Cognition.

Sunderman, G., & Kroll, J. (2009). When study-abroad experience fails to deliver: The internal resources threshold effect. *Applied Psycholinguistics*, *30*, 79-99.

Swain, M. (2000). The output hypothesis and beyond: Mediating acquisition through collaborative dialogue. In J. P. Lantolf (Ed.), Sociocultural theory and second language learning (pp. 97-114). Oxford: Oxford University Press.

Tokowicz, N., & MacWhinney, B. (2005). Implicit and explicit measures of sensitivity to violation in second language grammar: An event-related potential investigation. Studies in Second Language Acquisition, 27, 173-204.

Tokowicz, N., Michael, E., & Kroll, J. (2004). The roles of study-abroad experience and working-memory capacity in the types of errors made during translation. *Bilingualism: Language and Cognition, 7*(3), 255-272.

Tolentino , L. C. , & Tokowicz , N. (2010). The relationship between ERP and behavioral

Tolentino, L. C., & Tokowicz, N. (2011). Second language Swedish morphosyntactic instruction and cross-language similarity: An ERP investigation. Paper to be presented at the Eighth International Symposium on Bilingualism, Oslo.

VanPatten, B. (1991). The Foreign Language Classroom as a Place to Communicate. In B. Freed (Ed.) Foreign Language Acquisition Research and the Classroom. (pp.54-73). Boston: D. C. Heath.

VanPatten, B. (1996). *Input processing and grammar instruction in second language acquisition*. New York: Ablex.

VanPatten, B. (2002). Processing instruction: An update. *Language Learning, 52*, 755-804.

VanPatten, B. (2004). *Processing instruction: Theory, research, and commentary.* Mahwah, New Jersey: Lawrence Erlbaum.

Walter, C. (2004). Transfer of reading comprehension skills to L2 is linked to mental representations of text and to L2 working memory. *Applied Linguistics, 25*, 315-339.

Wechsler D. (1997). *Wechsler Adult Intelligence Scale–Third Edition*. San Antonio: The Psychological Corporation;

Appendices

Appendix A: Consent form

Informed Consent Form for Biomedical Research

The Pennsylvania State University
Title of Project: *Learned Attention, Blocking, and Transfer in Language Acquisition*
Principal Investigator:*Nuria Sagarra. 211 Burrowes Bldg. University Park, PA 16802. sagarra@psu.edu. 814 865 1140*

1. **Purpose of the study:** The purpose of this research is to investigate attentional processes in language learning in adults. In particular, we explore the effects of short-term and long-term learned attention on explicit and implicit knowledge in a natural language. Approximately 308 people will participate in this study.
2. **Procedures to be followed:** You will be asked to complete a language background questionnaire, a proficiency test in Spanish, a vocabulary test, and a production task in class, and two short memory tests and two processing tasks in a laboratory.For the processing tasks, you will be asked to read/hear sentences in Spanish and select one of four pictures. The movement of your pupils will be recorded while you process the sentences and the pictures.
3. **Discomforts and risks:** There are no risks in participating in this study.
4. **Benefits:** The benefits to you include learning more Spanish. The benefits to society include advancing our understanding of theories about how adults learn foreign languages.
5. **Duration/time of the procedures and study:** Between 1hr30min and 1hr50min.
6. **Statement of confidentiality:** Your participation in this research is confidential. The data will be stored and secured at the investigator's office in a password protected file and a locked file cabinet. In the event of publication of this research, no personally identifying information will be shared. The Pennsylvania State University's Office for Research Protections and Institutional Review Board, and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this project.
7. **Right to ask questions:** Please contact Prof. Nuria Sagarra at 856-905-8841 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. If you have any questions, concerns, problems about your rights as a research participant or would like to offer input, please contact The Pennsylvania State University's Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.
8. **Payment for participation and alternative procedures that could be utilized:** Participants will receive 3 extra points over the final grade of their Spanish course for completing all tasks. Should you wish to discontinue your participation in this study, you will be compensated for the portion of the time that you spent participating in it. For example, if you complete half of the tasks you receive 1.5 extra points. If you do not wish to participate in the study, you will have an equal alternative to receive the 3 extra credit points, consisting of writing a 4500 word original composition in Spanish about the geography, economy, politics, and history of Spanish speaking country of your choice and turn it in to the research within the next two weeks
9. **Voluntary participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.
10. **Injury Clause:** In the unlikely event you become injured as a result of your participation in this study, medical care is available. It is the policy of this institution to provide neither financial compensation nor free medical treatment for research-related injury. By signing this document, you are not waiving any rights that you have against The Pennsylvania State University for injury resulting from negligence of the University or its investigators.
    You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and agree to the information outlined above, please sign your name and indicate the date below. You will be given a copy of this signed and dated consent form for your records.

_____ _____
Participant Signature Date

_____ _____
Person Obtaining Consent Date

Appendix B: Language background questionnaire

Preguntas sobre su experiencia con otras lenguas

Nombre: _____ Apellidos: _____
Sexo: M/H Edad: _____
Lengua nativa: _____
Lengua(s) hablada(s) en casa: _____
Lengua(s) habladas durante los primeros 5 años de vida: _____
Lengua(s) estudiadas en:
Colegio/instituto: _____Universidad/academia/otro: _____
Lengua(s) habladas en casa, en el colegio, en el trabajo, o con amigos o familiares:_____
Otras lenguas que puede:
leer: _____ escribir _____ hablar _____
¿Con qué lengua se siente ahora más cómodo (incluyendo su lengua nativa)?_____

Contacto con inglés:

¿A qué edad comenzó a aprender inglés? _____
¿Cuántas horas a la semana oye o habla inglés ahora? _____
¿Alguna vez ha vivido en el extranjero? Sí / No. Si sí:
¿Dónde? _____ ¿Cuándo? _____ ¿Por cuánto tiempo? _____

Appendix C: Proficiency test

GRAMÁTICA (NIVEL BÁSICO)

___ 1. _____ edificio alto es la Torre 'Sears'.
A. Eso B. La C. Aquel D. 0

___ 2. Los autos que chocaron en el accidente iban _____ el oeste.
A. dentro B. hacia C. fuera D. 0

___ 3. Los novios pasaron unas vacaciones fantásticas _____ fueron a Hawaii.
A. cuando B. que C. donde D. 0

___ 4. --¿Van a invitar al profesor y a su esposa a la reunión? –Sí, vamos a invitar _____.
A. ellos B. sus C. los D. 0

___ 5. Si no puedes usar tu bicicleta usa _____.
A. nuestra B. de él C. la mía D. 0

___ 6. A Juana no _____ gustan las películas de ciencia ficción.
A. le B. se C. la D. 0

___7. En nuestro barrio hay muchas casas bonitas, pero _____ Juan es la más bonita.
A. su B. de la C. la de D. 0

___8. --¿Conoces _____ hombre de la camisa verde? --¿Es muy guapo verdad?
A. un B. al C. esto D. 0

___9. Oscar no va a graduarse este semestre, ni yo _____.
A. tampoco B. ningún C. además D. 0

__10. --¿Con quién saliste al bar anoche? –No salí con _____; fui sola.
A. tú B. alguien C. nadie D. 0

___11. Estamos comprando _____ pan francés para la cena de mañana.
A. la B. hay C. algo D. 0

___12. La palabra 'venir' viene _____ Latín.
A. por B. en C. del D. 0

GRAMÁTICA (NIVEL INTERMEDIO)

____ 1. Por favor, _____ llegues a Madrid, me llamas.
A. desde que B. antes de C. cuando D. después de

____ 2. – ¿Hasta qué hora estuvo Lorenzo en la consulta?
– Pues no sé, no lo vi. Cuando yo llegué, a las 12, ya se _____.
A. iba B. ha ido C. fue D. había ido

____ 3. Hoy invito yo _____ todos al café, que es mi cumpleaños.
A. para B. de C. a D. sobre

____ 4. ¿_____ has pedido ya a tus padres?
A. Se te B. Se lo C. Se les D. Se le

____ 5. Manuel, como no _____ más fruta, no tendremos suficiente.
A. compres B. compras C. compraras D. comprarás

____ 6. ¿Que te vas a París? ¡Quién _____ tú!
A. es B. sea C. sería D. fuera

____7. Sinceramente, yo que tú _____ un mapa antes de viajar.
A. compraré B. compro C. compraría D. comprara

____8. La música de los vecinos está muy alta. Estoy _____ llamar a la policía.
A. a B. por C. entre D. tras

____9. El médico me dijo que _____ que volver mañana.
A. había tenido B. tuve C. tenía D. he tenido

____10. Por favor, en cuanto _____ a Lucía, dile que me llame.
A. verás B. veas C. ves D. vieras

____11. El regalo que _____ he comprado a Andrés es muy bonito.
A. lo B. se C. la D. le

____12. El profesor me pidió que _____ a sus horas de oficina.
A. iré B. vaya C. iría D. Iba

GRAMÁTICA (NIVEL AVANZADO)

____ 1. Ellos estaban dispuestos a que _____ nosotros en el coche y ellos andando.
A. íbamos B. fuimos C. iríamos D. fuéramos

____ 2. _____ como se enteraron de lo sucedido fueron a visitar a la familia.
A. Tan pronto B. No bien C. En cuanto D. Nada más

____ 3. Elisa llegó a la estación cuando el tren _____ de salir, ¡qué rabia!
A. acabó B. acaba C. acabaría D. acababa

____ 4. En cuanto deje la maleta en la habitación del hotel _____ meterme en la piscina, ¡qué calor!
A. creo B. debo C. pienso D. siento

____ 5. Carolina y Luis se casaron muy jóvenes, _____ cumplieron los 20 años.
A. al B. apenas C. de D. pronto

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

A. que B. de C. y D. como

___7. El jefe no se ha enfadado porque María _____ llegado tarde, sino porque no la había preparado bien.
A. ha B. haya C. había D. hubiera

___8. Al abuelo le encantaba que Juanito ___ a verle todos los días.
A. haya ido B. iba C.fuera D. iría

___9. Pedro va a hablar con el director, pero no quiere que ___ vaya con él.
A. algún B. alguien C. nadie D. todos

___10. Aunque ___ muy tarde, iré a verte al hospital, te lo prometo.
A. llegue B. llegara C. llegaría D. llegué

___11. Le dieron todo lo que pidió, ____ estuviera feliz y se quedara allí.
A. a saber B. por eso C. de ahí que D. por consiguiente

___12. Está __ nevar, así que abrígate bien.
A. para B. en C. si D. Entr

COMPRENSIÓN ESCRITA (NIVEL INTERMEDIO)

Las bicicletas también son para el otoño

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

__4__ estemos ante un deporte muy beneficioso, ya que no sólo mejora nuestra condición física, a la vez que nos hace más resistentes: __5__ tiene unos efectos anímicos extraordinarios. Elimina el estrés y hace que __6__ más eufóricos y enérgicos, __7__ supone encontrarnos mejor. Un último elemento que añadir para lograr este óptimo estado es el contacto con la naturaleza.

Para practicar ese deporte, debemos __8__ en cuenta algunos aspectos. El tiempo es una de las dificultades con __9__ que se cuenta si se vive en la ciudad. Hay que intentar sacar tiempo de __10__ sea para poder practicar nuestro deporte preferido. En el caso de la bici, lo ideal es salir todos los días aunque sólo __11__ un cuarto de hora, si bien se recomienda pedalear __12__ 40 y 45 minutos. También se pueden realizar tres sesiones a la semana __13__ a los 60 minutos, y los fines de semana __14__ de entrenar un poco más porque tenemos más tiempo libre. La distancia a recorrer dependerá __15__ la velocidad y el ritmo que __16__, aunque no hay que obsesionarse con los kilómetros. Otro elemento __17__ importante es la elección que hagamos de la bicicleta: de carretera para los más deportivos, de montaña para los __18__ de la naturaleza, y las híbridas, que valen para todo.

Con la bici ya escogida, sólo __19__ resta equiparnos adecuadamente. En el atuendo no debe __20__ un buen *culotte*, un *maillot*, un chubasquero por si llueve, y un casco.

___ 1.	a) acceder	b) practicar	c) ejecutar
___ 2.	a) límite	b) término	c) frontera
___ 3.	a) quien	b) quienes	c) que
___ 4.	a) De modo que	b) De ahí que	c) Así que
___ 5.	a) pero	b) sino	c) también
___ 6.	a) estamos	b) estemos	c) estaremos
___ 7.	a) lo que	b) el cual	c) cuyo
___ 8.	a) tener	b) considerar	c) darnos
___ 9.	a) lo	b) las	c) la
___ 10.	a) donde	b) como	c) cuando
___ 11.	a) sería	b) es	c) sea
___ 12.	a) entre	b) hacia	c) de
___ 13.	a) alrededor	b) en torno	c) cerca
___ 14.	a) tratar	b) intentar	c) esforzarse
___ 15.	a) en	b) de	c) a
___ 16.	a) corramos	b) vayamos	c) llevemos
___ 17.	a) más	b) tan	c) muy
___ 18.	a) amantes	b) aficionados	c) interesados
___ 19.	a) se	b) nos	c) le
___ 20.	a) faltar	b) sobrar	c) quedar

COMPRENSIÓN AUDITIVA (NIVEL INTERMEDIO)

Escucha el texto 2 veces y responde a estas preguntas:
http://diplomas.cervantes.es/docs/ficheros/200906180001_7_23.mp3

___1. En la audición, el doctor Becerra afirma que los chicles…
A. blanquean los dientes
B. ayudan a mantener el color de los dientes
C. no son recomendables

.

___2. El doctor Becerra opina que…
A. las técnicas de blanqueamiento caseras no son las más adecuadas.
B. el proceso de blanqueamiento es conveniente en cualquier caso o situación.
C. la belleza de los dientes reside en su forma y armonía.

___3. En esta audición se dice que el blanqueamiento de dientes debe hacerse…
A. siempre que sea necesario.
B. sólo una vez en la vida.
C. cada cinco meses.

___4. El doctor Becerra dice que…
A. todos los chicles son malos
B. sólo los chicles con azúcar son malos
C. es mejor comer chicles sin ingredientes que blanqueen los dientes

Appendix D: Grammaticality judgment test

Last name: _____ First name: _____ Subject ID: ES___

Si la frase es correcta, haga un círculo en SÍ. Si la frase no es correcta, haga un círculo en NO y corrija el error. Todos los errores son gramaticales.

1.En este instante la peluquera necesitan las tijeras para su trabajo.	SÍ	/	NO
2.Sospechan que anoche el esposo dibuja unas flores para su amante.	SÍ	/	NO
3.Piensan que ahora el niño escaló la montaña con sus padres.	SÍ	/	NO
4.Creen que la alumna adivina la respuesta ahora en el aula.	SÍ	/	NO
5.Dicen que la novia guardó su ropa ahora en el armario.	SÍ	/	NO
6.Dicen que la semana pasada el hombre preguntó la fecha en la reunión.	SÍ	/	NO
7.Por la mañana las chicas saltan a la cuerda en el parque.	SÍ	/	NO
8.Mencionan que el primo cocina unas patatas ahora para su hermana.	SÍ	/	NO
9.De repente los empleados llena las cajas con los papeles.	SÍ	/	NO
10.Hoy aprende las lecciones con su hermano.	SÍ	/	NO
11.Por la mañana cepilla el pelo del perro en la calle.	SÍ	/	NO
12.Comentan que el tío gritó la dirección el mes pasado por teléfono móvil.	SÍ	/	NO
13.Descubren que el año pasado la abuela escucha la noticia con su nieta.	SÍ	/	NO
14.Por la tarde recibe la noticia en la oficina.	SÍ	/	NO
15.Comentan que ayer la muchacha firmó la carta con sus amigas.	SÍ	/	NO
16.Por la noche el muchacho recoge el regalo para su novia.	SÍ	/	NO
17.Explican que la periodista imprimió el periódico ayer en papel reciclado.	SÍ	/	NO
18.Por la tarde barre el suelo en el comedor.	SÍ	/	NO
19.Cuentan que ahora el abogado llevó las gafas en la lluvia.	SÍ	/	NO
20.En este momento las mujeres manda las cartas a sus hijos.	SÍ	/	NO
21.Anuncian que el cantante graba la canción anteayer con sus amigos.	SÍ	/	NO
22.Avisan que la compañía investiga el robo la semana pasada en el banco	SÍ	/	NO
23.De repente el hombre apagan la radio en su cuarto.	SÍ	/	NO
24.Hoy mejoran la comida en la cocina.	SÍ	/	NO

25.En este momento cancelan la cita con la peluquera. SÍ / NO

26.Avisan que ahora la mujer factura su maleta con su hija. SÍ / NO

27.Por la tarde los abuelos cambian el dinero en la tienda. SÍ / NO

28.Comentan que el nieto limpió los vasos ahora para su abuela. SÍ / NO

29.En este instante cortan el césped en el jardín. SÍ / NO

30.Anuncian que ahora el jefe comparte las galletas con sus empleados. SÍ / NO

31. Hoy la abogada espera el vuelo con sus colegas. SÍ / NO
32. Por la noche cenan pescado en un restaurante. SÍ / NO

VITA

Jacqueline Gauthier

EDUCATION

December 2011 **French and Francophone Studies**
The Pennsylvania State University
December 2011 **Spanish, specialization in linguistics**
The Pennsylvania State University
Honors Thesis: Processing L2 Tense: A Cross-Linguistic Investigation
Director: Nuria Sagarra (SLA, psycholinguistics)
Advisors: Marc Authier (formal syntax) Willa Z. Silverman (French, Jewish studies)
December 2011 **Political Science, Minor**
The Pennsylvania State University

HONORS

2009-2011 **Schreyer Honors College**
Penn State's Schreyer Honors College is a prestigious, highly competitive college, dedicated to academic excellence, ethical development, and creating opportunities for leadership.

2008-2011 **Paterno Fellowship**
The goal of the Paterno Fellowship is an academic program (with strict academic performance requirements) available to students of the College of Liberal Arts to develop students who are distinguished and well rounded in many different aspects of the liberal arts, including ethics, service, leadership, and international and intercultural awareness.

REFEREED CONFERENCE PRESENTATIONS

2011 Sagarra, N., Ellis, N., & Gauthier, J. "Processing verbal morphological agreement in L1 and L2: Language experience, working memory and linguistic effects." 7th International Morphological Processing Conference. Basque Center on Cognition, Brain and Language. Donostia, Spain. 2011.

2011 Sagarra, N., Ellis, N., Gauthier, J., & Hauser, C. Language experience and cognitive factors affecting adult language acquisition. International Symposium on Bilingualism 8. University of Oslo, Norway.

2010 Sagarra, N., Ellis, N., Seibert Hanson, A., & Gauthier, J. "Transfer effects in the L2 processing of temporal reference." *Second Language Research Forum.* University of Maryland.

NONREFEREED CONFERENCE PRESENTATIONS

2011 Gauthier, Jacqueline. "The Diaries of Henri Vever: Life and Times of a Parisian Jeweler and Art Collector in Fin-de-Siècle France." 2011 Undergraduate Research Exhibition. Pennsylvania State University, University Park.

2009 Gauthier, Jacqueline. "A Complete List of Modern Day Texters." Penn Statements. The Pennsylvania State University. University Park: Pennsylvania State University, 2009.

RESEARCH EXPERIENCE

2009-2011 **Research Assistant** for Nuria Sagarra, Department of Spanish, Penn State

Data collection:

The screening tests consisted of a language background questionnaire, a Spanish proficiency test, and a grammar and vocabulary test. The eyetracking tasks were given using the Eyelink 1000 machine, which required me to calibrate the machine for each participant, and have knowledge to operate the machine during each of the two tasks (one reading, on listening). Finally I administered two cognitive tests: a Flanker test, and a letter-number sequencing working memory test.

Data extraction:

The data was extracted and organized in Microsoft Excel.

2009-2011 **Research Assistant**, Department of French and Francophone Studies, Penn State

Assisted Willa Silverman with the personal diaries of Henri Vever (1875-1932), including transcription and minor research on exhibitions, places, and theatrical performances.