DETECTING ERRORS IN SUBJECT-VERB AGREEMENT DURING
ON-LINE SENTENCE COMPREHENSION IN SPANISH

A Thesis
Presented to the
Faculty of
San Diego State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Linguistics

by
Broc Alan Glendinning
Summer 2010
The Undersigned Faculty Committee Approves the

Thesis of Broc Alan Glendinning:

Detecting Errors in Subject-Verb Agreement During On-Line Sentence
Comprehension in Spanish

Gregory D. Keating, Chair
Department of Linguistics and Asian/Middle Eastern Languages

Eniko Csomay
Department of Linguistics and Asian/Middle Eastern Languages

Gail Robinson
Department of Spanish and Portuguese Languages and Literatures

May 18th, 2010
Approval Date
ABSTRACT OF THE THESIS

Detecting Errors in Subject-Verb Agreement During On-Line Sentence Comprehension in Spanish

by

Broc Glendinning

Master of Arts in Linguistics
San Diego State University, 2010

One major difficulty in the field of Second Language Acquisition is attempting to accurately monitor how, and if, second language learners process various types of grammatical information during on-line (i.e., real-time) sentence comprehension. The present study addresses two questions: (1) Do advanced L2 learners have native-like knowledge of Spanish subject-verb agreement, and (2) Does linear distance between the noun and the verb affect advanced L2 learners’ processing of subject verb agreement? Utilizing eyetracking equipment, this experiment recorded the eye movements of native Spanish speakers and advanced English-speaking learners of Spanish as they read sentences in Spanish that contained grammatical and ungrammatical instances of subject-verb agreement. Ungrammatical items involved person and/or number errors on the verb. In addition, the linear distance between the subject and the verb varied between zero, three, and six words. By comparing the reading times of native and nonnative speakers, this study finds that nonnative speakers of Spanish display native-like knowledge of Spanish verb morphology and native-like processing of morphosyntactic subject-verb agreement features in Spanish along increasing linear distances. The results are discussed in light of current theories of grammatical processing in second language learners.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ABSTRACT</th>
<th>iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>viii</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td>On-Line vs. Off-Line Tasks</td>
<td>4</td>
</tr>
<tr>
<td>L2 Morphosyntactic Processing</td>
<td>8</td>
</tr>
<tr>
<td>Previous Studies of Gender and Number Agreement Processing</td>
<td>9</td>
</tr>
<tr>
<td>Previous Studies of Subject-Verb Agreement Processing</td>
<td>14</td>
</tr>
<tr>
<td>Summary</td>
<td>19</td>
</tr>
<tr>
<td>The Present Study</td>
<td>20</td>
</tr>
<tr>
<td>Subject-Verb Agreement in Spanish</td>
<td>20</td>
</tr>
<tr>
<td>Eyetracking Technique</td>
<td>22</td>
</tr>
<tr>
<td>Research Questions and Hypotheses</td>
<td>22</td>
</tr>
<tr>
<td>2 METHODS AND PROCEDURES</td>
<td>24</td>
</tr>
<tr>
<td>Participants</td>
<td>24</td>
</tr>
<tr>
<td>Advanced L2 Learners</td>
<td>24</td>
</tr>
<tr>
<td>Native Spanish speakers</td>
<td>25</td>
</tr>
<tr>
<td>Materials and Design</td>
<td>26</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1. Comparison Chart between English/Spanish Subject-Verb Agreement ....................21
Table 2. Mean First-Pass Times (ms) and Standard Deviations  (In Parentheses) ..................33
Table 3. Mean Second-Pass Times (ms) and Standard Deviations  (In Parentheses) ..............34
Table 4. Mean Total Times (ms) and Standard Deviations (In Parentheses) ..........................35
ACKNOWLEDGEMENTS

This project would not have been possible without the assistance of Dr. Gregory D. Keating. I would not only like to thank him for the use of his data but also many thanks for his inspiration, patience and guidance. I would also like to thank Dr. Gail Robinson and Dr. Eniko Csomay for their participation on my thesis committee. Of course I owe a huge thanks to my family for their love and encouragement and for providing me with the confidence to follow my dreams. Finally, I would like to dedicate this to my soon to be born son, who will be joining us in August 2010.
CHAPTER 1

INTRODUCTION

The present study examines whether or not advanced second language (L2) learners of Spanish display native-like processing of subject-verb agreement in Spanish across various linear distances. The processing behaviors of native Spanish speakers and advanced learners of Spanish were recorded and compared utilizing the eyetracking technique. This chapter provides an overview of language processing, experimental methodologies, previous research and the research questions at hand.

BACKGROUND

A primary aim of research in the field of L2 sentence processing is to determine to what extent L2 learners process their L2 in a native-like way. Some empirical evidence suggests that native-like L2 processing is possible (e.g., Keating, 2009; Tokowicz & MacWhinney, 2005; Wen, Miyao, Takeda, Chu, & Schwartz, 2010), while other evidence suggests that it is not possible (e.g., Clahsen & Felser, 2006; Jiang, 2004, 2007). Attempting to ascertain whether a learner of a second language can process certain grammatical features of his or her L2 in a native-like way is both a complex and arduous task. When non-native processing occurs, the current division resides on whether or not non-target like processing behavior is a result of representational deficiencies or, conversely, processing (performance) deficiencies. Proponents of representational deficiencies (e.g., Clahsen & Felser, 2006; Hawkins & Liszka, 2003; Sorace, 2003), claim that non-native processing is due to a representational deficiency, whereby L2 grammatical representations are different from those
of native speakers. In this view, L2 learners may explicitly learn grammatical features of their L2, but they never function as their native language grammatical representations do because they are not fully acquired and implicit features in their L2. On the other hand, proponents of processing deficiencies suggest that the mental representations of the L2 grammar do not distinctly differ from those of native speakers and that non-native processing is due to computational/procedural deficiencies (e.g., Haznedar & Schwartz, 1997; Ladiere, 1998; Prevost & White, 2000). In this version the constraints of working memory, assigning grammatical structure to input strings, time pressures, and so forth while communicating or completing an on-line task may tax or overburden the processing capabilities of L2 learners, thus limiting their ability to efficiently process complex morphological, syntactic and lexical information during real-time experiments. Nevertheless, both approaches to second language acquisition share one important question. Can non-native speakers achieve native-like knowledge and processing in their L2?

A special case in point in regards to this representational vs. performance debate is the L2 processing of morphosyntactic agreement features (e.g., number, person and gender) across languages, as these have often been a source of great difficulty for L2 learners. For example, some studies have found that native-like agreement processing in the L2 is not possible and that this is due to representational deficiencies (e.g., Clahsen & Felser, 2006; Jiang, 2004, 2007) whereas others have proposed that native-like L2 processing of agreement is possible (e.g., Keating, 2009; Wen et al., 2010) and that any divergent processing between the L1 and L2 is not a result of representational deficiencies, but rather processing (performance) difficulties. This performance vs. representational deficiency debate has not only prompted numerous studies but has also offered a variety of explanations to try and
explain the divergent morphological agreement processing behaviors between native speakers and L2 learners. Some explanations attribute non-native processing to the effects of feature (dis)similarity between languages and L1 transfer/interference (Sabourin & Stowe, 2008; Tokowicz & MacWhinney, 2005), ‘selective integration’ or non-integration of certain grammatical features (Jiang, 2004, 2007), the utilization of processing strategies that don’t account for detailed syntactic or lexical information during comprehension (e.g., Clahsen & Felser, 2006; Keating, 2009), and the effects of proficiency levels (e.g., Keating, 2009; Ojima, Nakata, & Kakigi, 2005).

In addition to the accounts above, some studies (Keating, 2009; Myles, 1995; O’Grady, Lee & Choo, 2003; Wen et al., 2010) have investigated whether or not the effects of linear and structural distance between the controllers and targets of agreement may partially account for divergent L2 processing. Measurements of linear distance (in regards to agreement) are defined as the raw number of words between two agreement elements and structural distance refers to the number of phrases, or amount of embedding, between two agreement elements. For example, subject-verb agreement in English allows for adjacency between the subject and the verb, whereby the verb immediately follows the subject as in (1). English also allows for intervening elements between the subject and verb of the sentence, as seen in sentences (2) and (3).

(1) \[\text{[NP The girl [VP speaks Spanish.]]} \text{ (linear distance = 0 words; structural distance=1 VP).}\]

(2) \[\text{[NP The girl [VP rarely speaks Spanish.]]} \text{ (linear distance =1 word; structural distance = 1 VP).}\]

(3) \[\text{[NP The girl in the store [VP speaks Spanish.]]} \text{ (linear distance =3 words; structural distance= 1 VP).}\]
Given that agreement constructions in languages (1) have been especially problematic for second language learners, (2) are instantiated in the grammars of some languages and not others, and (3) can appear in various locations in a sentence, the manipulation of distance between the controllers and targets of agreement in research methods seems especially relevant to SLA in general, and to this study specifically. The present study is directed at L2 processing of agreement features and whether or not linear distance affects L2 processing. More specifically, this study examines whether L2 learners of Spanish are able to detect subject-verb agreement violations during real-time sentence comprehension and whether error detection in this domain is affected by linear distance between the subject and the verb.

Before examining previous research and its relevance to distance accounts, a brief overview of different research methods will be explored.

**ON-LINE VS. OFF-LINE TASKS**

The data collection methods utilized in morphological processing studies have also received considerable attention in the debate between representational deficit vs. performance accounts. Much of the early research on the acquisition of morphology involved the utilization of off-line tasks such as spontaneous speech tasks, free production tasks and untimed grammaticality judgment tasks. The problem has often been how to effectively prevent learners from utilizing explicit (learned) rather than implicit (acquired) knowledge of the forms being tested, as many of the types of off-line tasks mentioned above include the potential involvement of explicit knowledge. For example, the use of a written untimed grammaticality judgment task might allow an L2 learner to utilize explicit knowledge about grammatical rules to successfully answer questions about the L2 grammatical forms in question. While this type of task is useful in determining their explicit knowledge of the L2,
it does not report anything about the actual processing routines they are utilizing during comprehension or production of their L2 in real time. With the advent of newer experimental on-line techniques, such as Event-Related Potential (ERP) studies, eyetracking studies, timed grammaticality judgment tasks and self-paced reading tasks, researchers have begun to observe the immediate effects of grammatical errors on reading behavior in L2 learners, which allows for a more accurate depiction of the real-time processing routines of L2 learners.

Studies utilizing self-paced reading tasks such as moving-window designs have been widely used in psycholinguistic inquiry. Experiments of this type usually involve text that is divided into words or phrases and displayed one word or phrase at a time on a computer screen. The words are often presented left to right (so as to mimic natural reading behavior) and the participant presses a predetermined key or button to display the next word or segment onto the screen. The main measure in this type of task is the time between key presses. In this way the reading times for an ungrammatical trigger word or segment can be observed and recorded. In these types of tasks, longer reading times on ungrammatical segments relative to grammatical control segments are thought to be indicative of processing difficulties, or sensitivity to the violation. If no reading time differences are observed between grammatical and ungrammatical segments, then it is indicative that the violation did not pose any processing difficulty for the participant suggesting no sensitivity to the violation. While self-paced reading times offer valuable insights into L2 processing of morphology, the observation of much more complex and detailed processing behaviors are also available.
ERP studies measure neuronal reactions (electrical signals in the brain) to sensory stimuli and cognitive processes by placing nodes onto the surface of the scalp. As it relates to linguistic inquiry, various stimuli (usually an ungrammatical trigger word) are used during language comprehension and it is thought that “different ERP components appear to correlate with specific processes” (Carreiras & Clifton, 2004, p. 6). For example, different effects have been observed for semantic anomalies and syntactic anomalies. Reactions to a trigger word during semantic violations are considered to have a negative brain wave pattern peaking around 400ms, or the N400. In regards to syntactic information, two different readings have been utilized: a left-anterior negativity (LAN) and late centro-parietal positivity (P600), whereby P600 refers to positive brainwave pattern peaking at 600ms or more upon reading a trigger word. LAN effects and positive P600 readings have been linked to both syntactic and morphsyntactic violations during sentence comprehension. When utilized against a native speaking control group, neuronal reactions can be compared with those of L2 learners, thus giving an account of real-time L2 processing reactions during comprehension tasks. While this ‘mapping’ of brainwaves during sentence comprehension has been extremely valuable in the investigation of morphological processing, another data collection method has also proved quite valuable.

Eyetracking studies have also been useful in capturing real-time processing routines during sentence comprehension. In this technique the recording of the minute eye movements during reading comprehension are recorded and analyzed. While the measurement of reading times during the moving window technique mentioned above can record how long it takes to read a particular word or segment of a sentence, eyetracking offers an even more detailed measurement to include saccades (left or right movements) and
re-fixations on a word or segment. In this manner an arguably more ‘natural’ reading state can be accounted for as entire sentences can be displayed on a computer screen and participants’ ‘natural’ reading behaviors can be recorded. These detailed measurements can include reading times on a trigger word and multiple fixations and re-fixations on this word can be recorded and analyzed, thus allowing researchers to “draw inferences about cognitive operations while reading” (Carreiras & Clifton, 2004, p. 4).

In summarizing these more recent techniques, it is believed that longer reading times on ungrammatical words or sentences (moving window technique, timed grammaticality judgment tasks and self-paced reading experiments), increased reading times and regressive eye movements (eyetracking technique) and neuronal reactions to ungrammaticalities (ERP studies) during on-line experiments signal processing difficulties indicative of implicit knowledge/behavior characteristic of native speakers. This is especially true if the experiment is carefully controlled and participants have no prior knowledge of any grammatical forms being tested and if a focus on comprehension rather than grammatical form is utilized. If this is true, then investigation into the real-time processing routines of L2 learners and the observation and recording of these processing routines during on-line tasks offer a much more reliable measure of implicit knowledge by effectively reducing the ability to utilize explicit knowledge. The result is that these studies will measure implicit real-time behavior/reactions as opposed to measuring potential ‘learned’ knowledge of the L2. While off-line tasks may have limitations in comparison to on-line processing studies, they offer useful data in determining explicit knowledge of the grammatical forms in question and a combination of on-line and off-line tasks is often utilized in current data collection methods. In this way, a learner may show native-like explicit knowledge of a grammatical form in an
off-line grammaticality judgment task, but may not show native-like implicit processing of
the same form in an on-line task. On-line techniques have allowed researchers to investigate
the L2 processing of a variety of grammatical constructions including the processing of
morphosyntactic agreement violations, a topic to which I turn.

**L2 MORPHOSYNTACTIC PROCESSING**

To date, relatively few morphosyntactic agreement studies have specifically
manipulated distance. Linear and structural distance accounts have largely been used to
study the effects of distance in relation to filler gap dependencies and wh-movement rather
than in the morphosyntactic domain. Even so, previous studies relating to agreement have
been useful and have helped shed light on the effects of distance on L2 morphosyntactic
processing. By examining previous studies and accounting for distance effects between
them, it becomes apparent that the distance between the controllers and targets of agreement
constructions may indeed have a bearing on L2 morphosyntactic processing. Most previous
agreement studies have focused on gender and number constructions. These studies have
produced conflicting results that further divide the representational vs. performance accounts
of L2 processing mentioned earlier. As is relevant to this study, morphosyntactic processing
of subject-verb agreement in L2 learners has been of special interest, particularly since this
type of inflectional morphology has often been a great source of difficulty for L2 learners. In
addition, the fact that these types of agreement constructions can occur in different syntactic
locations in a sentence makes them prime candidates for examining the effects of structural
and/or linear distance. The following sections will provide an overview of previous studies
in two domains of morphosyntactic agreement: gender and number agreement between nouns
and modifiers and subject-verb agreement.
PREVIOUS STUDIES OF GENDER AND NUMBER AGREEMENT PROCESSING

The fact that the some languages encode gender and number agreement between nouns and modifiers, and the fact that others do not, make them especially relevant constructions for L2 learners and studies of L2 processing. If a learner’s L1 lacks these features and L2 learners with advanced/near-native proficiency show no sensitivity to agreement violations, then representational deficiency accounts could claim that these features are not acquirable in adult SLA. Performance accounts lay claim that these features are indeed acquirable but processing constraints may hinder efficient processing of the feature.

Seeing that it has been widely documented that English’s nominal plural –s has been a great source of difficulty for Chinese learners of English (Chinese lacks such a feature), Jiang (2007) investigated advanced Chinese learners’ processing of English nominal plural –s within NPs in sentences such as (4a-b). In a self-paced reading task, participants were instructed to read sentences word by word on a computer monitor and answer comprehension questions about the sentences as quickly as possible.

(4) a. The visitor took several of the rare coins in the cabinet.
   b.*The visitor took several of the rare coin in the cabinet.

Reading time results indicated that the L2 learners were not sensitive to the violations in sentences such as (4b), as there was no significant difference between reaction times on grammatical and ungrammatical plural noun forms. Jiang (2007) concluded that these non-native speakers were not sensitive to the plural –s and attributed this to ‘selective integration’ and the ‘nonintegratable’ nature of the plural morpheme for these learners. While this study
featured a structure that was unique to the L2 (English), the next study investigates a structure that is instantiated in the L1 and L2.

Sabourin and Stowe (2008) recorded the ERPs of L2 Dutch learners with German and Romance languages as their L1. They investigated non-adjacent agreement constructions of gender and ‘verbal domain dependency’ (grammatical and ungrammatical instances of infinitive and past participle verbal inflections). Although both agreement features are instantiated in German and Romance languages, they do differ in their constructions. German and Dutch gender features are very similar, down to the lexical level and draw a nearly complete one to one mapping (e.g., Dutch neuter = German neuter) while gender in Romance languages is different at the lexical level and allows for several mapping conditions (e.g., masculine = common or neuter; feminine = common or neuter). In the verbal domain dependency (7), both German and Romance languages pattern like Dutch in utilizing the past participial form of the verb in finite constructions and the infinitive form of the verb for non-finite constructions. Participants read sentences word by word on a computer screen with both grammatical and ungrammatical instances of gender and verb constructions, like those found in (5), (6) and (7) below.

(5) Het/*De kleine kind probeerde voor het eerst te lopen.
The neut/*com small child neut tried for the first to walk.
‘The small child tried to walk for the first time.’

(6) Hij komt eraan met de/*het verse koffie.
He comes to with the* neut/com fresh coffee com.
‘He is coming with the fresh coffee.’

(7) Ik heb in Groningen gewoond/*wonen.
I have in Groningen lived pastpart/*to live inf.
‘I have lived in Groningen.’

Results indicated that only those with German as their L1, and not Romance languages, showed a P600 effect for Dutch grammatical gender agreement in sentences such
as (5) and (6) above. However, both L2 groups showed sensitivity to the ungrammatical participial and infinitive inflectional forms in sentences such as (7) above. According to this study, the results for sensitivity to gender agreement for the German speakers was due to the fact that German and Dutch gender features are very similar, down to the lexical level. In regards to agreement in the verbal domain, both L2 groups (German and Romance languages) showed sensitivity and both groups were able to detect ungrammatical instances of participial and infinitive inflectional forms. The authors conclude that their results in regards to the verbal domain are consistent with the hypothesis that native-like processing is possible, at least when constructions are similar (down to the lexical level) and they are able to make use of their L1 processing routines in their L2. In regards to insensitivity in the gender domain for the Romance languages, this is an especially interesting outcome because Romance languages do indeed instantiate gender in their grammar. It was therefore proposed that it is not sufficient enough to have gender in the L1 but the features must also be very similar to that of the L1, even down to the lexical level and that the degree of (dis)similarity between the L1 and L2 determines the extent to which L2 morphological processing is native-like. While this study investigated two constructions that varied in similarity but that were instantiated in both grammars, the following study includes a third construction, a feature that was completely unique to the L2.

Tokowicz and MacWhinney (2005) measured the ERPs of beginning L2 learners of Spanish with English as an L1 and investigated the effects of three morphosyntactic constructions between English and Spanish. The three features in the study included a grammatical pattern that was formed similarly between English and Spanish (auxiliary omission) as seen in sentence (8) below, a construction that was different between both
languages (determiner-noun number agreement) as seen in sentence (9), and finally a constructions that was unique to the L2 (Spanish gender) as in sentence (10). In this grammaticality judgment task, participants read sentences in Spanish word by word on a computer monitor and were then required to indicate (via a button press) whether the sentences were grammatically acceptable.

(8) Su abuela *cocinando/cocina muy bien
His grandmother *cooking/cooks very well
‘His grandmother cooks very well.’

(9) *El niños están jugando
*The boys are playing
‘The boys are playing.’

(10) *Ellos fueron a un fiesta
*They went to a party
‘They went to a party.’

Results indicated positive P600 effects and sensitivity for gender (unique to the L2), marginal sensitivity to auxiliary omission (similar construction) and no sensitivity to determiner number agreement (different construction). The accuracy rates for the grammaticality judgments exceeded chance for auxiliary omission and determiner/number agreement and were at chance for the gender constructions. They posited that beginning learners of Spanish are only sensitive to violations of particular types and are dependent upon the match or mismatch between the L1 and L2 and concluded that the implicit processing of an L2 apparently depends on the similarity or dissimilarity between the L1 and L2. Specifically, they claimed that the unique construction (gender agreement) was sufficiently ‘learned’ and was thus not a problem for these L2 learners and that this construction did not ‘compete’ with any constructions in their L1 (English). So, acquisition of this type of unique feature is not hindered by the L1. In regards to determiner number agreement, the researchers propose that, since these features do exist in both languages (even though the constructions are
formed differently), participants essentially attempted to process these construction as they would in their L1, which resulted in unsuccessful processing and insensitivity to number determiner constructions in Spanish. While this study did provide useful information into morphological processing strategies of L2 Spanish learners, it ultimately fell short due to the fact that there was no native Spanish speaker control group with which to compare the results. Additionally, all agreement items in the study involved adjacent elements and only beginning learners were tested, issues that were addressed in the next study.

Keating (2009) conducted an eyetracking study which investigated sensitivity to grammatical gender errors across increasing structural distances in beginning, intermediate and advanced L2 learners of Spanish with L1 English (a language that lacks grammatical gender). In his stimuli, gender errors between the head noun and adjective were separated by three syntactic structural distances; adjectives within the DP, as in (11) where the head masculine noun *libro* ‘book’ was immediately followed by an ungrammatical adjective *larga* ‘long’, adjectives in the VP of the matrix clause, as in (12), and adjectives in a subordinate clause as in (13).

(11) *Un libro largo generalmente no se puede leer en un par de horas.*
   *A long book generally cannot be read in a few hours.*

(12) *Una película es bastante larga cuando dura más de tres horas.*
   *A movie is quite long when it lasts more than three hours.*

(13) *Un refresco tiene muy buen sabor cuando está frío y no caliente.*
   *A soda tastes very good when it’s cold and not hot.*

He determined that advanced L2 learners were indeed sensitive to gender errors within the DP, as in (11). However, neither of the three non-native speaking groups showed sensitivity in sentences such as (12) and (13), in which the head noun and ungrammatical adjective were
structurally separated by phrasal and/or clausal boundaries. In contrast, the native speakers showed sensitivity to gender violations at all three structural distances. Since the advanced learners reported sensitivity to gender agreement errors within the DP, Keating (2009) ultimately claimed that knowledge of gender agreement is acquirable in adult SLA. Since the advanced learners did not show sensitivity to gender agreement in non-local domains like native speakers did, he suggests that while native-like knowledge of gender agreement is acquirable, native-like processing of agreement may be limited to local domains. He concludes that his results support the Shallow Structure Hypothesis (SSH) proposed by Clahsen and Felser (2006), which suggests that L2 learners only attend to less detailed syntactic knowledge during comprehension and that processing capacities limit this knowledge to local domains (i.e., within a phrase). Since the intermediate and beginning learners did not show sensitivity, he proposed that gender agreement is acquired late. While this is indicative of processing limitations in agreement constructions across structural distances, whether or not linear distances would reflect similar results was not part of the study.

**Previous Studies of Subject-Verb Agreement Processing**

Previous studies relating to number agreement have also included stimuli in various syntactic domains and have resulted in conflicting accounts of L2 agreement processing. Since grammatical agreement features are rarely utilized in Chinese, this construction has been a source of great difficulty for Chinese learners of English. Jiang (2004; Experiment 2) investigated whether advanced L2 English speakers with Chinese as an L1 displayed sensitivity to number agreement violations between the subject and the verb in sentences in
which the head noun and the verb were separated by a prepositional phrase, as in (14). In a self-paced reading task, participants read such sentences on a computer and were asked to read sentences as quickly as they could and then answer comprehension questions based on the sentence they just read.

(14) a. The bridges to the island were about ten miles away.
    b. *The bridge to the island were about ten miles away.

Results indicated significantly longer reading times on the ungrammatical constructions for the native speaker control group reading the same sentences, indicating that the native speakers were sensitive to the agreement violations. However, the L2ers displayed no such increase in reading time on ungrammatical sentences, an indication that the subjects were not sensitive to English number agreement. This was ultimately, according to Jiang, a non-integrated feature in their L2, thus accounting for a representational deficiency in their L2. A potential flaw of this study is that all sentences involved agreement between non-adjacent elements as can be seen by the prepositional phrase separating the subject and verb in (14). A possible consideration is that this distance effect may have led to a premature conclusion.

In another study relating to the fact that Chinese rarely encodes grammatical morphology for number and presents substantial difficulties for Chinese learners of English, Chen, Shu, Liu, Zhao, and Li (2007) investigated sensitivity to subject-verb agreement with L2 Chinese learners of English. The ERPs of 15 ‘proficient’ Chinese learners (as well as a native speaker control group) were recorded during a grammaticality judgment task whereby sentences with a subject noun modified by a prepositional phrase and followed by a verb phrase were presented. The four versions of the sentences were constructed by creating mismatches between the local noun in the prepositional phrase and following verb as in (15).
Participants read sentences word by word on a computer screen and were asked to make a judgment as to the acceptability of the sentences.

(15)  a. The price of the car was too high. (agreement & local match)
       b. The price of the cars was too high. (agreement & local mismatch)
       c. * The price of the cars were too high. (disagreement & local match)
       d. * The price of the car were too high. (disagreement & local mismatch)

Accuracy rates for correct grammaticality judgments ranged between 85-95% and were indicative that the learners had excellent knowledge of the agreement features.

Contrastingly, ERP results reported that native speakers showed both LAN and P600 effects for sentences like (15c) and (15d), but the L2 learners showed neither, which is indicative that the L2 learners did not show sensitivity or process the agreement violations during real-time processing. As mentioned, the motivation for this study was a result of the significant difficulties that Chinese learners of English have with English subject-verb agreement constructions. The researchers suggested that “language-specific properties of Chinese influence learners’ processing characteristics” (p. 163) and reason that the unique properties of Chinese grammar, specifically its lack of grammatical number/agreement features, greatly influence the processing patterns in their L2, in this case English.

In another study, this time motivated by critical period accounts (L2 learning after childhood) and proficiency levels (intermediate and advanced), Ojima, Nakata, and Kakigi (2005) recorded the ERPs of intermediate and advanced Japanese learners in an attempt to discern whether proficient late learners of English were able to demonstrate native-like processing of subject-verb agreement, even though number morphology is not instantiated in Japanese. Participants read sentences in English such as those in (16) in which a subject and adjacent verb were presented in grammatical and ungrammatical sentences.

While native speakers showed both LAN and P600 effects and sensitivity to agreement violations, the advanced learners showed a LAN effect but no P600 effect and the intermediate showed neither. In regards to the advanced learners, the researchers proposed that sensitivity may increase as proficiency increases, but the absence of a P600 effect ultimately forced them to conclude that L2 learners may show ‘some’ sensitivity to agreement and that further investigation is needed.

Another study by Sato and Felser (2008) investigated the extent to which L2ers are sensitive to subject-verb agreement. Subject-verb agreement constructions in sentences were utilized whereby a singular or plural subject-noun phrase was followed by an adverb and a subsequent unmarked (ungrammatical) form of the verb (17b) or the third person singular form (17a). The study also included case agreement violations as in (18a-b) in which transitive verbs with a personal pronoun in the accusative were followed by either the nominative or possessive form. The items were presented in a speeded grammaticality judgment task and participants were asked to respond to the grammatical acceptability of the sentence as quickly as they could. Participants included L2 learners of English with German, Japanese and Chinese as their L1s.

(17)  a. She rarely flirts. b. *She rarely flirt.
(18)  a. He admires her. b. *He admires she

Despite the fact that all three groups displayed excellent knowledge of agreement in a supplementary off-line task, all three non-native groups had significantly longer reading times on case violations (18b vs. 18a) but not agreement violations (17b vs. 17a), suggesting that they showed no sensitivity to and had difficulty identifying subject-verb agreement errors. They also reported that their results support previous findings that learners have significant problems with subject-verb comprehension in their L2. They postulate that their
results reflect the fact that “nonnative comprehenders have difficulty building native-like hierarchical representations of the kind that mediate discontinuous morphosyntactic dependencies” (p. 32).

Finally, a recent study concerning agreement was conducted by Wen et al. (2010) using a self-paced reading task. Their study was motivated by the growing debate regarding distance effects and proficiency levels as contributing factors to nonnative processing, so they specifically manipulated distance in their agreement constructions. Their sentences consisted of simple NPs in which agreement violations were created between demonstratives and the nouns they modified. Distance was also manipulated by inserting an intervening adjective, as in sentences (19) and (20) below. The participants included intermediate and advanced L2 learners of English with Japanese and Chinese as their L1.

(19) Jill sold this beautiful house to her niece every evening.
   *Jill sold this beautiful houses to her niece every evening.

(20) Jill sold these beautiful houses to her niece every evening.
   *Jill sold these beautiful house to her niece every evening.

The results reported that the advanced learners did indeed show sensitivity to number agreement violations and that ‘non-local’ linear distance (agreement separated by an adjective) was not a hindrance to processing. However the intermediate participants did not show any sensitivity. They attribute these findings to be in line with the performance approach and that L2 learners can acquire native like knowledge of number agreement and that previous findings accounting for insensitivity may be a result of the processing demands imposed by the structural distances utilized in the stimuli of previous studies. While their stimuli do address non-adjacency with a linear distance of one word between agreement elements, it is not clear whether increased linear distance would pose a problem for L2 learners.
SUMMARY

In sum, the empirical evidence thus far supports both representational and performance accounts of agreement processing in L2 learners. Several agreement features across several languages have been investigated and various experimental methods have been deployed in an attempt to ascertain whether or not various agreement features can be acquired in various L2s. It is interesting to note that when the results of the previous studies are compared against each other, it appears that distance between the controllers and targets of agreement influence L2 processing. Of the previous studies, the distance between the controllers and targets of agreement can be divided in two classifications: those that included adjacent constructions (Chen et al., 2007; Keating, 2009; Ojima et al., 2005; Tokowicz & MacWhinney, 2005) and those that included non-adjacent constructions (Jiang, 2004, 2007; Keating, 2009; Sabourin & Stowe, 2008; Sato & Felser, 2007 Wen et al., 2010). Of the studies that had adjacency between the (dis) agreement elements, all reported that they did have sensitivity or at least some sensitivity (Keating, 2009; Ojima et al., 2005; Tokowicz & MacWhinney, 2005). So, when controllers and targets of agreement were juxtaposed, results often indicated sensitivity to agreement violations. In those studies with non-adjacent constructions almost all reported insensitivity (Jiang, 2004, 2007; Keating, 2009; Sato & Felser, 2007). In other words, when the controllers and targets of agreement were not juxtaposed and instead contained intervening words/phrases between them, results indicated insensitivity to agreement. So, it appears that when the agreement features are adjacent, subjects often show sensitivity but when they are not adjacent, they do not show sensitivity. Whether or not the distance between the controllers and targets of agreement accounts for the resulting insensitivity is still unclear. The research design in this study attempts to address
this question by purposefully manipulating the distances between the controller and targets of agreement.

With the exception of Keating (2009) and Wen et al. (2010), few studies have purposefully manipulated the distance (structural and/or linear) in agreement constructions. In Keating’s (2009) study, the increasing structural distance between his agreement constructions of gender in Spanish resulted in insensitivity to non-adjacent (non-local) constructions. What is not clear is whether or not linear distance and non-adjacency will have the same effect in regards to the processing of subject-verb agreement. Furthermore, while Wen et al.’s. (2010) study resulted in sensitivity to agreement in non-local domains with an intervening adjective (linear distance of one word), it is not clear whether longer distances will pose a problem to L2 learners. The current study addresses these issues by investigating whether or not L2 learners of Spanish will show sensitivity to instances of subject-verb agreement in non-adjacent constructions.

THE PRESENT STUDY

The present study utilizes subject-verb agreement constructions in Spanish, an excellent test case for examining agreement violations across distances.

Subject-Verb Agreement in Spanish

Although English has subject-verb agreement, person/number agreement is only required for the third person in the present tense. Contrastingly, subject-verb agreement in Spanish is much more marked than that of English and requires agreement in both number and person, each of which is morphologically marked on the suffix of the verb. English has a remarkably small inventory of suffixes by comparison. See Table 1 for a comparison of English and Spanish conjugation for the verb *hablar* ‘to speak’.
Table 1. Comparison Chart between English/Spanish Subject-Verb Agreement

<table>
<thead>
<tr>
<th>Person</th>
<th>Number</th>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Singular</td>
<td>speak</td>
<td>hablo</td>
</tr>
<tr>
<td>2nd</td>
<td>Singular</td>
<td>speak</td>
<td>hablas</td>
</tr>
<tr>
<td>3rd</td>
<td>Singular</td>
<td>speaks</td>
<td>habla</td>
</tr>
<tr>
<td>1st</td>
<td>Plural</td>
<td>speak</td>
<td>hablanos</td>
</tr>
<tr>
<td>2nd</td>
<td>Plural</td>
<td>--</td>
<td>hablais</td>
</tr>
<tr>
<td>3rd</td>
<td>Plural</td>
<td>speak</td>
<td>hablan</td>
</tr>
</tbody>
</table>

As in English, explicit subject pronouns and verbs in Spanish can be adjacent or separated by intervening words or phrases. Sentences (19-21) illustrate some ways in which the linear distance between nouns and verbs can be increased by the insertion of prepositional phrases, such as (21) where there is adjacent agreement between the subject and the verb (linear distance = 0 words) and (22) where there is an intervening prepositional phrase between the subject and verb (linear distance = 3 words) and (23) where two intervening prepositional phrases separate the subject and verb (linear distance = 6 words).

(21) La chica habla español.
   ‘The girl speaks Spanish.’

(22) La chica en la tienda habla español.
    ‘The girl in the store speaks Spanish.’

(23) La chica en la tienda de ropa femenina habla español.
    ‘The girl in the woman’s clothing store speaks Spanish.’

The ‘rich’ morphological agreement system of Spanish, along with the fact that verbs can be displaced from the nouns they agree with, make subject-verb agreement an ideal
construction to investigate. The present study utilizes similar constructions to those in (21-23) in order to investigate advanced learners’ sensitivity to subject-verb agreement in Spanish by means of the eyetracking technique, a technique that has proven to be an exceptional data collection method in studies relating to L2 grammatical processing and distance effects.

**Eyetracking Technique**

Eyetracking is a relatively new experimental technique only recently used in studies of L2 grammatical processing. The recording of the eye movements of participants in this study was used to examine participants’ sensitivity to subject-verb agreement errors. The technique is designed to record the complex eye movements one makes while reading text. These minute and extremely rapid eye movements include fixations and saccades (left or right movements) that are recorded and can be analyzed in relation to specific regions within a sentence, whether it be a word or sentence or portion thereof. The advantages of eyetracking over other types of on-line tasks, such as self-paced reading tasks, is the level of definition that can be observed in eyetracking. Whereas a self-paced reading study can only offer a single measurement (reading time on a particular region of interest), eyetracking can measure first-pass reading times (initial reaction to a region of interest (ROI)), second-pass reading times (considered to reflect re-analysis of a ROI) as well as total times (first-pass and subsequent reading times) (Frenck-Mestre, 2005). In the present study, the eyetracking technique provides a useful method for studying agreement constructions involving non-adjacent elements displaced by various linear distances.

**Research Questions and Hypotheses**

The present study addresses the following research questions and hypotheses:
1. Do advanced L2 learners of Spanish have native-like knowledge of subject-verb agreement?

In the present study it is assumed that if L2ers show sensitivity to violations of subject-verb agreement when nouns and verbs are adjacent then learners have acquired the person-number suffixes and the morphosyntactic agreement constructions of Spanish. As noted, previous research has concluded that when agreement constructions were adjacent to each other results indicated sensitivity to agreement violations. When constructions were non-adjacent they didn’t report any sensitivity to agreement violations. Therefore it is predicted that these L2 learners will be sensitive to violations of subject-verb agreement when the nouns and verbs are adjacent.

2. Does linear distance between the noun and the verb affect advanced L2 learners’ processing of subject verb agreement?

In light of previous research showing that L2 learners are less likely to show sensitivity to agreement violations when the target and controllers of agreement are separated, this study seeks to show that increased linear distances will result in insensitivity to agreement violations.
CHAPTER 2

METHODS AND PROCEDURES

This section provides a description of the materials used and the design of the study as well as the participant criteria, the method in which they were tested and the eyetracking apparatus used to collect the data. The methods and procedures described herein were provided through the research efforts of Dr. Gregory D. Keating, director of the Second Language Processing Laboratory at San Diego State University. The research was funded by a faculty research grant awarded to Dr. Keating for the purposes of studying native and nonnative Spanish speakers’ sensitivity to agreement violations in Spanish.

PARTICIPANTS

The current study examined a total of 31 participants, which included 13 advanced L2 learners of Spanish and 18 native Spanish speakers. The participation criteria for each group are presented below.

Advanced L2 Learners

The advanced L2 learners were native English speakers and included those with extensive academic study and exposure to the Spanish language. The central criteria for these participants to be considered for the study required that (1) they be native English speakers, (2) spoke English only at home, (3) have a B.A. or equivalent in Spanish and (4) have acquired Spanish in adulthood (post puberty). These participants were to have been raised in an English speaking household and were to not have studied any other languages.
besides Spanish and Spanish study was not to have begun any earlier than middle school. Due to the large number of heritage speakers in San Diego and the strict advanced learner criteria, the advanced learner participants were recruited from two universities: San Diego State University and Texas Tech University. The participants were primarily graduate assistants in the Spanish department who had completed a B.A. degree or equivalent in Spanish and were pursuing an M.A. or Ph.D. in Spanish. Participants also included faculty who possessed advanced degrees in Spanish. The average age of the advanced learner participants at the time of the experiment was 34 years of age (range: 22-56 years of age). Participants reported they began learning Spanish at an average age of 14.46 years of age (range: 12-21 years). All of the advanced learners reported having spent an average of 12.83 months abroad in a Spanish speaking country (range: 3-30 months).

Native Spanish speakers

The native Spanish speakers were selected from a pool of undergraduate and graduate students from across disciplines at San Diego State University. All participants were born in a Spanish-speaking country and were schooled there until at least the completion of high school. Only those meeting the following four criteria were considered. Participants who (1) learned Spanish in a Spanish-speaking country outside the continental U.S., (2) received a high school diploma from a high school in a Spanish-speaking country, (3) moved to the U.S. after the age of 18 and (4) specified using only Spanish at home. The average age of the native Spanish speaking participants was 24.68 years of age (range: 20-38 years). The average age of arrival in the United States was 23.11 years old (range: 19-38 years). Additionally, the participants reported an average of 18.81 months residency in the U.S. (range: 1-60 months).
MATERIALS AND DESIGN

The materials for the on-line reading task included 54 sentences that involved subject-verb agreement in three linear distance conditions, where linear distance refers to the raw number of words between the subject and the verb of the sentence. The first distance condition included a linear distance of zero words, which refers to a sentence that contains no intervening word between the subject and the verb, as illustrated in (1). The second condition consisted of a linear distance of three words, in which a three-word prepositional phrase separated the subject and verb of the sentence, as illustrated in (2). The third and final condition consisted of a linear distance of six words, in which two three-word prepositional phrases separated the subject and verb of the sentence, as illustrated in (3).

(1) La chica baila/*bailo en la discoteca los fines de semana.  
the girl3rd-sing dances3rd-sing/*dances1st-sing in the discotheque the ends of week
‘The girl dances in the discotheque on weekends.’

(2) Los cursos de español básico empiezan/*empieza a las ocho de la mañana.  
the courses3rd-plural of Spanish basic begin3rd-plural/*begin3rd-sing at five in the morning
‘The basic Spanish courses begin at eight in the morning.’

(3) Los víctimas del huracán Katrina en el golfo sufren/*sufres todavía muchas dificultades.  
the victims3rd-plural of hurricane Katrina in the gulf suffer3rd-plural/*suffer2nd-sing still many difficulties
‘The victims of Hurricane Katrina in the Gulf still suffer many difficulties.’

As is common in psycholinguistic experiments of this type, there was both a grammatical and ungrammatical version of each sentence and participants only read one version of each sentence. Ungrammatical sentences were created by manipulating the person and number agreement relations between the subject and the verb. In some sentences the error involved a violation of person agreement as in (1). In others, the violation included those with number agreement, as in (2). Finally, violations also occurred in both number and
person agreement, as in (3). A complete list of the sentences can be found in the Appendix.

The stimuli were presented in four pseudo-randomized presentation lists, labeled A, B, C and D. Sentences that were grammatical in lists A and B were ungrammatical in lists C and D. Additionally, the order of sentences was reversed in A and B and in C and D. Ungrammatical subject-verb agreement sentences never appeared consecutively. The experimental items were mixed among 100 distracter sentences, some of which involved other types of morphosyntactic errors.

**APPARATUS AND PROCEDURE**

The participants’ eye movements were recorded while reading sentences in Spanish using a table mounted EyeLink 1000/2K tracking device designed by SR Research. Utilizing a small infrared camera mounted near the computer monitor and placing the participants’ head in a stabilizing device, the camera recorded the pupil movements of the participants’ right eye. The tracking equipment was interfaced with a PC that controlled the experiment, stored the data and displayed the progress of the experiment on a second monitor behind the participant which was monitored by the research assistant during the experiment. The sentences were displayed in a single line in black against a light grey background. All sentences were displayed in normal upper and lower case letters. Once participants were seated, they were given both verbal and computer displayed instructions as to the procedures of the experiment and the camera was then calibrated to track the right eye utilizing a 9-point calibration test. Once the calibration was successful the participants read six practice sentences before beginning the experiment. One sentence at a time was displayed in the middle of the monitor and each sentence was preceded by a fixation target on the computer
screen, a small round circle, at the position of the first word of each sentence. Participants were required to simultaneously fixate on the fixation target and press the ‘advance’ button on a game controller to display the sentence. Participants were instructed to read the sentences and when they had finished reading it to press an ‘advance’ button on the controller to display the next sentence. The screen timed out after 10 seconds if a response was not made. To ensure that participants were reading the sentences for meaning, 35% of all trials were followed by a comprehension question. Participants indicated their responses to the comprehension questions by pressing the ‘yes’ or ‘no’ buttons on the game controller.

**METHODS OF ANALYSIS**

The eye tracking software is designed to record the millisecond by millisecond eye movements (saccades and fixations) one makes while reading text. These measurements were used to determine when and where processing difficulty occurred and how the reader responded to regions of interest (ROI) in the study. In this case, the region of interest was the critical verbs in sentences containing ungrammatical and grammatical instances of subject-verb agreement in Spanish. This study reports three mean reading time measures, each of which is described below.

*First-pass reading time* refers to the amount of time spent on the critical verb, from when the participant first entered the verb until he or she left the critical verb, with saccades (eye movements) to either the left or right of the word. First-pass reading time allows the researcher to investigate the initial behavior upon encountering the critical region of interest (ROI) for the first time.

*Second-pass reading time* refers to the reading time after the first-pass time, and includes all passes after the first pass. This allows the researcher to further investigate the
processing behavior on the critical region of interest and is believed to be a measure of reanalysis.

*Total reading time* refers to the total amount of reading time in a region of interest and includes both first- and second-pass reading times.
CHAPTER 3

RESULTS

This section reports the participants’ accuracy on the comprehension questions and explains how the eye-tracking data were prepared for analysis and reports the results of the statistical analysis conducted to determine the effects of linear distance on participants’ sensitivity to violations of subject-verb agreement in Spanish.

COMPREHENSION ACCURACY

Responses to the comprehension sentences, which occurred after 35% of the stimuli sentences in the eye-tracking study, were tallied and mean scores were calculated for each participant. Failures to select a response and inappropriate responses (e.g., selecting the advance button instead of the YES/NO buttons) were scored as missing values and means were calculated on the remaining sentences. Group results indicated that native speakers averaged a comprehension accuracy score of 94.5% and advanced learners averaged a comprehension accuracy score of 92.6%. There was no significant difference between the two groups, \( t(29)=1.550, p = .132 \). These results indicate that subjects were attentive to the content of the sentences and that sentences were equally understood by the native speakers and advanced learners.

DATA TRIMMING

The first-pass, second-pass, and total reading times were first screened for missing values. In some instances missing values may have been the result of inaccurate recording of
the subject’s eye movements and the camera either failed to record data or the participant may have ‘skipped’ a sentence or portion thereof, as it is natural for readers to skip words while reading. Missing values accounted for 3.8% of first-pass and total reading times. Missing data accounted for 48.4% of second-pass times. This large proportion was due to the fact that second passes to the critical verbs were optional and reanalysis of the verb was not always conducted by participants. For this reason, missing second pass times were replaced with zeros.

Before computing means for each participant and condition in the study, each participant’s first-pass, second-pass, and total reading times were screened for outliers in each of the six conditions in the study. A standard deviation of +/- 2 SDs was used as the criterion for identifying outliers. Outlying values were replaced with the participant’s mean for each respective condition. Outliers accounted for 4.8% of the first-pass reading times, 5.3% of the second-pass reading times and 3.8% of the total reading times.

Finally, once the data were screened for outliers and missing data, mean reading times were calculated by participants and then by items. Six means were computed for each participant, one for each of the six experimental conditions (the three linear distances crossed with the two grammaticality conditions). These means were used for the analyses by participants. In addition, four means were computed for each item in each of the three linear distance conditions, one for each group (native vs. advanced) and grammaticality condition (grammatical vs. ungrammatical). These means were used for the analyses by items. The statistical analysis consisted of paired samples t-tests that compared reading times on grammatical and ungrammatical verbs. The tests were conducted separately for each group (native and advanced) and linear distance condition (zero, three and six words). The paired t-
tests were conducted by participants ($t_1$) and by items ($t_2$). The effect of grammaticality is deemed significant when a significant $p$-value is obtained in the analysis by participants and in the analysis by items.

**Reading Times from Eye-Tracking**

Reading times for eyetracking are reported in three reading times: first-pass time, second-pass time and total time.

**First-Pass Time**

Mean first-pass times and standard deviations for each group and condition appear in Table 2. The data show that both the native speakers and the advanced learners spent more time reading ungrammatical verbs relative to grammatical ones in each of the three linear distance conditions. For the native speakers, the difference in means was marginally significant in the analysis by items when linear distance was zero words, $t_1(17) = 1.036, p = .315; t_2(17) = 2.056, p = .055$, but was not significant when linear distance was three words, $t_1(17) = .873, p = .395; t_2(17) = 1.221, p = .239$. However there was a significant difference in the analysis by participants and items when linear distance was six words, $t_1(17) = 2.241, p < .001; t_2(17) = 4.077, p = .039$.

For the advanced learners at linear distances of zero words there was a significant difference in means in the analysis by items but not in analysis by subjects, $t_1(12) = 1.060, p = .310; t_2(17) = 2.812, p = .012$. The difference was not significant when linear distance was three words, $t_1(12) = .894, p = .389; t_2(17) = 1.112, p = .282$. At linear distances of six words, there was a significant difference by items but not by participants, $t_1(12) = 1.019, p = .328; t_2(17) = 2.512, p = .02$. 
Table 2. Mean First-Pass Times (ms) and Standard Deviations (In Parentheses)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Condition</th>
<th>Linear Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 words</td>
</tr>
<tr>
<td>Native</td>
<td>18</td>
<td>UG</td>
<td>237 (58)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>222 (53)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>15</td>
</tr>
<tr>
<td>Advanced</td>
<td>13</td>
<td>UG</td>
<td>291 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>265 (81)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>26</td>
</tr>
</tbody>
</table>

Note: UG = ungrammatical; G = grammatical; Difference = UG – G; *significant in paired-samples t-tests conducted by subjects and by items (α = .05)

Second-Pass Time

Mean second-pass times and standard deviations for each group and condition appear in Table 3. Similar to the first-pass times, the data show that both the native speakers and the advanced learners spent more time reading ungrammatical verbs relative to grammatical ones in each linear distance condition. For the native speakers, the difference in means was significant across all three linear distances: zero words: \( t_1(17) = 4.359, p = .001; \) \( t_2(17) = 4.067, p = .001; \) three words: \( t_1(17) = 5.709, p < .001; \) \( t_2(17) = 5.787, p < .001; \) and six words: \( t_1(17) = 2.477, p = .024; \) \( t_2(17) = 5.563, p < .001. \)

For the advanced learners the difference in means was also significant across all three linear distances: zero words: \( t_1(12) = 2.584, p = .024; \) \( t_2(17) = 4.067, p = .001; \) three words:
Table 3: Mean Second-Pass Times (ms) and Standard Deviations (In Parentheses)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Condition</th>
<th>Linear Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 words</td>
</tr>
<tr>
<td>Native</td>
<td>18</td>
<td>UG</td>
<td>219 (169)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>92 (115)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>127*</td>
</tr>
<tr>
<td>Advanced</td>
<td>13</td>
<td>UG</td>
<td>285 (145)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>139 (92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>146*</td>
</tr>
</tbody>
</table>

Note: UG = ungrammatical; G = grammatical; Difference = UG – G; *significant in paired-samples t-tests conducted by subjects and by items (α = .05)

\[ t_1(12) = 2.860, p = .014; t_2(17) = 5.787, p < .001; \] and six words: \[ t_1(12) = 3.208, p = .008; t_2(17) = 5.563, p < .001. \]

Total Reading Times

Mean total times and standard deviations for each group and condition appear in Table 4. The data show that both the native speakers and the advanced learners spent more time reading ungrammatical verbs relative to grammatical verbs in each linear distance condition. For the native speakers, the difference in means was significant across all three linear distances: zero words: \( t_1(17) = 5.839, p < .001; t_2(17) = 4.557, p < .001; \) three words: \( t_1(17) = 5.082, p < .001; t_2(17) = 4.304, p < .001; \) and six words: \( t_1(17) = 3.059, p = .007; t_2(17) = 4.586, p < .001. \)
Table 4. Mean Total Times (ms) and Standard Deviations (In Parentheses)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Condition</th>
<th>Linear Distance</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>18</td>
<td>UG</td>
<td>497 (186)</td>
<td>475 (171)</td>
<td>463 (167)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>328 (121)</td>
<td>339 (106)</td>
<td>353 (141)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>169*</td>
<td>136*</td>
<td>110*</td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td>13</td>
<td>UG</td>
<td>600 (117)</td>
<td>572 (163)</td>
<td>695 (255)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>410 (105)</td>
<td>419 (80)</td>
<td>462 (94)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difference</td>
<td>190*</td>
<td>153*</td>
<td>233*</td>
<td></td>
</tr>
</tbody>
</table>

*Note: UG = ungrammatical; G = grammatical; Difference = UG – G; *significant in paired-samples t-tests conducted by subjects and by items (α = .05)

For the advanced learners, the difference in means was also significant across all three linear distances: zero words: $t_1(12) = 3.349$, $p = .006$; $t_2(17) = 5.758$, $p < .001$; three words: $t_1(12) = 3.030$, $p = .010$; $t_2(17) = 4.319$, $p < .001$; and six words: $t_1(12) = 3.124$, $p = .009$; $t_2(17) = 5.492$, $p < .001$.

**SUMMARY**

The data clearly show overall that advanced learners and native speakers spent longer time reading ungrammatical verbs compared to grammatical verbs. Additionally, the data reveal that advanced learners displayed processing patterns almost identical to those of the native speakers, suggesting that advanced learners do show native–like processing patterns and sensitivity to subject-verb agreement errors in Spanish across increasing linear distances.

In first-pass reading times, the advanced learners did not report any statistically significant differences in both the participants and items analysis across any of the linear
distances. Native speakers did show sensitivity to agreement errors and a significant
difference in both analysis at a linear distance of six words.

Analysis of second-pass times and total times revealed significant differences across
both groups in all linear distance conditions. Again, this suggests that advanced non-native
speakers and native speakers are similar in their processing of subject-verb agreement errors
across increasing linear distances.
CHAPTER 4

DISCUSSION

The purpose of this study was (1) to determine if advanced English-speaking learners of Spanish have native-like knowledge and processing of subject-verb agreement in Spanish and (2) to examine whether or not linear distance between the subject and verb posed any processing limitations. The results of the study suggest the following:

- Advanced learners of Spanish, like native Spanish speakers, are sensitive to subject-verb agreement violations when subjects and verbs are adjacent to each other. Therefore, native-like knowledge of subject-verb agreement in Spanish is possible in adult SLA.

- Linear distances of three and six words between subjects and verbs did not pose any processing difficulties for either native Spanish speakers or the advanced learners, suggesting that native-like processing of subject-verb agreement is also possible in adult SLA.

These results suggest that (1) native-like knowledge of subject-verb agreement in Spanish is acquirable for adult learners of Spanish and that (2) native-like processing of subject-verb agreement is also possible. In light of previous studies, these findings have ramifications for theories of L2 processing and provide indirect support for the importance of proficiency levels and the role of the L1 in determining whether or not native-like processing is attainable.

In an attempt to provide a theoretical account of non native-like L2 processing, Clausen & Felser (2006) proposed the Shallow Structure Hypothesis (SSH) which claims that non target-like processing may be a result of processing limitations for L2 learners whereby learners may only have the ability to process less detailed syntactic and local (i.e., adjacent or
within simple phrase structures) information during real-time comprehension and that L2 processing is fundamentally different from that of native speakers. While the SSH was primarily addresses the processing of complex syntactical structures, the authors also extended the hypothesis to include the processing of agreement features (noun-adjective and subject-verb agreement). In regards to agreement processing, the SSH postulates that L2 learners may display native-like sensitivity to agreement but only when the targets and controllers of agreement are in close proximity of each other, although they do not specify what the conditions of proximity are. In other words, the SSH would predict that L2 learners in this study may show sensitivity to linear distances of 0 or 1 words separating the subject and verb but not linear distances of 3 or 6 words. As it turns out, Keating’s (2009) study of gender agreement in Spanish supported these claims due to the fact that the advanced learners in his study showed sensitivity to gender violations on adjectives when nouns and adjectives were adjacent to each other and insensitivity when nouns and adjectives were not adjacent. Keating (2009) attributed these results to be in line with the SSH and accounted for this distance effect by suggesting that L2 learners “may not have the processing resources necessary to hold information about gender in working memory while processing material that intervenes between nouns and adjectives” (p. 30). In light of these findings, it was anticipated that the L2 learners in this study would also exhibit similar processing constraints, but they did not and the reasons why are still not clear. It may be the fact that the claims of the SSH are based primarily on studies that examine the effects of structural distances as opposed to linear distances, or that it may need to more accurately define distance conditions as well as account for various proficiency levels of L2 learners. While the results of the current study do not support the SSH, the successful processing for L2 learners
in this study may be attributed to the proficiency level of the participants themselves as well as the L1 of the participants.

The proficiency levels of the participants in this study may have been a factor that contributed to successful processing as they were advanced learners of Spanish with extensive knowledge and exposure to Spanish language and grammar. The participants were primarily graduate assistants in the Spanish department who had completed a B.A. degree or equivalent in Spanish and were pursuing an M.A. or Ph.D. in Spanish which translates into 6-8 years or more of Spanish language study beyond high school. Also, the fact that the participants had reported an average of nearly 13 months of living abroad in a Spanish speaking country may have supplemented their academic exposure as well. In addition to the considerably high proficiency level for these L2 learners, the learners’ L1 may have also aided in successful processing of subject-verb agreement in Spanish. Many of the previous studies that resulted in insensitivity investigated agreement constructions that were not instantiated in the learners’ L1s. The fact that English grammar does instantiate subject-verb agreement may have had a bearing on these L2 learners’ processing capabilities of subject-verb agreement in Spanish. Even though Spanish and English are morphologically distinct and much more grammatical information is encoded on Spanish agreement features, the presence of even limited subject-verb agreement in English may have been sufficient enough for learners to show sensitivity to subject-verb agreement in Spanish. Additionally, Spanish verb conjugation is not only taught at a very early stage in Spanish language courses but is also a very consistent topic of review throughout many levels of instruction, so it is likely that these advanced learners have had a considerable amount of consistent classroom review and instruction on verb conjugation and subject-verb agreement in Spanish.
LIMITATIONS OF THE STUDY

Improvements in the design of the stimuli and the proficiency levels of participants may offer an even more thorough account of agreement processing in Spanish. The stimuli in this study only included 3rd-person singular instances of subject-verb agreement in Spanish. To fully account for knowledge of agreement, it is necessary to test additional person/number combinations, which may result in different outcomes. In line with the aims of this study, participants were limited to advanced learners. However, including additional proficiency levels, such as beginning and intermediate learners, would provide an opportunity to examine the development of L2 processing abilities, potentially targeting at what stage learners are able to detect violations and across which distance conditions they are able to detect violations over time.

FUTURE RESEARCH

The results of this study clearly indicate that increased linear distance does not pose any limitations on advanced L2 learners’ processing of subject-verb agreement in Spanish. Future research seems most warranted in further manipulating the types of distance to include structural distances between the subject and the verb, as this may result in a different outcome and would be useful in helping to further understand divergent processing behaviors. That is to say that if it is found that learners have more difficulties processing agreement across structural distances rather than linear distances, then future processing studies may be more able to accurately diagnose divergent L2 processing and its relation to distance. In addition, future research would benefit by investigating additional grammatical features of Spanish as well as different levels of learners to include beginning and intermediate learners of Spanish.
CONCLUSION AND IMPLICATIONS

The results of this study suggest that native-like knowledge of subject-verb agreement in Spanish is possible for advanced L2 learners of Spanish. Additionally, linear distance between the subject and verb does not hinder processing of subject-verb agreement and advanced learners are able to detect ungrammatical instances of subject-verb agreement in Spanish over linear distances of three and six words. In sum, subject-verb agreement in Spanish for advance L2 learners is a fully acquirable feature and native-like knowledge and processing of this feature is possible.
REFERENCES


APPENDIX

STIMULI SENTENCES AND COMPREHENSION QUESTIONS
1. La chica baila/bailo en la discoteca los fines de semana.
2. El doctor escucha/escuchas música clásica en su consultorio.
3. La directora habla/hablan español y portugués muy bien.
   ¿Es monolingüe la directora?

4. El trabajador bebe/bebo mucha agua porque hace calor.
   ¿Tiene sed el trabajador?

5. El atleta hace/haces ejercicio en el gimnasio todos los días.
6. Mi madre entiende/entienden muy bien el francés.
7. Mi nieta vive/vivo con su padre en Atlanta.
8. El arquitecto sale/sales con sus colegas los viernes.
   ¿Tiene el arquitecto una vida social?

10. Los vecinos me llaman/llamo cuando no funciona su computadora.
    ¿Tienen los vecinos problemas con su computadora?

11. Mis amigos necesitan/necesitas dinero para salir este sábado.
    ¿Van a salir unos amigos este viernes?

12. Los autobuses llegan/llega tarde cuando llueve o nieva mucho.
13. Los hijos deben/debo ayudar a sus padres en la casa.
14. Los padres comprenden/comprende lo difícil que es criar a niños.
15. Mis abuelos tienen/tiene una casa grande en la Florida.
    ¿Viven los abuelos en un condominio?

16. Mis compañeros asisten/asisto a clases los martes y jueves.
17. Los astrónomos descubren/descubres nuevos planetas de vez en cuando.
18. Algunos gatos siguen/sigue a sus dueños para no estar solos.

19. El profesor de música clásica toca/toco la guitarra y el piano.
    ¿Tiene el profesor talentos musicales?

20. La esposa de mi hermano trabaja/trabajas en un hospital para niños.
21. El viajero en el aeropuerto descansa/descansan en la sala de espera.
    ¿Está el viajero en el avión en este momento?

22. La madre de mi esposo cree/creo en los espíritus y extraterrestres.
24. El jefe de la compañía lee/leen su correo electrónico todos los días.
25. El cliente en el restaurante pide/pido un bistec y unas salchichas.
   ¿El cliente es vegetariano?
26. La mujer en la calle dice/dices cosas absurdas en público.
27. La maestra de química orgánica corrige/corrigen la tarea en su oficina.
28. Los alumnos de geografía urbana toman/tomo cinco clases al semestre.
29. Los jugadores de fútbol americano juegan/juegas los domingos y lunes.
30. Los cursos de español básico empiezan/empieza a las ocho de la mañana.
   ¿Se puede tomar una clase de español as las 8.00 am?
31. Las muchachas en el parque corren/corro con sus amigas.
32. Las personas con mucho dinero pueden/puede viajar con frecuencia.
33. Los animales en el zoológico comen/come dos veces al día.
34. Los tíos de mi amiga insisten/insisto en pagar su alquiler este mes.
35. Las secretarias de la compañía reciben/recibes muchas llamadas cada día.
   ¿Llama mucha gente a la compañía cada día?
36. Los bares cerca del campus sirven/sirve muchas cervezas de México.
   ¿Son de Europa las cervezas de estos bares?

Linear Distance = 6 words

37. El concierto en el auditorio de la escuela comienza/comienzo a las siete.
   ¿El concierto toma lugar en un estadio?
38. La profesora de la facultad de lenguas asiáticas enseña/enseñas japonés y chino.
   ¿Necesita el hombre alguna medicina?
40. El cliente en el mercado de la plaza quiere/quiero comprar dos kilos de tomates.
41. La amiga de mi abuela en Los Ángeles conoce/conoces al gobernador Schwarzenegger.
42. El cantante con tres discos de música samba vuelve/vuelven a tocar en mi ciudad.
43. El restaurante al lado de la iglesia protestante abre/abro a las seis de la mañana.
   ¿Se puede desayunar en este restaurante?
44. El chico en mi clase de arte africano interrumpe/interrumpes mucho a la profesora.
45. El autor de tres libros de ciencia ficción escribe/escriben desde su casa en Santa Fe.
46. Los libros para la clase de historia mundial cuestan/cuesto poco dinero.
   ¿Es caro comprar libros para esta clase?
47. Los niños en el balcón de la casa cantan/cantas para divertirse.
48. Los médicos en la ciudad de San Diego ganan/gana mucho dinero.
49. Los árboles en el parque cerca del hotel pierden/pierdo sus hojas en el otoño.
50. Los estudiantes en la clase del profesor López aprenden/aprendes mucha teoría. ¿Enseña el profesor los aspectos prácticos de su campo?

51. Los jóvenes en los colegios de este país saben/sabe muy poca geografía.
52. Las flores en el jardín de mi apartamento mueren/muero en el invierno.
53. Los víctimas del huracán Katrina en el golfo sufren/sufres todavía muchas dificultades.
54. Los vendedores en el mercado de mi pueblo prefieren/prefiere recibir dinero en efectivo. ¿Los vendedores trabajan en un mercado?