Processing Instruction and Redundant Morphology in Spanish as a Second Language

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PROCESSING INSTRUCTION AND REDUNDANT MORPHOLOGY IN SPANISH AS A SECOND LANGUAGE

By

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A Dissertation submitted to the Department of Modern languages and Linguistics
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I dedicate this dissertation to my family.
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I would like to first acknowledge and thank my family and friends who have supported me during every step of this process. Without their support, encouragement, and love, I would not be where I am today.

I would also like to thank Dr. Michael Leeser, my professors, and committee members, for all of the support and guidance that they have provided me.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj</td>
<td>Adjective</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>Det/D</td>
<td>Determiner</td>
</tr>
<tr>
<td>DP</td>
<td>Determiner Phrase</td>
</tr>
<tr>
<td>FEM</td>
<td>feminine</td>
</tr>
<tr>
<td>IP</td>
<td>Input Processing</td>
</tr>
<tr>
<td>L2</td>
<td>second language</td>
</tr>
<tr>
<td>MASC</td>
<td>masculine</td>
</tr>
<tr>
<td>NP</td>
<td>Noun Phrase</td>
</tr>
<tr>
<td>N</td>
<td>Noun</td>
</tr>
<tr>
<td>NumP</td>
<td>Number Phrase</td>
</tr>
<tr>
<td>PI</td>
<td>Processing Instruction</td>
</tr>
<tr>
<td>SPR</td>
<td>self-paced reading</td>
</tr>
<tr>
<td>UG</td>
<td>Universal Grammar</td>
</tr>
<tr>
<td>VP</td>
<td>Verb Phrase</td>
</tr>
</tbody>
</table>
ABSTRACT

For almost 20 years, research on Processing Instruction (PI) has shown that PI is an effective tool for altering the processing strategies of learners, and has been generalized over a variety of linguistic structures and for a variety of target languages. This presentation seeks to extend the PI research agenda by investigating a processing problem that has not been widely researched: the Preference for Nonredundancy Principle. Specifically, if learners receive PI targeting gender agreement (that falls under this principle), will they make gains on interpretation and production tasks with gender agreement?

This dissertation examines whether PI targeting noun-adjective gender agreement leads to L2 Spanish learners improved performance on interpretation and production tasks. In addition, it asks if PI will improve noticing of gender agreement mismatches in an online self-paced reading task. Another goal of this dissertation is to investigate whether the effects of PI on gender agreement (primary effects) will extend to subject-verb agreement, which is a similar form with a similar processing problem (secondary transfer-of training effects). L2 Spanish learners (N = 112) received either Processing Instruction (PI group) or no instruction (Control group). A pretest, immediate posttest, and delayed posttest design was used to examine the impact of PI on learners’ performance on interpretation, production and self-paced reading tasks.

The participants in this study made significant improvements on production tasks at the delayed posttest, which suggests a positive effect for the PI treatment. On the other hand, the self-paced reading task shows that the learners’ did not recognize mismatches in the primary structure (gender agreement), which suggests that it is not yet part of their internal grammar (i.e., their developing system). We propose that PI is effective in altering how learners approach a production task, but that more input is needed to see results on a sensitive measure like self-
paced reading. We discuss our findings in light of the Input Processing theory and its implications for future PI research.
CHAPTER 1
INTRODUCTION

For almost 20 years, a research priority in instructed SLA has been to investigate whether second language (L2) learners can overcome processing difficulties in order to more efficiently process second language input (Doughty, 2003). Input is defined as language that learners are exposed to that has communicative intent and all major theoretical frameworks in SLA posit a fundamental role for input in language acquisition. As a result, some researchers have investigated ways to enhance or alter how L2 learners’ process input (Doughty, 2003). This dissertation will focus on one type of instructional intervention that is designed to alter how L2 learners process input, which is known as Processing Instruction (PI) (as described by VanPatten, 1996, 2002a, 2004). The goal of this chapter is to provide the theoretical background for the present study. It is organized in the following way. First, I discuss the role of input in SLA and a relevant model of second language input processing. I will then discuss Processing Instruction (PI) in detail and outline the significance of the present study. Lastly, I will provide a definition of terms used throughout the dissertation and an outline of the remaining chapters.

Role of Input in SLA

Second Language Acquisition (SLA) is complex and can be “best conceived of as involving multiple processes that in turn may contain subprocesses that work at every stage of acquisition.” (VanPatten, 2004). Just as there are many processes and stages of acquisition, there are many theories and models that attempt to explain how these processes take place. Despite the
variety, all theoretical approaches to SLA posit a fundamental role for input in second language acquisition (Doughty, 2003). Gass (1997) has said:

The concept of input is perhaps the single most important concept of second language acquisition. It is trivial to point out that no individual can learn a second language without input of some sort. In fact, no model of second language acquisition does not avail itself of input in trying to explain how learners create second language grammars. (p. 1)

To further illustrate, let’s consider two very different views of SLA: universal grammar (UG) and connectionism. Generative approaches to language acquisition (i.e. Universal Grammar) are concerned with attempting to explain how learners acquire all of the complexities of a language despite the lack of some of these complexities in the input (i.e. the poverty of the stimulus). Originally postulated to explain child language acquisition, in recent decades, UG has been applied to second language acquisition. According to UG, knowledge of language is symbolic, and takes the form of an abstract, unconscious mental representation of language. This mental representation is a separate faculty, or organ of the mind, meaning that language is distinct from other forms of cognition (White, 2007). A learner’s interlanguage, according to UG, is determined by principles and parameters. Principles are general, universal ‘rules’ for all languages and parameters are specific features that define a specific language and account for language and interlanguage variability. Input is an important construct in UG: it is what allows parameters, and therefore interlanguages, to be set. In other words, input is important in UG because it triggers the setting of parameters.

Connectionism is different from UG in that it views language knowledge, not as an innate faculty with abstract rules, but as a complex network made from the extraction of patterns and regularities found in the input (Gass & Selinker, 2008). Another difference is that language cognition is not a separate system as UG claims, but falls within the same “cognitive architecture” that is used to acquire many other types of knowledge (Ellis, 2007). A learner’s
interlanguage, according to Connectionism, is systematic in that it follows predictable paths based on regularities in the input, variable in that natural factors such as token frequency, recency, context, salience, etc. will affect the patterns in the input, and dynamic in the sense that each component of the environment can affect the outcome of acquisition (Ellis, 2007; Ortega, 2007). The linguistic environment, specifically frequency, is the most important component in Connectionism because it is what allows learners to extract patterns and regularities from the input (which, of course, is also essential).

Without a doubt, connectionism and universal grammar are fundamentally different in terms of how they define language knowledge and how that knowledge is formed. The point of the discussion here, however, is to illustrate that two different theoretical perspectives on second language acquisition both postulate a fundamental role for input in language acquisition.

Although input is considered *necessary* for acquisition, it does not necessarily imply that input is *sufficient* for acquisition. Research conducted in French immersion programs show that even learners who are exposed to large amounts of input fall short of native like performance (Lyster, 2004; Swain, 1991). Researchers thus began to investigate why input itself is insufficient and what other components of language learning could affect this lack of native-like performance. This avenue of research lead to investigations of information processing: what learners are doing during comprehension? One of the main theoretical models that attempts to describe what learners are doing during comprehension (i.e. how they process input) is VanPatten’s (1996, 2004, 2007) model of input processing, which will be described in detail below.
Input Processing (IP)

According to VanPatten, “Input Processing (IP) is a model of moment-by-moment sentence processing during comprehension and how learners connect or don’t connect particular forms with particular meanings. It is a model of how learners derive the initial data from input for creating a linguistic system” (VanPatten, 2007, p. 116). In other words, Input Processing is a model that explains what learners are doing during processing while they are engaged in comprehension. Figure 1.1 illustrates where IP fits into an acquisition scheme (VanPatten, 2007, p. 117)

![Input Processing Diagram]

Figure 1.1: Where IP fits into an acquisition scheme.

Input Processing (IP) (VanPatten 1996, 2004, 2007) is concerned with explaining (a) under what conditions learners make initial form-meaning connections (b) why learners make some form-meaning connections and not others, and (c) what internal strategies learners use to comprehend sentences. To explain these three conditions, VanPatten has outlined several principles that L2 learners use when processing input. Table 1.1 presents these principles in their most recent form (VanPatten, 2007).
Table 1.1

Principles of Input Processing (VanPatten, 2007)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Primacy of Content Words</td>
<td>Learners process content words in the input before anything else.</td>
</tr>
<tr>
<td>The Lexical Preference Principle</td>
<td>Learners will process lexical items for meaning before grammatical forms when both encode the same semantic information.</td>
</tr>
<tr>
<td>The Preference for Nonredundancy Principle:</td>
<td>Learners are more likely to process nonredundant meaningful grammatical markers before they process redundant meaningful markers.</td>
</tr>
<tr>
<td>The Meaning before Nonmeaning Principle</td>
<td>Learners are more likely to process meaningful grammatical markers before nonmeaningful grammatical markers.</td>
</tr>
<tr>
<td>The First Noun Principle</td>
<td>Learners tend to process the first noun or pronoun they encounter in a sentence as the subject.</td>
</tr>
<tr>
<td>The L1 Transfer Principle</td>
<td>Learners begin acquisition with L1 parsing procedures.</td>
</tr>
<tr>
<td>The Event Probability Principle</td>
<td>Learners may rely on event probabilities, where possible, instead of the First Noun Principle to interpret sentences.</td>
</tr>
<tr>
<td>The Lexical Semantics Principle</td>
<td>Learners may rely on lexical semantics, where possible, instead of the First Noun Principle (or an L1 parsing procedure) to interpret sentences.</td>
</tr>
<tr>
<td>The Contextual Constraint Principle</td>
<td>Learners may rely less on the First Noun Principle (or L1 transfer) if preceding context constrains the possible interpretation of a clause or sentence</td>
</tr>
</tbody>
</table>
Table 1.1 (continued)

*Principles of Input Processing* (VanPatten, 2007)

| The Sentence Location Principle | Learners tend to process items in sentence initial position before those in final position and those in medial position. |

Depending upon the language and grammatical structure of the input that the learner is trying to comprehend, one could see that the learner would have difficulty interpreting the input if he or she is relying on these strategies. For example, the First Noun Principle states that learners “tend to process the first noun or pronoun they encounter in a sentence as the subject” (VanPatten 2007, p. 122). This processing strategy that learners tend to adopt often results in the incorrect interpretation of OVS sentences in Spanish such as *Lo besa María*. By interpreting *Lo* as the subject, L2 Spanish learners may misinterpret this sentence as “He kisses María” instead of “María kisses him.” Because many of these strategies are like this example, and result in misinterpretation of sentences, the logical next step is to ask: is there an intervention that can change the strategies that learners are using to processing input?

**Processing Instruction (PI)**

PI was developed with the goal of helping learners overcome the misinterpretations outlined in the model of Input Processing so that they can make correct form-meaning connections in the input in order to correctly interpret sentences that may present processing problems. PI uses three instructional steps in order to achieve this goal. First, learners are provided with explicit information about the particular grammatical form. Second, they are provided with information about the processing problem that this form may present. For
example, they may be told that Spanish has flexible word order and that, although they may want to interpret the first noun in the sentence as the subject, the first word in the sentence may not always be the subject. Finally, learners complete structured input (SI) activities. These are activities that manipulate sentences in a way that makes the target form more salient so that the learner can correctly interpret the sentence in order to complete the activity. The main difference between PI and other forms of instruction is that learners are not asked to produce the target form. During SI activities, learners are asked only to read the sentence and interpret the meaning of the sentence. The unique characteristic of SI activities is that the learners must understand and process the target form in order to comprehend the sentence. In other words, they must use both meaning and form in order to get the correct answer.

It is important to note that PI does not claim to manipulate the mechanisms that the brain uses to process input, but that it “manipulates the input data so that the processors can do whatever it is they need to do to change” (VanPatten, 2002, p. 769). However, many of the key PI studies claim that PI has an impact on the learners’ developing system (VanPatten and Cadierno, 1993; VanPatten and Oikkenon, 1996), meaning that the manipulation of the input and the apparent change in the processing strategies contributes in some way to the learners’ internal system.

**Principles of IP in PI Research**

As mentioned earlier, PI was developed with the goal of helping learners overcome the misinterpretations outlined in the model of Input Processing. This means that the linguistic forms targeted in PI research are selected due to the processing problem they represent (see Table 1.1) and not the complexity of the form itself. Although PI research has covered a variety of linguistic
forms, it has only investigated a few of the processing problems illustrated in Table 1.1, namely the First Noun Principle, the Lexical Preference Principle, and the Primacy of Content Words Principle. Therefore, one goal of this study is to investigate a principle of IP that has not been widely investigated: the Preference for Nonredundancy Principle. This principle states that “learners are more likely to process nonredundant meaningful grammatical markers before they process redundant meaningful markers.” One linguistic form that is able to capture this processing problem is noun-adjective gender agreement in Spanish. This section will discuss gender agreement in syntactical terms, and argue for its use in PI studies.

Gender agreement within a noun phrase can be analyzed using a syntactical model. It is important to understand the syntax of the noun phrase in order to understand the differences between gender agreement in different languages, specifically English and Spanish, which is the focus of this study. In generative accounts of syntax (e.g., Chomsky, 1995), language is constrained by universal principles according to Universal Grammar (UG), and cross linguistic variation is the result of differences in parameters and various properties of parameters. Parameters are usually binary, having only two settings, and are said to be located in the lexicon. They are comprised of lexical categories, which include content words like verbs and nouns, as well as functional categories, which include grammatical information such as gender, person, number, agreement, case, tense, etc. These categories, both lexical and functional, consist of sets of features that define the parameter. The strength of a particular feature, such as gender, can also vary from language to language. As White (2003) explains, cross linguistic variation is the result of the following:

(a) Differences in functional categories.

(b) Differences in features.
(c) Differences in feature strength.

These variations cause changes in the syntax. For example, strong features trigger some form of movement within the phrase, whereas weak features result in non-overt syntactic change (i.e., no movement).

Chomsky (2000, 2001) proposes that strong gender features trigger movement of the adjective as well as the process that he terms Agree, which is a syntactic process that identifies the relationship between two positions in the syntactic structure (Miyagawa, 2010). Because Spanish is a language with strong agreement features, the noun moves to a higher position within the DP, and the determiner, noun and adjective enter into a relationship that requires agreement among these categories. The movement of the noun in Spanish is what distinguishes it from other non-Romance languages, like English. Abney (1987) has proposed that the DP contains a number phrase (NumP) which contains the agreement features. Movement of the noun, as a result of the strong features in Spanish, can be seen in (1):

(1)

```
          DP
            |
            D’
              |
            D     NumP
                |
                Num’
                    |
                  Num [+[gender] libro]
                    |
                AP viejo
                    |
                N’
                    |
                N
```

(Abney, 1987)
As a result of this movement, the word order within the DP becomes: determiner (Det), noun (N), adjective (Adj). In addition to movement, Chomsky (2000, 2001) explains that agreement involves features that differ in their valuation and interpretability. Features can be either valued or unvalued and interpretable or uninterpretable. In terms of gender agreement Pesetsky and Torrego (2004) explain that the gender features of the determiner and adjective are lexically unvalued and uninterpretable, and get valued via agreement with the gender features of the noun. According to Chomsky (2000, 2001b), and as explained in (2a) and (2b), which are from Pesetsky and Torrego (2004), once an uninterpretable feature is valued, it can and must delete. So, the process of Agree, in the context of gender agreement, is a process that gives value to unvalued features and deletes uninterpretable features of the determiner and adjective.

(2) a. **Agree (Assignment version; following Chomsky (2000, 2001b))**

(i) An unvalued feature F (a probe) on a head H scans its c-command domain for another instance of F (a goal) with which to agree.

(ii) If the goal has a value, its value is assigned as the value of the probe.

b. **Deletion of uninterpretable features**

Once an uninterpretable feature is valued, it can and must delete.

Movement of the adjective is a result of both Agree and feature checking. The features of the noun motivate movement, and movement is also licensed by agree. English contrasts with Spanish in terms of both movement and agreement, and therefore L2 learners of Spanish whose first language is English have difficulties acquiring the features of Spanish.
English is different from Spanish in that it lacks grammatical gender. Inanimate nouns in English do not have any markers for gender; however animate nouns and pronouns contain semantic gender driven by the semantics of the word. For example, the noun *girl* can be said to have a feminine gender due to the semantic nature of the word. Similarly, the pronoun *her* also has a semantic gender. The way gender is marked in English, however, is quite different from Spanish. Semantic gender in English is encoded lexically instead of morphologically (with very few exceptions). Within a minimalist view, English has weak agreement features within the DP, and as a result, no movement occurs within the DP, as in (3a), or as some argue, covert movement occurs as in (3b). Covert movement indicates that movement may occur abstractly without affecting the overt word order in order to check certain features, such as the EPP feature, which requires that certain clauses have a subject, or that certain functional heads have a specifier. The adjective may move covertly, then, to check this EPP feature. Notice that movement is indicated in (3b), but word order remains the same as in (3a):

\[(3a)\]

```
       DP
        |  
       D′
        / 
    D    NumP
    the   
    |  
    Num′
    / 
Num [-gender] NP
    / 
AP    N′
    / 
old    N
    / 
book
```
Whether covert movement or no movement occurs within the DP, the resulting word order is different from Spanish. Spanish word order is Det, N, Adj, whereas the English word order is Det, Adj, N. Because there is no gender feature on the noun, there is no probe and no goal for gender agreement to occur. Thus, agreement for an L2 Spanish learner is difficult syntactically because unlike English, there is movement in the Spanish DP, and also the notion of agreement, valuation, and interpretation of gender features.

This difference in word order, as well as the agreement that takes place within the DP often causes problems for L2 Spanish learners. The Agree feature within Spanish creates a DP that is redundant in nature: all three lexical items within the DP are required to contain the exact same agreement features. To illustrate, consider the phrase: *la alumna alta* (the FEM student FEM old book)

---

1 Det, Adj, N is also a possible word order in Spanish, perhaps motivated by an emphasis feature (Laezlinger, 2004), or a Focus/Degree feature (Androutopoulou, Echevarría, & Prévost, 2008). This study does not investigate this phenomenon, and will not go into detail about this possibility, though it is important to note that it does exist in Spanish and could also cause additional processing problems and misinterpretations for L2 learners.
tall_{FEM}). The feminine gender marker ‘a’ is repeated three times. According to the Preference for Nonredundancy Principle, learners will be slower to process the gender on the adjective because it is simply a repetition of grammatical information. Benati (2004) is the only study to date that has investigated this principle. He argues that the positive results that have been found for PI in studies investigating other processing principles are generalizable to the Preference for Nonredundancy Principle. However, more research is needed to substantiate this claim, which is the primary motivation for the selection of this processing principle in the current study.

**The Transfer-of-Training Effects of PI**

Most of all of the PI research to date focuses on what Benati and Lee (2008) refer to as primary effects. Primary effects are seen when participants receive treatment targeting structure X and the results show gains on tasks that also target structure X. Benati and Lee (2008) were the first researchers to publish their findings investigating the secondary or transfer-of-training effects of PI. A transfer-of-training effect occurs when learners make significant gains in tasks targeting structure X as well as some other linguistic structure (structure Y). Benati and Lee (2008) argue that these transfer-of-training effects can be broken down into two types: secondary effects and cumulative effects. Secondary effects occur when structure X and structure Y both address the same processing principle (e.g., Gender agreement in Spanish and subject-verb agreement in Spanish both fall under the “Preference for Nonredundancy Principle”). If, however, structures X and Y represent different processing problems (e.g., Gender agreement [Preference for Nonredundancy] accusative and dative clitics (word order) [first noun principle]), it is referred to as a cumulative effect.
Transfer-of-training effects were chosen as a focus of this study in order to investigate the main goals of PI. As stated previously, PI attempts to alter second language (L2) learners’ non-optimal processing strategies so that they are more likely to make correct form-meaning connections during comprehension. By researching a transfer-of-training effect, one can determine whether the effects of PI are due to the target form (primary effect) or whether they are truly altering the processing strategies of L2 learners.

The grammatical structure that was chosen to investigate transfer-of-training effects is subject-verb agreement in Spanish. Like most romance languages, Spanish requires the grammatical inflections of the verb to match the subject of the sentence in both person and number. Table 1.2 below illustrates how inflections change according to the subject.

Table 1.2

*Verbal Inflections for Various Subjects for Present Tense –AR, -ER- and –IR Verbs in Spanish*

<table>
<thead>
<tr>
<th></th>
<th>Hablar (‘to talk’)</th>
<th>Comer (‘to eat’)</th>
<th>Vivir (‘to live’)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-person singular</td>
<td>-o</td>
<td>-o</td>
<td>-o</td>
</tr>
<tr>
<td></td>
<td>Hablo</td>
<td>Como</td>
<td>Vivo</td>
</tr>
<tr>
<td>Second-person singular</td>
<td>-as</td>
<td>-es</td>
<td>-es</td>
</tr>
<tr>
<td></td>
<td>Hablas</td>
<td>Comes</td>
<td>Vives</td>
</tr>
<tr>
<td>Third-person singular</td>
<td>-a</td>
<td>-e</td>
<td>-e</td>
</tr>
<tr>
<td></td>
<td>Habla</td>
<td>Come</td>
<td>Vive</td>
</tr>
<tr>
<td>First-person plural</td>
<td>-amos</td>
<td>-emos</td>
<td>-imos</td>
</tr>
<tr>
<td></td>
<td>Hablamos</td>
<td>Comemos</td>
<td>Comimos</td>
</tr>
</tbody>
</table>
Table 1.2 (continued)

*Verbal Inflections for Various Subjects for Present Tense –AR, -ER- and –IR Verbs in Spanish*

<table>
<thead>
<tr>
<th></th>
<th>-áis</th>
<th>-éis</th>
<th>-ís</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Second-person plural</strong></td>
<td>Habláis</td>
<td>coméis</td>
<td>Vivís</td>
</tr>
<tr>
<td><strong>Third-person plural</strong></td>
<td>Hablan</td>
<td>Comen</td>
<td>Viven</td>
</tr>
</tbody>
</table>

Similar to noun-adjective gender agreement, strong features trigger movement of the subject and the verb in Spanish (Chomsky 1995, 2000, 2001). Many researchers propose that strong agreement features trigger movement of the Subject to the SpecTP and the verb to the head of TP (Goodall 2000, 2002, Zubizarreta 1998, Suñer 2003, Beas 2007, among others). As mentioned with gender agreement, Agree makes any uninterpretable features interpretable and gives them value, and the strong features (i.e., an EPP feature) trigger the movement of the verb. This structure is shown in example (4) below:\(^2\):

(4)

![Tree diagram]

\(^2\) There are two theoretical approaches to the position of preverbal subjects: i) the Spec TP Approach (Goodall 2000, 2002, Zubizarreta 1998, Suffer 2003, Beas 2007, among others), and ii) the Left Peripheral (LP) Approach (A&A, O&T, among others), where the subject moves to a higher position in the tree.
Because Spanish is a null-subject language, the subject is not necessary. If the subject is absent, the SpecTP position is occupied by pro, which satisfies the EPP feature and licenses the movement of the verb.

The structure for English is similar to Spanish. The main difference, and what can be difficult for L2 learners, is that English requires the presence of an overt subject on which the EPP feature is located. To illustrate, a sentence such as (5a) in Spanish is grammatical, but its English counterpart in (5b) is ungrammatical because English requires overt subjects.

(5)  

a. Habla con sus amigos.

b. *Talks with her friends

This EPP feature is what motivates movement. Just like Spanish, the Agree interacts with Move and causes movement, as in (6).
Again, similar to gender agreement, subject-verb agreement in Spanish, when an overt subject is present, is redundant. Consider the sentence: \textit{Juan juega en el parque} (John\textsuperscript{1ST\,SING} plays\textsuperscript{1ST\,SING} in the park). The lexical item \textit{Juan} and the verb morphology both encode the grammatical information \textquotedblleft 1\textsuperscript{st} person singular.	extquotedblright Because the verb morphology encodes this information, the overt subject, \textit{Juan}, is not required in Spanish. However, when it is present, learners have a tendency to overlook the verb ending because of its redundancy. This similarity to gender agreement provides the justification for using subject-verb agreement to investigate the secondary effects of PI.

\textbf{Methodology in PI Studies}

Another focus of this dissertation is to investigate the primary claim of PI: that it uses input to \textquotedblleft alter processing strategies and increase better intake for acquisition\textquotedblright (VanPatten et al., 2013, pp. 507). In other words, PI claims to influence processing which in turn has an effect on the developing linguistic system of the learner. As mentioned, PI attempts to achieve this by identifying the processing problem and then manipulating the structured input activities in order to help learners correctly interpret the sentences. Much of the research to date has shown that PI yields superior post-test results than other types of instruction, particularly in terms of sentence interpretation. But is this kind of evidence sufficient to show that the learners’ developing system has been altered?

A typical PI study uses a pre/posttest design. The measurement tools for the pre- and posttests include both an interpretation and production activity. The interpretation task is generally a structured input task in which the participants are asked to listen to a sentence and choose the best interpretation (i.e., which picture matches the sentence you heard?). The
production task consists of a picture or pair of pictures with a written sentence, and participants are asked to fill in the blank with the target structure. These tools are effective in two ways. One, they show if learners improve their ability to interpret the sentences. Second, they show whether learners can produce the correct form without receiving direct instruction in production. These pre- and posttest measures that have historically been used in PI research are considered offline methods. Offline methods are those that incorporate techniques such as oral production (picture identification, picture description, etc.), grammaticality judgment tasks (GJT), vocabulary tests, or other types of grammar tests (i.e., circle the correct article) that occur after comprehension has taken place. In contrast, online studies are those that provide researchers with millisecond-precise accounts of processing difficulties and/or sensitivity to morphosyntactic violations during sentence comprehension (Mitchell, 2004). Offline tasks are able to show that learners have improved their accuracy on tasks targeting a particular structure. In the context of PI, this is interpreted as a change in the strategy that learners are using to process a sentence. Offline tasks, however, are not sufficient to show whether this change in processing strategy results in a change in the learners’ developing system, which is a claim of PI. In order to make this type of claim, studies should utilize online measures to more accurately show what learners are doing during processing. This type of data would reveal more than an offline task could about the nature of the learners’ developing system. Therefore, this study will add to the body of PI research by incorporating an online task to portray learners’ implicit knowledge of the grammar in order to make conclusions about whether PI has the ability to alter the learners’ developing system.

Self-paced reading (SPR) is an online methodology that is able to show what learners are doing during language comprehension. This methodology uses a moving window design which presents participants with both grammatical and ungrammatical sentences in a word-by-word
fashion. SPR is often used as an indirect measure of grammatical competence because it “allows less room for the application of explicit grammar rules” (Jegerski, 2014, p. 28). The assumption that researchers make is that differential patterns of processing between grammatical and ungrammatical sentences is an indication of a mismatch between the sentence they are reading and their underlying grammar. Consider the following sentences:

(7)  
(a)  John went to the store.
(b)  John goed to the store.

If a native speaker were presented with these sentences during SPR, an analysis of the reading times would show longer reading times for sentence (7b) than for sentence (7a). Because sentence (7b) is ungrammatical, it would not match the reader’s underlying grammar, and would result in a delay in processing. SPR is used similarly in studies investigating L2 grammatical competence. If L2 learners pattern like native speakers and exhibit longer reading times for ungrammatical sentences, then the conclusion can be reached that their underlying grammar is similar to that of a native speaker. In other words, they have acquired the form and its features.

To date, no studies investigating processing instruction have used self-paced reading as a measurement tool. As mentioned, PI studies traditionally use offline methods to measure whether the processing strategies that L2 learners use have changed. Because PI claims to alter the strategies that learners use during sentence processing in order to create intake, it is prudent to use a measurement tool that can show whether intake has occurred to the point of affecting the developing system. Thus the justification for using self-paced reading. The third chapter will elaborate on how this method will be utilized in the experimental design.
The Present Study and its Significance

A mentioned in this chapter, PI research to date has investigated the effectiveness of PI. It has shown that PI is a successful tool for helping L2 learners overcome non-optimal processing strategies (e.g., Cadierno 1995; Cheng, 1995; Farley, 2001; Fernández, 2008; VanPatten & Cadierno, 1993; VanPatten & Fernández, 2004; VanPatten & Oikkenon, 1996; Benati, 2004), and that this success extends to a variety of languages: French (Benati & Lee, 2008; VanPatten & Wong, 2004), English (Benati & Lee, 2008), Italian (Benati, 2001, 2004), and Japanese (Lee & Benati, 2007). Research has also shown that PI has been successful across a variety of linguistic forms: accusative pronouns and word order (VanPatten & Oikkenon, 1996; Sanz & Morgan Short, 2004; Fernandez, 2008; Henry, Culman and VanPatten, 2009), subjunctive (Farley, 2004; Fernandez, 2008), affirmative and negative sentences (Wong, 2004). However, PI is primarily motivated by processing principles (e.g., First Noun, Lexical Preference, etc.) and not specific linguistic forms. The linguistic forms targeted in PI research are selected due to the processing problem they represent (e.g., first noun, redundancy, sentence location, etc.) and not the complexity of the form itself. Although research has covered a variety of linguistic forms, it has only investigated a few of the processing problems that have been illustrated in Table 1.1, namely the First Noun Principle, the Lexical Preference Principle, and the Primacy of Content Words Principle. In addition, PI research has focused on what Benati and Lee (2008) refer to as primary effects, meaning the effects that are seen if learners receive PI that targets structure X and in turn make gains on interpretation and production tasks with structure X.

The purpose of this dissertation in the context of PI research is to examine whether PI is an effective tool for altering the processing strategies of L2 learners based on a processing problem that has not been widely researched: the Preference for Nonredundancy Principle.
Specifically, if learners receive PI targeting gender agreement (that falls under this principle), will they make gains on interpretation and production tasks with gender agreement (primary effects)? In addition, this study questions whether the effects of a PI treatment targeting gender agreement will extend to a structure with a similar processing problem (secondary effects): subject-verb agreement. Another significant point to make about this study is that it will use an online, self-paced reading tool as a measure of interpretation to draw conclusions about the effectiveness of PI in altering learners’ processing strategies, and in turn having an effect on their developing systems. Only one study has investigated the Preference for Nonredundancy Principle (Benati, 2004), and only a handful have investigated secondary effects (Benati & Lee, 2008). No studies to date have used self-paced reading in the context of PI research. Chapter 2 will review these studies and their limitations.

**Organization of Dissertation**

This chapter discussed the role of input in SLA and a relevant model of second language input processing, Processing Instruction, and details about the present study. Chapter 2 of this dissertation provides the motivation for the present study and instructional treatments by reviewing relevant research for various types of processing instruction. Chapter 2 ends with the research questions and hypotheses that guide the study. Chapter 3 presents the research design and methodology of the study. Chapter 4 presents the results of the statistical analyses used. Finally, Chapter 5 includes a discussion of the results along with directions for future research and conclusions.
Definitions

**Acquisition**: The processes of the internalization of a linguistic system (e.g., meanings, forms and uses of the phonology, morphology, lexicon, syntax, pragmatics, etc.) of a language.

**Explicit information**: A part of instruction that includes information about the language and how it works.

**Developing System**: The learner’s underlying linguistic system.

**Input**: The linguistic data to which learners are exposed in a communicative context.

Input processing: The stage of acquisition when learners first make form-meaning connections and parse sentences during comprehension.

**Intake**: 

**Offline method**: An experimental method in which some kind of data is gathered after comprehension has taken place (e.g., timed or untimed grammaticality judgments, comprehension questions, recall protocols, etc.).

**Online method**: data collection methodologies (e.g., self-paced reading, eye tracking, ERPs) that track moment to moment variations in workload during language comprehension and provide researchers with millisecond-precise accounts of processing difficulties and/or sensitivity to morphosyntactic violations during sentence comprehension (Mitchell, 2004).

**Primary effects**: Results found when testing learners on their interpretation and production of a form for which they received instruction.

**Processing Instruction**: A type of focus on form that is informed by an Input Processing model; attempts to alter learners’ non-optimal processing strategies.

**Secondary effects**: Results from testing learners on the interpretation and production of a form for which they were not instructed, but shares a similar processing strategy with a form for which
they did receive instruction.

**Structured input activities**: Activities that contain input manipulated to push learners away from non-optimal processing strategies.
CHAPTER 2

REVIEW OF RELEVANT LITERATURE AND MOTIVATION

As mentioned in Chapter 1, the present study investigates PI and focuses on a processing problem that has not been widely investigated in PI research: the Preference for Nonredundancy Principle. Another novel aspect of this study is that it will use an online method to investigate the claims of PI that, again, has not been used in previous research. In addition, this study will focus on an area of PI research that is just beginning to be investigated. PI research to date has investigated three main areas: PI versus traditional instruction (TI), the role of explicit information, and transfer-of-training effects. The present study will investigate transfer-of-training effects. This chapter will summarize the major PI studies and their conclusions. It will also discuss studies that have investigated the preference for nonredundancy principle, and that have also looked at transfer-of-training effects. It will outline the limitations of these studies, and present the relevance of the current study within this line of research. The chapter concludes with the research questions and hypotheses that guided the dissertation.

Summary of PI Studies

As discussed in Chapter 1, much of the PI research focuses on just a few of processing problems that are reviewed in Input processing (see Table 1.1). These studies utilized offline interpretation and production tasks to draw conclusions about how learners processed the targeted linguistic forms, and about the state of their developing systems. This section will present a summary of PI studies that make these claims. These studies and their limitations will provide motivation for the investigation of alternative processing problems as well as the use of self-paced reading as tool for investigating participants’ online sensitivity to the target structure.
VanPatten and Cadierno (1993) was the first study to investigate the effects of PI. Their study focused on the processing of accusative pronouns and compared PI with traditional instruction (TI). The study examined intermediate Spanish learners’ interpretation and production of accusative pronouns in sentences with varying word orders (Object-Verb-Subject, Subject-Verb-Object and Subject-Object-Verb). Accusative pronouns are problematic for learners because they often cause misinterpretation of sentences in Spanish. To illustrate, L2 Spanish learners may misinterpret the OVS (object-verb-subject) sentence *Lo besa María* as “He kisses María” instead of “Maria kisses him” because they misinterpret the accusative pronoun *lo* as the subject of the sentence. In the study, TI was defined and presented as an explanation of grammar involving the target form followed by production practice of the target form. PI, as defined in Chapter 1, included an explanation of the form along with an explanation of the processing problems involved with the form, followed by practice interpreting the target form (i.e., structured input). The study compared 3 groups: The TI group, the PI group, and the control group. The TI group received TI as defined above: a presentation of grammar and production practice. The PI group received full PI including an explanation of the form along with an explanation of the processing problems involved with the form, followed by a structured input activity. The control group received no instruction regarding the form. The research questions that guided the study were:

1. Does altering the way in which learners process input have an effect on their developing systems?
2. If there is an effect, is it limited to processing more input, or does instruction in IP also affect output?
3. If there is an effect, is it the same effect as TI? (Van Patten & Cadierno, p. 47)
The participants were university students in their second year of Spanish study, whose first language was English. All three groups (PI, TI, and control) were assessed using a pretest, posttest, and delayed posttest design. The tests included an interpretation and a production task. For the interpretation task, participants were asked to match each sentence they heard in Spanish with one of two pictures that were simultaneously presented to them via overhead projector. There were 15 items – 10 with OVS word order and 5 with SVO word order that served as distractors. For the production task, a sentence was paired with two pictures, and the subjects completed the sentence based on the pictures with the pictures serving as clues for how to complete the sentence.

The results showed that on the pretests there were no differences between groups. Following instruction, the immediate and delayed posttests revealed that PI outperformed all groups for interpretation, and there was no significant difference between the control and the TI groups. For the production tasks, both the PI and TI groups outperformed the control, but there was no significant difference between the PI and TI groups, even though PI received no practice in the production of the target form.

The authors explain their results by arguing that PI “altered the way in which the subjects processed input, which in turn had an effect on the developing system and what subjects could access for production” (p. 238). As seen in Figure 2.1, Processing Instruction provides training on interpretation which attempts to affect language acquisition early in the process. VanPatten (1996, 2002a, 2004) has explained that pushing learners attend to the form (while also keeping meaning in focus) during structured input has the ability to enhance the way that learners comprehend and produce language which may result in a restructure of the developing system.
TI on the other hand, simply teaches the learners a skill, production, but does not alter learners’ interpretation of the target form.

![Diagram of Processes in SLA (VanPatten 1996, Wong 2004)](image)

Since the publication of VanPatten and Cadierno (1993), PI research has examined the effects of PI over a variety of languages and linguistic structures:

- Spanish (Cadierno 1995; Cheng, 1995; Farley, 2001; Van Patten & Fernández, 2004; Keating & Farley, 2005; Morgan-Short & Bowden, 2006; Fernández, 2008; Leeser & Demil, 2013, among others)
- English (Benati, 2005; Benati & Lee, 2009)
- French (Benati & Lee, 2008; Wong, 2004; Allen, 2000)
- Italian (Benati, 2001; Benati, 2004)
- Japanese (Lee & Benati, 2007)
- Past tense morphemes (Cadierno, 1995; Benati, 2005)
- Accusative pronouns (Keating & Farley, 2005; Fernandez, 2008; Culman, et al., 2009; Henry, et al., 2009; Leeser & Demil, 2013, among others)
- Future tense (Benati, 2001)
- Subjunctive (Collentine, 1998; Farley, 2001)

In general, these studies have supported the claims of VanPatten and Cadierno (1993), and have added to the findings of PI. Some of the general findings in support of PI are as follows:

- PI is superior to TI for altering learners’ processing strategies (VanPatten & Cadierno, 1993; Benati, 2001; Leeser & Demil, 2013; Shintani, 2014).
- Structured Input (SI) is key component of PI that affects outcomes (i.e., explicit information is not required for change to occur) (VanPatten & Oikkenon, 1996; Sanz & Morgan Short, 2004; Benati, 2004; VanPatten & Borst, 2012; Shintani, 2014).

Although the findings of this research have been robust, most of the PI research to date has centered on just a few of the principles of IP that were illustrated in Table 1.1. In fact, if we group the major PI studies according to the processing principle that they address, as in Table 2.1, we can see that the majority of studies has focused on the ways in which PI can assist learners in overcoming the First Noun Principle.

Table 2.1

<table>
<thead>
<tr>
<th>Principles of IP</th>
<th>Relevant Studies</th>
<th>Linguistic Forms Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VanPatten &amp; Sanz (1995)</td>
<td>Spanish accusative pronouns</td>
</tr>
<tr>
<td></td>
<td>VanPatten &amp; Oikkenon (1996)</td>
<td>Spanish accusative pronouns</td>
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<td></td>
<td>VanPatten &amp; Wong (2004)</td>
<td>Spanish accusative pronouns</td>
</tr>
<tr>
<td></td>
<td>VanPatten &amp; Fernandez (2004)</td>
<td>Spanish accusative pronouns</td>
</tr>
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Table 2.1 (continued)

*Major PI Studies Grouped According to the IP Principles and Linguistic Forms*

<table>
<thead>
<tr>
<th>Principles of IP</th>
<th>Relevant Studies</th>
<th>Linguistic Forms Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Culman, Henry &amp; VanPatten (2009)</td>
<td>German accusative case</td>
</tr>
<tr>
<td></td>
<td>Henry, Culman &amp; VanPatten (2009)</td>
<td>German accusative case</td>
</tr>
<tr>
<td></td>
<td>VanPatten &amp; Borst (2012)</td>
<td>German and Spanish accusative</td>
</tr>
<tr>
<td></td>
<td>Leeser &amp; Demil (2013)</td>
<td>Spanish accusative pronouns</td>
</tr>
<tr>
<td>Lexical Preference Principle</td>
<td>Farley (2001)</td>
<td>Spanish subjunctive</td>
</tr>
<tr>
<td></td>
<td>Benati (2001)</td>
<td>Italian future tense</td>
</tr>
<tr>
<td></td>
<td>Benati (2005)</td>
<td>English past tense</td>
</tr>
<tr>
<td></td>
<td>Cadierno (1995)</td>
<td>Spanish past tense</td>
</tr>
<tr>
<td>Primacy of Content Words Principle</td>
<td>Keating &amp; Farley (2005)</td>
<td>Spanish accusative pronouns</td>
</tr>
</tbody>
</table>

One reason for the relatively large number of studies focusing on the First Noun Principle (FNP) stems from the fact that PI is motivated by the processing problem that a linguistic form
presents, and not the form itself. For this reason, PI targeting the FNP should be effective for different forms in a number of different languages, for which L2 learners may rely on the FNP. Because the finding of the studies mentioned in this section overwhelmingly support the effectiveness of PI in helping learners overcome the FNP, the time has come to expand the scope of inquiry to linguistic forms that fall under other processing problems. For the Preference for Nonredundancy Principle, only Benati (2004) has investigated the effects of PI on pushing learners to process redundant morphology. Therefore, the following section will review Benati (2004) in detail.

**PI and the Preference for Nonredundancy Principle**

Benati (2004) is the only study that has investigated processing problems that are outside of the First Noun Principle, the Lexical Preference Principle, or the Primacy of Meaning Principle. Benati (2004) investigated the effects of processing instruction, structured input activities and explicit information on the processing of noun-adjective gender agreement in Italian. Adjectives in Italian must agree in number and gender with the noun they modify (la *casa*$_{FEM}$ *bella*$_{FEM}$). This structure is highly redundant because the noun and adjective carry the exact same morpheme, and thus is representative of the Preference for Nonredundancy principle of Input Processing, which states “Learners are more likely to process nonredundant meaningful grammatical markers before they process redundant meaningful markers.” It is also low in semantic value because it does not contribute much to the meaning of the sentence (there is no difference in meaning between *casa*$_{FEM}$ *bella*$_{FEM}$ and *casa*$_{FEM}$ *bello*$_{MASC}$), and is representative of the Meaning Before Nonmeaning Principle of Input Processing, which states “Learners are more likely to process meaningful grammatical markers before nonmeaningful grammatical markers.”
The study compared 3 groups: the PI group, the SI only group, and the EI only group. The PI group received full PI including explicit information (an explanation of the form along with an explanation of the processing problems involved with the form) followed by a structured input activity. The SI only group completed a structured input activity only, and the EI only group received only the explicit information. The research questions that guided the study were:

1. How do effects of SI, EI, PI treatments compare when measured by an interpretation task?
2. How do effects of SI, EI, PI treatments compare when measured by a discrete item (written production) test?
3. How do effects of SI, EI, PI treatments compare when measured by a more spontaneous task (oral production)? (Benati, 2004, p. 72)

Benati’s (2004) participants were first semester undergraduate students of Italian. All three groups (PI, SI, and EI) were assessed using a pretest and an immediate posttest. The tests included an interpretation and two production tasks. For the interpretation task, participants were asked to match each sentence they heard in Italian (e.g., È bello ‘It is pretty’) with one of two pictures that were simultaneously presented to them. There were 20 items – 10 referential activities having a definite yes or no answer, and 10 affective activities that required learners to respond with an opinion (i.e., D’accordo ‘I agree’ or Non D’accordo ‘I disagree’). For the written production task, participants filled in the blanks in a short passage by providing the correct form of the adjective in parenthesis. For the oral production task, participants were given two pictures illustrating two environments (the town and the country) and were given four minutes to describe the pictures in detail.
The results for all tasks showed that the learners from the PI group made gains equal to those of the SI group and that the gains from both PI and SI were greater than the gains from the EI group, which made no gains. Benati (2004) concludes that “SI practice alone is sufficient to improve performance, and EI plays no role in PI” (p. 78). In addition, the author concludes that the findings that SI is the key factor in PI that pushes learners to make correct form-meaning connections (when the processing problem is the First Noun Principle or the Lexical Preference Principle) can be generalized for the Meaning Before Nonmeaning Principle and the Preference for Nonredundancy principle.

Limitations of Benati (2004)

As shown, most of the PI research to date focuses on three processing principles of IP: the First Noun Principle, the Lexical Preference Principle, and the Primacy of Meaning Principle. Because research is limited to these areas, it is difficult to conclude whether PI is equally as effective for altering other non-optimal processing strategies that are outlined in the model of IP. Benati (2004), as reviewed above, is the only study that has investigated whether the positive effects found for other processing problems can be generalized to the Meaning before Nonmeaning Principle and the Preference for Nonredundancy Principle. However, Benati’s (2004) study is not without some limitations.

The first limitation relates to the materials used. Benati (2004) used a fill-in-the-blank written production task with the verb provided in parenthesis. The following example is taken from Benati (2004) (8).

(8) Complete the following test with the right adjectives agreement.

Milano è una città (bello) __________ ma (grigio) ____________.
Milano is a\textsubscript{FEM} city\textsubscript{FEM} (pretty\textsubscript{MASC}) _______ but (gray\textsubscript{MASC}) ________.

In these examples, learners do not need to know the meaning of the word in parenthesis in order to complete the sentence. This lack of meaningfulness in some PI research has been noted by Doughty (2004). In her review of PI research, she notes that, “the potential that I have always seen in PI lies in its aim to draw learner attention to form while meaning and function are evident to the learner, that is focus on form” (p. 257). Within the instructed SLA literature, focus on form is often contrasted with focus on form\textsubscript{S}, which is defined as “decontextualized, highly metalinguistic, teacher-centered grammar instruction” (Williams, 2005, p. 671). Doughty (2004) continues her remarks on this type of focus on form\textsubscript{S} activities by stating that these activities, “in a PI instructional sequence is likely to be superfluous, but when the essential activity that fosters forms-meaning-function mapping is missing, this constitutes a serious omission, and renders the PI like traditional instruction” (p. 262). In order to avoid the mechanical nature of these types of activities, the present study will use a fill-in-the blank strategy that requires participants to choose from a word bank instead of words in parenthesis. Participants must read each sentence for meaning, then decide which word, and which form of the word, best completes the sentence. As a result, the participants are able to focus on the form (putting the word in the correct form) while meaning and function are evident.

Another limitation of Benati’s (2004) study is that it used only semantic gender agreement in the structured input activity. Semantic gender generally refers to an animate object, and the gender markers refer to the biological characteristics of the referent (the referent is either female or male), as in (9). Grammatical gender, however, also exists in romance languages. It generally refers to an inanimate object, and the grammatical markers do not refer to any
biological characteristics (e.g., a house is neither feminine nor masculine based on its biology), but are required by the linguistic restraints of the language as in (10).

(9) \textit{La niña quiere una hermana pequeña.}

The girl wants a feminine sister small feminine

‘The girl wants a little sister.’

(10) \textit{La familia vende una casa pequeña.}

The family sells a feminine house small feminine

‘The family is selling a small house.’

Research has shown that there is a difference between how these two types of gender agreement are processed (Atchley & Leeser, in progress). Atchley and Leeser (in progress) argue that meaningful and redundant grammatical markers (semantic gender agreement) are easier and more quickly processed than nonmeaningful and redundant markers (grammatical gender agreement). As a result, the present study will use both types of gender agreement in order to generalize findings across both structures.

The Secondary Effects of PI

A newer area of interest in PI research is the study of the secondary effects of PI. As discussed in Chapter 1, secondary effects occur when two different grammatical structures both address the same processing principle (e.g., Spanish inflectional morphology for the preterit and the future both fall under the “Lexical Preference Principle”). If PI is aimed at altering processing strategies, not specific grammatical structures, then it is of interest to see if the
alteration of these strategies carries over, or transfers, from one structure to another or from one processing strategy to another.

In their book, Benati and Lee (2008) present three studies that investigate the primary and secondary effects of PI on the following structures: a) PI of Noun-Adjective agreement in Italian to secondary effects on Italian Future tense b) PI on English past tense to secondary effects for English 3rd person singular present tense, and c) PI on French Imparfait to Secondary effects of Subjunctive and Causative constructions. Each of these studies will be discussed below.

The first study investigated whether L2 learners of Italian, who receive PI on noun-adjective gender agreement, will be able to transfer that training to tasks involving future tense verb morphology. The rational for choosing these target structures involved the processing problems that they address. Both structures are redundant because the information contained in the morphology of each is a repetition of the noun or subject with which it agrees. Therefore, both structures address the Preference for Non-redundancy principle of Input Processing. The morphology of each (the gender of the adjective in noun-adjective agreement and the verb morphology in Italian future tense) also tends to be overlooked by the learner because they can gather information about gender from the noun or about the subject of the sentence from an overt subject. This addresses the Lexical Preference Principle of Input processing. The participants in this study were beginning learners of Italian whose native language was English and who had not been taught or exposed to the primary or secondary grammatical forms. The participants were divided into three groups: a PI group, a traditional instruction (TI) group and a control group.

The materials consisted of pre- and post-tests as well as instructional intervention. All groups completed a pre-test and post-test that measured interpretation and production on both target forms. The pre-test was administered one week before treatment and the post-test was
administered immediately after treatment. For the treatment portion, the PI group received processing instruction about the target form. They were given explicit information about noun-adjective gender agreement and the potential processing problems that learners may encounter. The participants then completed SI activities that addressed the primary structure, noun-adjective gender agreement in Italian. These activities were structures such that the participants heard a sentence such as È bello (is good-looking\textsubscript{MASC}) or È bella (is good-looking\textsubscript{FEM}) and had to identify the subject of the sentence (either a man or a woman). The treatment for the TI group was different than for the PI group. The TI group received explanation about noun-adjective gender agreement and then participated in output practice. The participants were given a series of sentences with a blank and an adjective in parenthesis. They were asked to fill in the blank with the appropriate form of the adjective. The control group completed only the pre- and post-tests and did not receive instruction of any kind.

The results for primary effects (noun-adjective gender agreement) showed that only the PI group improved their performance on interpretation from pre- to posttest and that this performance was significantly better than the TI group and the control group. They also showed that both the PI group and the TI group improved from pre- to posttest on production and that this performance was significantly better than the control group. In addition, on production, there was no significant difference between the PI group and the TI group. These results mirror finding from other PI research investigating the differences between PI and TI. The results for the secondary effects (future tense verb morphology) showed that although both the TI group and the PI group improved on the posttest (PI about 25% and TI about 4%), only the PI group’s improvement was significant. In addition, this performance was significantly better than the TI group and the control group. For production, both the PI and TI groups improved from pre- to
posttest, but only the PI group’s improvement was significantly greater than the control group. The authors conclude that PI helps learners process grammatical forms in an efficient way and alters their processing strategies in such a way that they are able to transfer that knowledge or strategy to the processing of other linguistic structures.

For the second study, the researchers investigated the primary effects of PI and TI on the simple past tense morphology “–ed” in English. They also examined whether training on the past tense could have transfer-of-training effects of the English third person singular “–s” in the present tense. These two forms were chosen because the processing difficulties involved are the same: The Lexical Preference principle and The Preference for Non-redundancy Principle. As in the Italian Future tense, the English past tense is most often accompanied by a temporal adverb (yesterday), making the –ed redundant and with low communicative value. In the sentence, Yesterday, I watched the game, both Yesterday and the past tense marker –ed, contain the meaning “past”, thus the –ed is redundant. The –ed is also less noticeable to a learner than the word yesterday, which is why they rely on the lexical item (yesterday) instead of the –ed (i.e. Lexical Preference Principle).

The participants in the study were native Korean speakers, who were beginning learners of English. The participants were divided into two treatment groups: Processing Instruction (PI) and Traditional Instruction (TI). All participants had been taught the form before, though were not currently studying these specific targets in their classes.

The pre- and post-tests for the primary form consisted of an interpretation task and a production task. For the interpretation task, learners heard 20 aural sentences and were asked to mark a column to indicate whether they heard the past tense, present tense, or ‘can’t tell’. For the production task, learners were presented with a paragraph, and were asked to fill in the blanks
with the correct form of the verb in the past tense. In order to test the secondary form, the participants completed additional interpretation and production tasks. For the secondary form, for interpretation, learners heard 20 sentences and had to mark columns for singular (one person) or plural (2 or more people) or ‘can’t tell’. For the production task, learners again were presented with a paragraph and asked to fill in the blank with the correct form of the verb.

The results revealed that for the primary form, PI significantly outperformed TI on both the interpretation and production tasks. For the secondary form, PI significantly outperformed TI on both the interpretation and production tasks.

In the third study, Benati and Lee investigated the transfer-of-training effects of PI on the acquisition of French. The study examined whether learners who received instruction on French imperfect tense could transfer the training to the French subjunctive (secondary effect) and to the French causative expressions with *faire* (cumulative effect). Making progress on the French subjunctive is considered a secondary effect because both the subjunctive and the imperfect present learners with the same processing problem (the Lexical Preference Principle). Information about the meaning of the sentence is contained in a lexical item. Progress on the French causative *faire* is considered a cumulative effect because it presents learners with a different processing problem (the First Noun Principle).

The participants were 30 undergraduates studying intermediate-level French. They were divided into three groups: a PI group, a TI group, and a no instruction or control group. The study consisted of a pretest, a classroom treatment and an immediate posttest. The results showed that the PI group significantly outperformed the TI and control groups on the interpretation task for the primary form (the French Imperfect tense), but there were no differences between the groups on production tasks. For the secondary form, the French subjunctive, the PI group
significantly outperformed the TI and Control groups on both interpretation and production. Finally, for the cumulative form, the French *faire*, the PI group significantly outperformed the TI and Control groups on both interpretation and production.

Another recent study conducted in this area was by Leeser and Demil (2013). They used participants who were L2 learners of Spanish with intermediate proficiency and divided them into three groups: processing instruction (PI), traditional instruction (TI), or no instruction (NI), which served as a control group. Accusative clitics were the main target of the study and are often misinterpreted as the subject of a sentence as predicted by the First Noun Principle of input processing. Dative clitics also cause a similar processing problem and therefore also fall under the First Noun Principle. The participants took a pre-test, post-test, and a delayed post-test that measured their interpretation and production of accusative and dative clitics. Following the pre-test, the PI group received explicit instruction about accusative clitics as well as about the processing problem that they present. They then completed structured input activities. The TI group also received explicit information about accusative clitics, but did not receive information about the processing problem. The TI group completed production-based activities designed with opportunities to produce the target form in either written or oral format. The results showed that PI was superior to TI on the interpretation of accusative clitics, but there was no difference between PI and TI on production tasks. In addition, the results showed that the PI group made significant gains from pretest to the immediate posttest on the secondary structure, dative clitics, and that these gains were maintained on the delayed post-test.

In summary, all of the studies reviewed in this section show positive results for transfer-of-training effects. Most of the research in this area was conducted by Benati and Lee (2008). They show that training on noun-adjective gender agreement in Italian transfers to Italian future
tense; training on English past tense transfers to English 3rd person present tense; training on French imparfait transfers to causative constructions. Leeser and Demil (2013) also investigated transfer-of-training effects and found that training on accusative clitics in Spanish have secondary effects for dative clitics. All of these authors conclude that these transfer-of-training effects show that PI is successful at changing learners’ processing strategies.

**Limitations of PI Research**

Generally, limitations of PI research fall under two main categories: the type of processing problems that have been investigated and the types of assessments used.

In the previous sections, it was argued that PI studies tend to focus on a limited set of processing principles, and that this study will seek to add to PI research by investigating the Preference for Nonredundancy principle of IP, which has only been studied by Benati (2004). Spanish gender agreement was selected as the linguistic form that is able to capture the processing problem illustrated in this principle. To review, gender in Spanish is marked on both the noun and the adjective. For example, the phrase *un abrigo largo* (a coatMASC longMASC) shows that the masculine gender is marked on both the noun *abrigo* and the adjective *largo*. This gender marker on the adjective is redundant. Thus, gender agreement falls under the Preference for Nonredundancy principle, which states that learners are more likely to process nonredundant meaningful grammatical markers before redundant meaningful grammatical markers (VanPatten, 2007), meaning that learners would likely overlook the ‘o’ at the end of the adjective ‘largo’ because it is simply a repetition of the ‘o’ at the end of the noun.

Another limitation with many PI studies has to do with the types of assessments used. Many PI studies make claims that PI has altered the processing strategies of L2 learners, or has
had an effect on the learners’ developing system. These studies use improvement on offline measures (such as a paper-and-pencil fill-in-the-blank test) from pre- to posttest as evidence that internal change has occurred. This may be a valid assumption because the posttests show that learners are indeed approaching the task in a new way after receiving a PI treatment. However, PI is based on the model of input processing, and VanPatten (2007) has said that input processing is a “model of moment-by-moment sentence processing during comprehension” (p. 116). If IP is concerned with what learners are doing during comprehension, then PI research should be investigating whether PI is altering what learners are doing during comprehension.

The preferred methodology for investigating what learners are doing moment-by-moment during comprehension is through the use of online measures. Online measures refers to those data collection methodologies (e.g., self-paced reading, eye tracking, ERPs) that track moment to moment variations in workload during language comprehension and provide researchers with millisecond-precise accounts of processing difficulties and/or sensitivity to morphosyntactic violations during sentence comprehension (Mitchell, 2004). When making claims about how learners are processing grammatical features of a language, it is important to use a methodology that is able to measure online processing. Thus, this study will use an online, sentence processing task to measure whether the PI treatments show alterations in participants’ internal strategies.

**Research Questions and Hypotheses**

In order to address the above limitations and add to the current body of PI research, the present study asks the following questions and makes the following hypotheses.

- **Research Question 1**: Does PI targeting noun-adjective gender agreement lead to L2 Spanish learners improved performance on:
b. Accuracy on a sentence-level production task?

c. Noticing of gender agreement mismatches in a self-paced reading task?

- **Hypothesis 1:** For interpretation (a), it is predicted that learners in the PI group will improve from pre- to posttest, which is in line with most of the previous PI research (specifically Benati (2004)). For accuracy in production (b), it is again predicted that both learners in the PI group will improve from pre- to posttest. For noticing mismatches in a self-paced reading task (c), it is predicted that learners in the PI group will improve from pre- to posttest. This prediction is in line with the findings from Atchley and Leeser (in progress) that show that beginning learners do not recognize agreement mismatches for grammatical gender at initial stages. It is predicted that PI will have an effect on the developing system, as claimed by previous research, and that the effect will be shown as improvement in mean reaction times for the posttests.

- **Research Question 2:** Will the training that learners receive in Spanish noun-adjective gender agreement lead to L2 Spanish learners improved performance on:

  a. Interpretation of Spanish first and third-person, singular and plural subject-verb agreement within a structured input task?

  b. Accuracy on a sentence-level production task?

  c. Noticing of subject-verb agreement mismatches in a self-paced reading task?

- **Hypothesis 2:** For interpretation (a), it is predicted that the PI group will improve from pre- to posttest on subject-verb agreement, but that the control group will not
improve. This is in line with previous research (Benati and Lee, 2007, Leeser and Demil, 2013), which shows transfer-of-training effects within a variety of grammatical structures. For accuracy in production (b), it is again predicted the PI group will improve from pre- to posttest, but that the control group will not improve. This is again, in line with previous research. For noticing mismatches in a self-paced reading task (c), it is also predicted that reading times for the PI group will improve from pre- to posttest, but that the control group will not improve.
CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

To address the research questions posed in Chapter 2, a study was designed where participants were divided into one of two treatment groups that were differentiated by distinct instructional interventions. The instructional interventions are described below, as well as the assessment tasks used to measure learner performance. Spanish gender agreement was chosen as the target form for instruction. It was chosen because it presents a processing problem for L2 learners. Recall that gender is redundant because the gender marking of the adjective must match the gender marking of the noun. This falls under the Preference for Non-redundancy principle of Input Processing. Beginning learners in their second semester of instruction were chosen for this study because they have sufficient knowledge of the language and vocabulary to successfully complete the tasks, but are still in the beginning stages of acquisition. All variables are summarized in Table 3.1 below. This chapter details the various aspects of the study from the overall design, the participants, and the instructional and assessment instruments. It also includes an explanation of how data was scored and analyzed.

Research Design

Participants were divided into two instructional treatment groups as presented in Table 3.1. The PI group received full processing instruction which included explicit information along with structured input activities. The second group functioned as a control group, completing a distractor activity and receiving no instructional intervention. Both groups completed a pretest, immediate posttest and a delayed posttest.
Table 3.1

Summary of Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Processing Instruction</td>
</tr>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Test</td>
<td>Pretest</td>
</tr>
<tr>
<td></td>
<td>Immediate Posttest</td>
</tr>
<tr>
<td></td>
<td>Delayed Posttest</td>
</tr>
</tbody>
</table>

Primary Structure: Gender Agreement

Following Benati (2004), the primary target structure was gender agreement in Spanish. This form was chosen because it addresses the Preference for Non-Redundancy principle because the repetition of the gender on the adjective is redundant and is often overlooked by L2 learners. In Spanish, the gender of the noun is repeated on the adjective, which follows the noun, as in (11). Because it is repetitive, L2 learners often overlook the gender on the adjective.

(11) *La profesora busca a una alumna alta para llevar los libros.*

   The professor looks for a female student tall to carry the books.

   ‘The professor looks for a tall student to carry the books.’

Secondary Structure: Subject-Verb Agreement

Subject-verb agreement in Spanish was selected as the secondary target form that was used to investigate the secondary effects of PI. This form was chosen because it is comparable to gender agreement in that it is also a form that is redundant. In Spanish, the overt subject and the
morphological inflection on the verb both encode the same information about who is completing
the action, as in (12). Therefore, learners often overlook the verbal inflection because it is
redundant, making this form useful in investigating the secondary effects of PI.

(12) *Ahora Pedro* *toma* *el refresco en el salon.*

‘Now Pedro drinks the soft drink in the living room.’

**Participants**

Participants consisted of 112 undergraduate students from Florida State University. The
experimental groups consisted of non-native speakers of Spanish, whose L1 was English.
Participants were recruited from second semester Spanish classes at Florida State University.
This course introduces basic Spanish vocabulary and grammar. The participants that were
selected for final analysis met the following criteria:

- They participated in all testing sessions: pretest, treatment, immediate posttest, and
delayed posttest. This reduced the subject pool to 56 participants.

- For the PI group, they scored 70% or higher on the SI treatment activity. Eleven
participants were excluded due to not performing above chance on the treatment.

Of the 112 participants, only 45 met the inclusion criteria. There were 23 participants in
the PI group and 22 participants in the control group.

Prior to completing the pretest, the participants signed a consent form and completed a
language history questionnaire. To ensure that the grouping of the participants reflected truly
different groups, self-rating scores (on reading, writing, speaking, comprehension and
expression) from the language history questionnaire were submitted to separate one-way
ANOVAs, with Group as the between-subjects variable. The ANOVAs revealed no significant differences between groups on any of the self-reported measures. The mean self-reported scores can be seen in Table 3.2.

Table 3.2

Characteristics of Participants Represented as Means

<table>
<thead>
<tr>
<th>Characteristics of Participants</th>
<th>Age</th>
<th>Reading</th>
<th>Writing</th>
<th>Speaking</th>
<th>Comprehension</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI Group</td>
<td>21</td>
<td>4.8</td>
<td>3.8</td>
<td>4</td>
<td>4.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Control Group</td>
<td>21</td>
<td>4.7</td>
<td>4.2</td>
<td>4.2</td>
<td>4.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

*Mean score out of 10 possible points.

Materials

The materials consisted of a pretest, explicit information about the target structure and the processing problem it may cause, a vocabulary task, a structured input task, a distractor activity, a posttest and a delayed posttest.

Pre and Posttests

Interpretation – Self-Paced Reading

The pretest, posttest and delayed posttest consisted of three parts: two interpretation tasks and a production task. The first interpretation task was a self-paced reading task. All experimental sentences were taken from Atchley and Leeser (in progress) and consisted of a noun phrase (NP) containing an indefinite article [e.g., *una* (feminine) or *un* (masculine)], a singular noun ending in –*o* (masculine) or –*a* (feminine), and an adjective also ending in –*o*
(masculine) or –a (feminine). The sentences were counterbalanced across 8 lists. Each list contained 20 sentences with grammatical gender and 20 sentences with semantic gender plus 40 distractors for a total of 80 sentences per list. The lists were also counterbalanced such that half of the target sentences contained a masculine noun and half contained a feminine noun. In addition, half of the target sentences were grammatical and half were ungrammatical. The following sentence is an example of one target sentence:

(13)  a.  \textit{La mujer necesita un abrigo largo/*larga para el invierno.}

The woman needs a\textsubscript{MASC} coat\textsubscript{MASC} long\textsubscript{MASC/*FEM} for the winter.

The 40 distractor sentences from the self-paced reading served as the experimental materials for testing secondary effects. These sentences were taken from VanPatten, Keating and Leeser (2012). They consisted of 40 experimental sentences. 20 of the 40 sentences crossed first- and third- person singular subjects with first- and third person singular verb forms to create agreement matches and mismatches as seen in example (14) (VanPatten, et al., 2012).

(14)  a.  \textit{Ahora Pedro tomar el refresco en el salon.}

Now Pedro\textsubscript{3rd-sing} drinks\textsubscript{3rd-sing} the soft drink in the living room.

b.  *\textit{Ahora Pedro tomo el refresco en el salon.}

Now Pedro\textsubscript{3rd-sing} drink\textsubscript{1st-sing} the soft drink in the living room.

c.  \textit{Ahora yo tomar el refresco en el salon.}

Now I\textsubscript{1st-sing} drinks\textsubscript{1st-sing} the soft drink in the living room.

d.  *\textit{Ahora yo toma el refresco en el salon.}

Now I\textsubscript{1st-sing} drinks\textsubscript{3rd-sing} the soft drink in the living room.

The remaining 20 sentences crossed second-person singular and third person plural subjects with their corresponding verb forms as in (15) (VanPatten, et al., 2012).
Following each sentence, learners were asked to answer a Yes/No comprehension question to ensure that they were reading each sentence for meaning.

**Interpretation – Structured Input**

The second interpretation task was a structured input activity. Participants saw a picture on a computer screen and heard a statement that consisted of ‘Es’ (‘it is’) followed by an adjective. For instance, for the picture in Figure 3.1, one sentence that the participants may have heard was *Es negra* (‘it is black\textsubscript{MASC}’). They were instructed to respond to what they heard by pressing YES, if the statement described the picture, pressing NO if the statement did not describe the picture.

The participants completed 20 items for this interpretation task. 10 of the items targeted gender agreement. The other 10 items targeted subject-verb agreement. The items targeting subject-verb agreement consisted of a picture of a person completing an action as illustrated in Figure 3.2.
Figure 3.1. Interpretation task using structured input targeting gender agreement. 
Note. All drawings done by Maria Olivella.

Figure 3.2. Interpretation task using structured input targeting subject-verb agreement.

The participants heard a statement that consisted of a verb, and sometimes followed by a prepositional phrase or a noun phrase. The participants heard a statement such as *Juegan afuera* (Play$_{3RD\ person\ plural}$ outside) and were instructed to press YES if the statement described the picture or NO if the statement did not describe the picture.

The items for the structured input interpretation task were counterbalanced creating four lists based on meaning (does the noun describe the picture) and form (does the grammatical structure match the picture). If an item in list A was [+meaning+form], it would be [+meaning-form] in list B, [-meaning+form] in list C, and [-meaning-form] in list D. The same was true for
the items targeting subject-verb agreement. Table 3.2 below shows the counterbalancing of the lists, and examples of the variations of meaning and form.

Table 3.3

Counterbalancing of Items for Structured Input Interpretation Task

<table>
<thead>
<tr>
<th>List A</th>
<th>List B</th>
<th>List C</th>
<th>List D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement</td>
<td>Answer</td>
<td>Statement</td>
<td>Answer</td>
</tr>
<tr>
<td>Es negro</td>
<td>YES</td>
<td>Es negra</td>
<td>NO</td>
</tr>
<tr>
<td>[+m+f]</td>
<td>[-m-f]</td>
<td>[-m+f]</td>
<td>[-m-f]</td>
</tr>
<tr>
<td>Juega</td>
<td>NO</td>
<td>Juegan</td>
<td>YES</td>
</tr>
<tr>
<td>afuera</td>
<td></td>
<td>teléfono</td>
<td>teléfono</td>
</tr>
<tr>
<td>[+m-f]</td>
<td>[-m-f]</td>
<td>[-m+f]</td>
<td>[-m+f]</td>
</tr>
</tbody>
</table>

m = meaning, f = form

Half of the items in List A had a YES answer and half had a NO answer. In addition, half of the gender agreement items were masculine and half were feminine.

Production

The production task was also conducted on a computer, and participants were required to record their answers on a piece of paper that was provided to them. In order to target the primary form, gender agreement, participants were shown a picture, and alongside the picture, was a list of four adjectives in Spanish that could be used to describe the picture. Participants were asked
to fill in the blanks with the correct form of the adjective that best completed the sentence. All of
the adjectives were presented in masculine form (ending in ‘o’). Figure 3.3 below is an example
of what the participants saw on their screen.

Figure 3.3. Example of written production task item targeting gender agreement.

Half of the items targeted gender agreement and asked the participants to fill in the blanks with
an appropriate adjective. In order to test for secondary effects, the remaining items targeted
subject-verb agreement and asked the participants to fill in the blanks with an appropriately
conjugated verb. Figure 3.4 shows an example of an item targeting subject-verb agreement.

Figure 3.4. Example of written production task item targeting subject-verb agreement.
The pictures were counterbalanced such that half of the items in a list targeted gender agreement and half targeted subject-verb agreement. This resulted in the creation of two lists. If a picture was used for gender agreement in list A, then it was used for subject verb agreement in list B. The participants were randomly assigned one of the two lists for the pretest and posttests. Table 3.3 below shows the counterbalancing of the production task.

Table 3.4

*Counterbalancing of Items for Production Task*

<table>
<thead>
<tr>
<th>List A</th>
<th>List B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture</td>
<td>Structure targeted</td>
</tr>
<tr>
<td>1</td>
<td>Gender agreement</td>
</tr>
<tr>
<td>2</td>
<td>Subject-verb agreement</td>
</tr>
<tr>
<td>3</td>
<td>Gender agreement</td>
</tr>
<tr>
<td>4</td>
<td>Subject-verb agreement</td>
</tr>
</tbody>
</table>
Treatment

Vocabulary Task

Because the participants are beginning Spanish learners, there was a concern that the vocabulary for some participants might not be sufficient to successfully complete the structured input task. Therefore, before beginning the treatment portion, the participants completed a vocabulary task followed by a vocabulary quiz to ensure that they would recognize the nouns used in the structured input activity. A second purpose of this activity was to insure that participants would associate the appropriate Spanish word with the picture because many objects in Spanish can be described using more than one noun. For example, in Spanish there are several nouns that can describe a ball: balón (masculine), pelota (feminine), bola (feminine), to name a few.

For this task, the participants saw a picture of an object on the screen along with the name of the object in Spanish as shown in Figure 3.5.

![Figure 3.5. Example of vocabulary item.](image)

Ten vocabulary items were presented followed by ten questions about the items. The participants again saw an image along with a noun in Spanish, and were asked to press YES if the word on the screen was the name of the object in Spanish or NO if it was not.
Explicit Information

For the treatment portion of the experiment, the participants were randomly assigned to one of two groups: a PI group, or a control group. Participants in the PI group received explicit information about the target structure as well as about the processing problem it presents. This was done on the computer screen through written text that they read. Figure 3.6 shows the EI that participants read (adapted from Benati, 2004).

You have probably noticed that nouns and adjectives in Spanish have different gender: in Spanish, adjectives must agree in number and gender with the noun they modify.

\[
\begin{array}{c|c}
\text{Masculine} & \text{Feminine} \\
\hline
\text{\textit{alto}} & \text{\textit{alta}} \\
\text{\textit{un chico}} & \text{\textit{una chica}} \\
\text{\textit{El chico es alto.}} & \text{\textit{La chica es alta.}} \\
\end{array}
\]

Another characteristic of gender in Spanish is that some have biological referents and some do not. \textit{Chico} and \textit{chica} in the examples above are masculine/feminine because they refer to biology (masculine refers to males and feminine to females). Inanimate objects also have gender, but their gender is purely a grammatical requirement of the language and does not refer to biology. Notice that in the grammatical examples below, there is nothing biological that motivates the gender of \textit{libro} or \textit{mesa}.

\[
\begin{array}{c|c}
\text{Biologically Motivated} & \text{Grammatically Motivated} \\
\hline
\text{alumno} & \text{\textit{libro}} \\
\text{‘male student’} & \text{‘book’} \\
\text{\textit{El alumno alto.}} & \text{\textit{El libro rojo.}} \\
\text{\textit{alumna}} & \text{\textit{mesa}} \\
\text{‘female student’} & \text{‘table’} \\
\text{\textit{La alumna alta.}} & \text{\textit{La mesa alta.}} \\
\end{array}
\]

It is often easy to ignore the gender of the adjective because it is redundant. You must pay attention to the adjective ending in order to understand what we are referring to. In addition to that, you need to understand the meaning of the sentence containing the adjective.

\textit{Figure 3.6. Explicit information about gender agreement in Spanish.}
Structured Input Activity

The participants in the PI group completed a structured input activity following the explicit information. The Structured Input (SI) activity consisted of 50 items and targeted only the primary structure: gender agreement.

Figure 3.7. Example of structured input activity.

The participant saw a picture on their screen and then heard a statement such as ‘Es negra’ (it is black\textsubscript{FEM}) as in Figure X. Semantically, the adjective ‘negro’ describes the shirt, and the feminine gender of the adjective also matches the feminine gender of the noun ‘camiseta’. We could say, then, that the adjective ‘negra’ is [+meaning] and [+form] because both the meaning of the word and the grammatical form match the picture. For this item, then, the participant pressed the button marked ‘YES’ on the button box as the correct answer. A statement such as ‘Es negro’ (it is black\textsubscript{MASC}) would require a ‘NO’ response because although the shirt is black, the masculine gender of the noun does not match the feminine gender of ‘camiseta’. The statement ‘Es negro’ (it is black\textsubscript{MASC}) is [+meaning] and [-form]. Along the same lines, if the statement presented is ‘Es blanca’ (it is white\textsubscript{FEM}), the correct answer would again ‘NO’, because although the feminine gender of the adjective matches the feminine gender of the noun, the
meaning (blanco = white) is incorrect. The statement ‘Es blanca’ (it is white\textsubscript{FEM}), then is [-meaning] and [+form]. A fourth option requiring a ‘NO’ response would be a statement such as ‘Es blanco’ (it is white\textsubscript{MASC}), which is [-meaning] and [-form] because the meaning of the adjective does not describe the picture nor does the gender of the adjective match the gender of the noun. Following each item, the participant was told whether their answer was correct or incorrect.

The structured input items were counterbalanced according to their gender, as well as meaning versus form. Half of the items were feminine and half were masculine. As illustrated previously, some statements were [+meaning+form], others were [+meaning-form], [-meaning+form] or [-meaning-form]. The counterbalancing of the lists according to meaning and form is illustrated in Table 3.5.

<table>
<thead>
<tr>
<th>+/-meaning, +/-form</th>
<th>Sample item*</th>
<th>Answer to sample item</th>
</tr>
</thead>
<tbody>
<tr>
<td>[+meaning, +form]</td>
<td>Es negro</td>
<td>YES</td>
</tr>
<tr>
<td>[+meaning, -form]</td>
<td>Es negra</td>
<td>NO</td>
</tr>
<tr>
<td>[-meaning, +form]</td>
<td>Es blanco</td>
<td>NO</td>
</tr>
<tr>
<td>[-meaning, -form]</td>
<td>Es blanca</td>
<td>NO</td>
</tr>
</tbody>
</table>

*These statements correspond to the sample item in Figure 3.6.

The lists were also counterbalanced so that half of the items had a NO answer and half had a YES answer.
**Distractor Activity**

The distractor activity was presented to the participants that were randomly assigned to the control group. This activity followed the vocabulary task and was completed prior to the participants completing the immediate posttest. The activity consisted of four passages in Spanish that targeted the Spanish future tense. The passages were chosen because they did not address gender agreement and targeted a form in which the participants had not received formal instruction. In addition, the length of time required to read the passages was roughly equal to the length of time for the structured input activity that the PI group completed.

**Data Selection and Analyses**

Analyses were conducted for all sections of the pre, post and delayed posttests. For the self-paced reading, each experimental sentence was divided into segments or regions. Example (16a-b) illustrates the regions for the sentences with gender agreement (region 1 is a marker that is used in the software to mark the beginning of a new sentence).

\[
\text{(16)} \quad \begin{align*}
a. & \text{ La \ mujer \ necesita \ un \ abrigo \ largo \ para \ el \ invierno} \\
   b. & \text{ * La \ mujer \ necesita \ un \ abrigo \ larga \ para \ el \ invierno}
\end{align*}
\]

For these sentences, reading times were examined in three key regions to determine participants’ sensitivity to noun-adjective gender agreement violations. Region 6 is the adjective and is the location of the gender agreement violation in ungrammatical sentences. Regions 7 and 8 served as the spillover regions, and the first spillover region in all of the gender stimuli consisted of the preposition *para* “for / in order to.” Example (17a-b) illustrates the regions for the sentences with subject verb agreement.
For these sentences, reading times were examined in three key regions to determine participants’ sensitivity to noun-adjective gender agreement violations. Region 4 is the verb and is the location of the subject-verb agreement violation in ungrammatical sentences. Regions 5 and 6 served as the spillover regions, and the first spillover region in all of the gender stimuli consists of either the article ‘el’ or ‘la’.

For statistical analyses, participants who scored less than 75% accuracy on comprehension questions were excluded. This did not affect any of the final participants. In addition, reading times that were 2.5 standard deviations longer or shorter than the mean reading times for each region, or higher or lower than the high and low cut-offs set at 200 ms and 2000 ms, were excluded. This did not affect any of the data from the final group of participants. For the self-paced reading, mean reading times for each participant were calculated at each region of interest based on grammaticality (ungrammatical or grammatical). For each group and region of interest, a paired-samples t-test was conducted to compare the mean reading times for ungrammatical and grammatical sentences. An alpha level was set at .05.

The structured input interpretation task for the pretest and posttests was scored for accuracy. Participants received a score of 1-10 for accuracy on gender agreement and 1-10 for accuracy on subject-verb agreement. The production task was also scored for accuracy. Participants were given a score of 1-8 for accuracy on meaning for items targeting gender agreement, and 1-8 for accuracy on form for items targeting gender agreement. The same scores (1-8) for meaning and form were given for items targeting subject-verb agreement. The meaning
score indicates whether participants chose the correct word for the sentence regardless of grammatical form. The form score shows whether participants put the word in the correct grammatical form regardless of the meaning of the word within the sentence.

In order to determine whether PI would lead to improve performance, the scores for the interpretation and production tests were submitted to separate, within groups, repeated measures ANOVAs, with an alpha-level was set at 0.05. Simple main effects analyses were conducted to explore all significant effects. The scores were also submitted to factorial ANOVAs in order to compare the PI group and the control group, with an alpha-level set at 0.05. Simple main effects analyses were conducted to explore all significant effects and interactions.
CHAPTER 4

RESULTS

This chapter presents the analyses of three different tasks: interpretation, production, and self-paced reading. The mean scores for the interpretation and production tasks are presented by group (PI, Control). The reading times for the self-paced reading task are presented by group and are discussed by region.

Primary Structure: Gender Agreement

Interpretation Task

Table 4.1 shows the mean scores and standard deviations for each group (PI and Control) on each of the three interpretation tests (pretest, immediate posttest and delayed posttest) targeting gender agreement. The table shows that both groups had higher scores on the delayed posttest than on the pretest, but suggest greater improvement for PI.

Table 4.1

Mean Scores on Interpretation Task for Gender Items

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>PI Group</td>
<td>6.04</td>
<td>1.77</td>
<td>6.04</td>
</tr>
<tr>
<td>Control Group</td>
<td>6.09</td>
<td>1.87</td>
<td>6.09</td>
</tr>
</tbody>
</table>

Maximum possible score is 10 points.
The factorial ANOVA for gender agreement revealed a main effect for Test $F(2, 86) = 4.61, p = .012, \eta^2 = .097$. There was no effect for Group, $F(1, 43) = .000, p = .997, \eta^2 = .000$, and no significant Group X Test interaction $F(2, 86) = .049, p = .952, \eta^2 = .001$. The analysis of simple main effects revealed that there was a marginal difference between the scores on the pretest and delayed posttest ($p = .097$). The scores on the delayed posttest were higher than the scores on the pretest. Although there was no significant interaction between Group and Test, separate repeated measures ANOVAs were conducted separately on each group in order to examine trends in the data. The ANOVA for the PI group revealed a marginal effect for Test, $F(2, 44) = 2.67, p = .08, \eta^2 = .11$. The analysis of simple main effects revealed that scores on the delayed posttest were higher than scores on the pretest. For the control group, the ANOVA revealed no effect for Test, $F(2, 42) = 1.97, p = .152, \eta^2 = .086$.

**Production Task**

Table 4.2 displays the mean percentage scores for each group on the three sentence-level production tests targeting gender agreement broken down by meaning and form. The meaning score shows how many times the participant chose the correct word based on the meaning of the sentence, regardless of whether the participant put the word in the correct grammatical form. The form score shows whether the participant put the word in the correct grammatical form regardless of its meaning within the sentence. The data in the table suggests that both the PI and Control groups improved from the pretest to the delayed posttest.

The factorial ANOVA for the meaning scores revealed neither main effects nor interactions. The factorial ANOVA for the form scores revealed a main effect for Test, $F(2, 43)$
= 4.031, \( p = .021, \eta^2 = .086 \). There was no effect for Group \( F(1, 43) = .167, p = .685, \eta^2 = .004 \) and no significant Group X Test interaction \( F(2, 43) = .804, p = .451, \eta^2 = .018 \).

Table 4.2

*Mean Scores for Meaning and Form on Production Task for Gender Items*

<table>
<thead>
<tr>
<th></th>
<th>Meaning Scores</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>Delayed Posttest</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>PI Group</td>
<td>6.91</td>
<td>1.47</td>
<td>7.39</td>
<td>1.16</td>
</tr>
<tr>
<td>Control Group</td>
<td>7.09</td>
<td>1.38</td>
<td>7.27</td>
<td>1.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Form Scores</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>Delayed Posttest</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>PI Group</td>
<td>4.91</td>
<td>1.38</td>
<td>5.74</td>
<td>1.89</td>
</tr>
<tr>
<td>Control Group</td>
<td>5.09</td>
<td>1.66</td>
<td>5.45</td>
<td>1.77</td>
</tr>
</tbody>
</table>

Maximum possible score is 8 points for meaning and 8 points for form.

The analysis of simple main effects revealed that there was a significant difference between the scores on the pretest and immediate posttest \( (p = .024) \) as well as from pretest to delayed posttest \( (p = .012) \). The scores on the posttests were higher than the scores on the pretest. Although there was no significant interaction between Group and Test, separate repeated measures ANOVAs were conducted separately on each group in order to examine trends in the data.
For meaning, the repeated measures ANOVA for the PI group revealed a main effect for Test, $F(2, 44) = 5.66, p = .006, \eta^2_p = .21$. The analysis of simple main effects revealed that the PI group made significant gains from the pretest to the immediate posttest on meaning ($p = .05, d = .23$), and from the pretest to the delayed posttest on meaning ($p = .008, d = .29$). For the control group, the ANOVA revealed no effect for Test, $F(2, 42) = .197, p = .124, \eta^2_p = .006$.

For form, the repeated measures ANOVA for the PI group revealed a main effect for Test, $F(2, 44) = 3.73, p = .03, \eta^2_p = .145$. The analysis of simple main effects revealed that the PI group made significant gains from the pretest to the immediate posttest on form ($p = .05, d = .40$), and from the pretest to the delayed posttest on form ($p = .024, d = .38$). For the control group, the ANOVA revealed no effect for Test, $F(2, 42) = .751, p = .478, \eta^2_p = .035$.

**Self-Paced Reading - PI Group**

Table 4.3 provides an overview of mean reading times for the PI group ($N = 23$) for the three regions of interest on all three tests in the sentences targeting gender agreement: the target region, which consisted of the adjective (region 6) and the spillover regions, which included the two words immediately following the adjective (regions 7 and 8).

A paired-samples t-test was conducted to compare the means for ungrammatical and grammatical sentences at each target region and for each test for sentences targeting gender agreement.

For region 6, the t-test revealed no differences in reading times for the PI group between ungrammatical and grammatical sentences on the pretest, $t(22) = .38, p = .71$, immediate posttest $t(22) = .34, p = .74$, or delayed posttest $t(22) = .07, p = .94$. 

64
Table 4.3

*Mean Reading Times (in ms) for PI Group for Target and Spillover Regions for Gender Items on all Three Tests*

<table>
<thead>
<tr>
<th>Region 6 (Target Region)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>922.79</td>
<td>305.55</td>
<td>587.65</td>
</tr>
<tr>
<td>Grammatical</td>
<td>943.18</td>
<td>381.20</td>
<td>597.86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region 7 (Spillover Region 1)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>1007.64</td>
<td>314.92</td>
<td>689.73</td>
</tr>
<tr>
<td>Grammatical</td>
<td>926.65</td>
<td>360.59</td>
<td>659.62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region 8 (Spillover Region 2)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>675.58</td>
<td>151.76</td>
<td>575.68</td>
</tr>
<tr>
<td>Grammatical</td>
<td>770.93</td>
<td>269.33</td>
<td>527.02</td>
</tr>
</tbody>
</table>

For region 7, the t-test revealed no differences in reading times for the PI group between ungrammatical and grammatical sentences on the pretest, $t(22) = 1.35, p = .19$, immediate posttest $t(22) = .95, p = .35$, or delayed posttest $t(22) = .64, p = .53$.

For region 8, the t-test revealed no differences in reading times for the PI group between
ungrammatical and grammatical sentences on the pretest, \( t(22) = 1.72, p = .10 \), immediate posttest \( t(22) = 1.60, p = .12 \), or delayed posttest \( t(22) = .51, p = .62 \).

**Self-Paced Reading - Control Group**

Table 4.4 provides an overview of mean reading times for the Control group (\( N = 22 \)) for the three regions of interest on all three tests in the sentences targeting gender agreement: the target region, which consisted of the adjective (region 6) and the spillover regions, which included the two words immediately following the adjective (regions 7 and 8).

Table 4.4

*Mean Reading Times (in ms) for Control Group for Target and Spillover Regions for Gender Items for all Three Tests*

<table>
<thead>
<tr>
<th></th>
<th>Region 6 (Target Region)</th>
<th>Region 7 (Spillover Region 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Immediate Posttest</td>
</tr>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>916.19</td>
<td>430.53</td>
</tr>
<tr>
<td>Grammatical</td>
<td>932.57</td>
<td>340.35</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>951.56</td>
<td>421.39</td>
</tr>
<tr>
<td>Grammatical</td>
<td>920.29</td>
<td>284.23</td>
</tr>
</tbody>
</table>
Table 4.4 (continued)

Mean Reading Times (in ms) for Control Group for Target and Spillover Regions for Gender Items for all Three Tests

<table>
<thead>
<tr>
<th>Region 8 (Spillover Region 2)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>610.39</td>
<td>211.88</td>
<td>503.77</td>
</tr>
<tr>
<td>Grammatical</td>
<td>612.39</td>
<td>160.79</td>
<td>496.39</td>
</tr>
</tbody>
</table>

A paired-samples t-test was conducted to compare the means for ungrammatical and grammatical sentences at each target region and for each test for sentences targeting gender agreement.

For region 6, the t-test revealed no differences in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = .33, p = .74$, immediate posttest $t(21) = .79, p = .44$, or delayed posttest $t(21) = 1.70, p = .10$.

For region 7, the t-test revealed no differences in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = .50, p = .62$, immediate posttest $t(21) = .61, p = .55$, or delayed posttest $t(21) = .61, p = .55$.

For region 8, the t-test revealed no differences in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = .05, p = .96$, immediate posttest $t(21) = .34, p = .74$, or delayed posttest $t(21) = .82, p = .42$. 
Secondary Structure: Subject-Verb Agreement

Interpretation Task

Table 4.5 shows the mean scores for each group (PI and Control) on each of the three interpretation tests (pretest, immediate posttest and delayed posttest) targeting subject-verb agreement. The table shows that both groups had higher scores on the delayed posttest than on the pretest.

Table 4.5

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pretest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI Group</td>
<td>7.74</td>
<td>1.98</td>
<td>7.74</td>
<td>1.98</td>
<td>8.22</td>
<td>1.44</td>
</tr>
<tr>
<td>Control Group</td>
<td>7.59</td>
<td>2.26</td>
<td>7.59</td>
<td>2.26</td>
<td>7.86</td>
<td>1.42</td>
</tr>
</tbody>
</table>

Maximum possible score is 10 points.

The factorial ANOVA for subject-verb agreement revealed no effect for Test, $F(2, 86) = 1.22, p = .304, \eta^2 = .027$, no effect for Group, $F(1, 43) = .209, p = .649, \eta^2 = .005$, and no significant Group X Test interactions, $F(2, 86) = .090, p = .914, \eta^2 = .002$. Although there was no significant interaction between Group and Test, separate repeated measures ANOVAs were conducted separately on each group in order to examine trends in the data. The repeated measures ANOVA for the PI group revealed no effect for Test, $F(2, 44) = 1.09, p = .344, \eta^2 = .047$. For the control group, the ANOVA revealed no effect for Test, $F(2, 42) = .285, p = .753, \eta^2 = .013$. 
Production Task

Table 4.6 displays the mean scores for each group on the three sentence-level production tests targeting subject-verb agreement broken down by meaning and form. The meaning score shows how many times the participant chose the correct word based on the meaning of the sentence, regardless of whether the participant put the word in the correct grammatical form. The form score shows whether the participant put the word in the correct grammatical form regardless of its meaning within the sentence. The data in the table suggests that both the PI and Control groups improved from the pretest to the posttests.

Table 4.6

Mean Scores for Meaning and Form on Production Task for Subject-Verb Agreement

<table>
<thead>
<tr>
<th></th>
<th>Meaning Scores</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>Delayed Posttest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>PI Group</td>
<td></td>
<td>6.43</td>
<td>1.67</td>
<td>7.0</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td>6.72</td>
<td>1.42</td>
<td>6.50</td>
</tr>
</tbody>
</table>

Form Scores

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Immediate Posttest</td>
<td>Delayed Posttest</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>PI Group</td>
<td>5.83</td>
<td>2.48</td>
<td>5.74</td>
</tr>
<tr>
<td>Control Group</td>
<td>5.31</td>
<td>2.87</td>
<td>6.13</td>
</tr>
</tbody>
</table>

Maximum possible score is 8 points for meaning and 8 points for form.
The factorial ANOVA for the meaning scores revealed a marginal effect for Test, $F(2, 86) = 2.701, p = .073, \eta^2_p = .059$, no effect for Group, $F(1, 43) = .388, p = .536, \eta^2_p = .009$, and no significant Group X Test interactions, $F(2, 86) = 1.932, p = .151, \eta^2_p = .043$. Although there was no significant interaction between Group and Test, separate repeated measures ANOVAs were conducted separately on each group in order to examine trends in the data.

For meaning, the repeated measures ANOVA for the PI group revealed a main effect for Test, $F(2, 44) = 5.43, p = .008, \eta^2_p = .20$. The analysis of simple main effects revealed that the PI group made significant gains from the pretest to the delayed posttest on meaning ($p = .004, d = .28$). For the control group, the ANOVA revealed no effect for Test, $F(2, 42) = .50, p = .614, \eta^2_p = .023$.

The factorial ANOVA for the form scores revealed a main effect for Test, $F(2, 86) = 3.03, p = .05, \eta^2_p = .066$. There was no effect for Group, $F(1, 43) = .000, p = .929, \eta^2_p = .000$, and no significant Group X Test interaction, $F(2, 86) = 1.334, p = .269, \eta^2_p = .030$. The analysis of simple main effects revealed that there was a significant difference between the scores on the pretest and delayed posttest ($p = .017$). The scores on the delayed posttest were higher than the scores on the pretest. Although there was no significant interaction between Group and Test, separate repeated measures ANOVAs were conducted separately on each group in order to examine trends in the data.

For form, the repeated measures ANOVA for the PI group revealed no effect for Test, $F(2, 44) = .861, p = .43, \eta^2_p = .038$. For the control group, the ANOVA revealed a marginal effect for Test, $F(2, 42) = 2.80, p = .072, \eta^2_p = .118$. The analysis of simple main effects revealed that the control group made marginal gains from the pretest to the delayed posttest on form ($p = .07, d = .59$).
Self-Paced Reading (SPR) - PI Group

Table 4.7 provides an overview of mean reading times for the PI group (N = 23) for the three regions of interest on all three tests in the sentences targeting subject-verb agreement: the target region, which consisted of the verb (region 4) and the spillover regions, which included the two words immediately following the verb (regions 5 and 6).

A paired-samples t-test was conducted to compare the means for ungrammatical and grammatical sentences at each target region and for each test for sentences targeting gender agreement.

Table 4.7

Mean Reading Times (in ms) for PI Group for Target and Spillover Regions for Subject-verb Agreement on all Three Tests

<table>
<thead>
<tr>
<th>Region 4 (Target Region)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>927.58</td>
<td>324.56</td>
<td>668.16</td>
</tr>
<tr>
<td>Grammatical</td>
<td>1022.10</td>
<td>400.15</td>
<td>674.58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region 5 (Spillover Region 1)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>1071.23</td>
<td>366.94</td>
<td>696.77</td>
</tr>
<tr>
<td>Grammatical</td>
<td>833.62</td>
<td>219.00</td>
<td>652.47</td>
</tr>
</tbody>
</table>
Table 4.7 (continued)

*Mean Reading Times (in ms) for PI Group for Target and Spillover Regions for Subject-verb Agreement on all Three Tests*

<table>
<thead>
<tr>
<th>Region 6 (Spillover Region 2)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>539.61</td>
<td>120.87</td>
<td>451.07</td>
</tr>
<tr>
<td>Grammatical</td>
<td>511.63</td>
<td>92.34</td>
<td>435.34</td>
</tr>
</tbody>
</table>

For region 4, the t-test revealed no differences in reading times for the PI group between ungrammatical and grammatical sentences on the pretest, $t(22) = 1.73$, $p = .10$, immediate posttest $t(22) = .15$, $p = .88$, or delayed posttest $t(22) = .80$, $p = .43$.

For region 5, the t-test revealed significant differences in reading times for the PI group between ungrammatical and grammatical sentences on the pretest, $t(22) = 4.43$, $p < .001$. The reading times for ungrammatical sentences were significantly longer than the reading times for grammatical sentences. The t-test revealed no differences in reading times for the PI group between ungrammatical and grammatical sentences on the immediate posttest $t(22) = 1.36$, $p = .19$, or delayed posttest $t(22) = 1.13$, $p = .27$.

For region 6, the t-test revealed no differences in reading times for the PI group between ungrammatical and grammatical sentences on the pretest, $t(22) = .88$, $p = .39$, immediate posttest $t(22) = .70$, $p = .49$, or delayed posttest $t(22) = 1.05$, $p = .31$. 
**Self-Paced Reading (SPR) - Control Group**

Table 4.8 provides an overview of mean reading times for the Control group (N = 22) for the three regions of interest on all three tests in the sentences targeting subject-verb agreement: the target region, which consisted of the verb (region 4) and the spillover regions, which included the two words immediately following the verb (regions 5 and 6).

Table 4.8

*Mean Reading Times (in ms) for Control Group for Target and Spillover Regions for Subject-Verb Agreement for all Three Tests*

<table>
<thead>
<tr>
<th>Region 4 (Target Region)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>974</td>
<td>340.79</td>
<td>648.11</td>
</tr>
<tr>
<td>Grammatical</td>
<td>901.41</td>
<td>332.61</td>
<td>625.63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region 5 (Spillover Region 1)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>982.36</td>
<td>320.54</td>
<td>666.66</td>
</tr>
<tr>
<td>Grammatical</td>
<td>925.14</td>
<td>278.45</td>
<td>659.07</td>
</tr>
</tbody>
</table>
Table 4.8 (continued)

Mean Reading Times (in ms) for Control Group for Target and Spillover Regions for Subject-Verb Agreement for all Three Tests

<table>
<thead>
<tr>
<th>Region 6 (Spillover Region 2)</th>
<th>Pretest</th>
<th>Immediate Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Ungrammatical</td>
<td>501.64</td>
<td>180.42</td>
<td>457.36</td>
</tr>
<tr>
<td>Grammatical</td>
<td>489.79</td>
<td>155.1</td>
<td>448.03</td>
</tr>
</tbody>
</table>

A paired-samples t-test was conducted to compare the means for ungrammatical and grammatical sentences at each target region and for each test for sentences targeting subject-verb agreement.

For region 4, the t-test revealed a marginal difference in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = 1.83, p = .08$, meaning that reading times were longer for ungrammatical sentences than for grammatical sentences. The t-test revealed no differences in reading times on the immediate posttest $t(21) = .65, p = .52$, or delayed posttest $t(21) = .30, p = .77$.

For region 5, the t-test revealed no differences in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = .95, p = .35$, immediate posttest $t(21) = .19, p = .86$, or delayed posttest $t(21) = .78, p = .45$.

For region 6, the t-test revealed no differences in reading times for the Control group between ungrammatical and grammatical sentences on the pretest, $t(21) = .49, p = .63$, immediate posttest $t(21) = .38, p = .71$, or delayed posttest $t(21) = .21, p = .84$.  

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Summary of Results

The analyses related to the primary and secondary effects of instruction can be summarized as follows:

- The PI group improved their performance from pretest to delayed posttest for interpretation of the primary form, but this increase in scores was only marginal.

- The PI group made significant gains on meaning and form scores from the pretest to the delayed posttest on production of the primary form.

- For both groups, the reaction times for ungrammatical sentences on SPR were not significantly different from the reaction times for grammatical sentences on any of the three tests on the primary form.

- The PI group improved their performance from pretest to delayed posttest for interpretation of the secondary form, but this increase in scores was not significant.

- The PI group made significant gains on meaning scores from the pretest to the delayed posttest on production of the secondary form, and the control group made marginal gains on form scores from pretest to delayed posttest production of the secondary form.

- For the PI group, reactions times for ungrammatical sentences were significantly longer than reaction times for grammatical sentences on the pretest only for the secondary form. This result was also marginally found in the control group.

- The reaction times for ungrammatical sentences on SPR for the immediate and delayed posttests were not significantly different from the reaction times for grammatical sentences for either group on the secondary form.
CHAPTER 5
DISSCUSSION AND CONCLUSIONS

This chapter discusses the results reported in Chapter 4 in light of the hypotheses presented in Chapter 2, as well as in comparison with previous PI research. Finally, the limitations of the study will be discussed along with avenues for future research.

Discussion of Results

Research Question 1

The first research question for this study asks whether PI targeting noun-adjective gender agreement leads to L2 Spanish learners improved performance on interpretation of noun-adjective gender agreement within a structured input task, accuracy on a sentence-level production task, and noticing of gender mismatches on a self-paced reading task.

Interpretation Task. For interpretation, it was predicted that learners in the PI group, and not the control group, would improve from pre- to posttest. The results are partially supported in that the control group made no significant improvements. However, the results for the PI group are not robust, and show only a trend that the PI group made improvements from the pretest to the delayed posttest ($p = .08$). Looking only at the mean scores for the interpretation task, it is clear that both groups improved their scores from pretest to delayed posttest and that the scores for the PI group were higher than for the control group, but none of the increases in scores were significant, and the increase was only seen at the delayed posttest and not the immediate posttest. These results are different from Benati (2004) and other PI
studies that show significant improvement from pretest to immediate posttest for groups receiving a PI treatment.

Recall that Benati (2004) investigated the effects of PI on gender agreement in Italian and found that the PI group made significant improvements from the pretest to the posttest. One explanation for the difference in results between the present study and Benati’s study is the design of the interpretation task. Benati (2004) presented participants with two pictures: one of a famous Italian actress, and one of a famous Italian actor. The participants heard sentences such as È bella (‘is pretty\textsubscript{FEM}’) and they had to indicate whether the sentence described the man or the woman. The pictures remained the same throughout the task, so the participants only had to focus on the form of the adjective they heard in the sentence. If they heard a word with a feminine marker, then they checked the box under the image of the woman. The meaning of the adjective came into play as an affective activity in which the learners were asked to check a box to indicate whether they agreed or disagreed with the statement. For the present study, the participants saw a new picture for each item. Some pictures were of inanimate objects and some were of people. The participants in the present study they had to think about both the meaning and form of the object or person in Spanish, whether it was masculine or feminine, and then also had to focus on both the meaning and form of the adjective they heard in the sentence to match it to the noun.

In studies investigating the effects of PI on word order, results are more robust for interpretation tasks. VanPatten and Cadierno (1993), for example, found a significant increase from pre- to posttest for the interpretation of OVS sentences in Spanish. For their interpretation task, participants were asked to match the sentence they heard with one of two pictures that were presented on the screen. For example, participants heard Lo saluda la chica (Him\textsubscript{OBJ} greets the
‘The girl greets him’), where the object is the first word and the subject is the last word in the sentence (OVS). This sentence is often misinterpreted as ‘He greets the girl.’ Participants were asked to match this sentence with one of two pictures. One picture showed a boy waving at a girl (who did not wave back), and the other showed a girl waving at a boy (who did not wave back). The participants had to look at the pictures and decide which person is the subject or object in order to match it with the sentence they heard. In these first noun studies, the form determines the meaning of the sentence because word order affects meaning. However, the present study presents a different challenge because the form (for grammatical gender) is meaningless – it serves a purely grammatical function. Therefore, the participants in the present study have an added challenge of focusing on both the meaning and form of the noun pictured, while also trying to match the meaning and form of what they hear, even though the forms for grammatical gender agreement are meaningless.

Discussing his model of Input Processing, VanPatten (2007) makes claims about what guides learners’ processing. He claims that “comprehension for learners is initially quite effortful in terms of cognitive processing and working memory, and that learners are limited capacity processors and cannot process and store the same amount of information as native speakers can during moment-by-moment processing” (p. 117). In light of these claims, the results, or lack of results, from the interpretation task could be due to the taxing nature of the task. Benati’s (2004) participants only had to hold a few pieces of information in working memory while completing the interpretation task: the gender of the picture – feminine or masculine (form), and the adjective (form) they heard. The same is true for the participants in VanPatten and Cadierno (1993). Participants had to hold in working memory the sentence they heard (meaning and form) and the subject or object of the pictures (form) they saw. In contrast, the participants in the
present study had to hold several items of information in their working memory: the name of the object in Spanish (meaning), its gender (form), and the adjective (meaning and form) they heard. In addition, for the present study, this information changed with every item. You can see that for Benati’s task, the participants could focus on the form of the adjective without thinking about the meaning of the noun, but in the present study, the participants had to focus on both the meaning and the form of the noun as well as the meaning and form of the adjective. It is possible that this is just too taxing on the working memories of these beginning learners, and is why they failed to make significant gains from pretest to posttest.

When designing a PI study, VanPatten (2002) notes that it is important to keep meaning in focus while also allowing learners to focus on form. Learners need to be engaged in meaningful comprehension of the language, and not simply a mechanical drill that can be accomplished without knowing the meaning of the sentence, objects, or pictures being used. The participants in Benati’s task had to know the meaning of the adjective in order to decide whether it described the pictures so that they could express their opinion on the affective SI activity, so in this way, the task is meaningful. However, they did not need to know the meaning of the adjective for the referential activity. In order to choose the correct picture, the participants could focus solely on the form of the adjective. In this way, it can be argued to be a focus on form activity, which is contrary to the goals of PI (Doughty, 2004). The participants in VanPatten and Cadierno’s task had to know the meaning of the sentence they heard in order to choose the appropriate picture, thus creating a meaningful SI activity. What the present study does differently is that it requires learners to think about not only the meaning of the adjective they hear, but also the meaning of the noun of the picture they see on the screen. It is a meaningful task, but the question is: is it too much for beginning learners? There needs to be a balance
between meaning and form, so that the form can be salient, while keeping meaning in focus, and without taxing the working memories of the participants.

**Production Task.** For accuracy in production for gender agreement, it was predicted that learners in the PI group would improve from pre- to posttest, but that the control group would not improve. These predictions were supported. The PI group made significant gains from the pretest to the delayed posttest on both meaning scores and form scores, and the control group made no significant improvements. Recall that the meaning score shows their accuracy in choosing an appropriate word for the sentence regardless of form, and the form score shows their accuracy in choosing the appropriate form of the word regardless of meaning.

The consistency of the production results indicates that PI had some effect on how learners processed gender agreement. Recall that PI does not instruct learners in the production of the form. PI focuses on interpretation and altering how learners are interpreting, or processing the form. The learners in the PI group received explicit information about gender agreement and the processing problem that it presents and completed a structured input activity that focused on interpretation. Learners were never asked to produce the form during treatment. The fact that they are able to make improvements in production, especially on the delayed posttest (two weeks after treatment), is noteworthy. Again, the question is why we see these results on the production task, but not on the interpretation task, if instruction is focused on interpretation.

The previous discussion of the interpretation results is again a possible the answer to this question. The results for the interpretation task were not robust because they were too taxing on the working memories of the participants. Similarly, the production task asked the participants to choose words from a word bank, put them in the appropriate place in the paragraph, and in the appropriate form. Meaning was kept in focus because the participants had to read and understand
the paragraph in order to put the words in the appropriate spaces, but the participants were not required to supply the words on their own, as they did in the interpretation task. The words that matched the pictures were given to them in the word bank, or within the paragraph itself. In this way, the production task is less taxing on the participants’ working memory than the interpretation task, which explains the differences in results between the two tasks.

It is also important to note the difference between the written production task for present study and the written production tasks from Benati (2004) and other PI studies. As mentioned, the present study kept meaning in focus by asking participants to fill in the blank with the correct word from a word bank. The participants had to understand both the meaning of the sentence and the meaning of the words in the word bank in order to answer correctly. In contrast, Benati (2004) as well as other PI studies (e.g. Cadierno, 1995) asked participants to fill in the blank with the word in parenthesis that immediately followed the blank. This type of activity is more like a mechanical drill because the participants do not need to know the meaning of the sentence or the word in parenthesis in order to put it in the correct form. Thus, it is interesting that the results for the present study show significant improvement on form for the PI group, even though the task is more taxing than in previous studies due to its meaningful nature. For this reason, I conclude that PI has been successful in altering how learners approach gender agreement, even though the results of the interpretation tasks used in this study are less clear.

**Self-Paced Reading Task.** For noticing mismatches in a self-paced reading task, it was predicted that learners would improve from pre- to posttest. Improvement was identified by the participants’ ability to recognize gender mismatches at the target regions. The expected result was that participants would not recognize gender mismatches in target regions on the pretest, but that they would recognize mismatches in target regions on the posttests.
The results, however, do not support this prediction, and showed no differences in the reading times between ungrammatical and grammatical sentences at any region on any test, and this is true for both the PI and control groups. This is interpreted to mean that participants did not recognize the gender mismatches at the target regions. Why not? Why did participants not recognize these gender mismatches?

One possible reason that PI was not successful at altering the processing strategies of L2 learners. Recall that SPR was chosen because it is an online task that is able to show what learners are doing moment-to-moment during processing. In addition SPR is often used as an indirect measure of grammatical competence in which increased reading times at or near the region where the grammatical violation occurred, is interpreted as evidence that grammatical competence of the structure has been acquired (Jegerski, 2014). In other words, one use of SPR is as a processing measure that reflects acquisition. However, before settling on this conclusion, we need to consider the results of the production and interpretation tasks. Because there was improvement on these tasks, it is likely that PI had some effect on how learners are approaching these tasks. Perhaps, SPR is not simply a reflection of a change in the processing strategy, but more of a reflection of a change in underlying system.

Recall that PI is designed to alter input to produce better intake data, which can then be made available for accommodation and restructuring for a developing system, as in Figure 2.1, repeated here as Figure 5.1.

SPR, then, can be used as an indirect measure of the developing system. Notice from Figure 5.1 that between the introduction of processing instruction and the developing system, some form of accommodation and restructuring occurs. In syntactic terms, if PI was successful in causing change to the developing system, then during stage II, some sort of parameter resetting
would occur. To reiterate, nouns in Spanish carry strong gender features [+gender] that attract the adjective to a position higher in the tree (see example (2) from Chapter 1). In addition, the features of the adjective are initially unvalued and uninterpretable (Pesetsky & Torrego (2004), and the process of Agree is what gives the adjective value and deletes its uninterpretable feature. Thus, L2 learners must reset the parameters or features of the noun as well as acquire the process of Agree. So perhaps what the SPR data is showing is that the L2 learners in this study have only partially acquired the full model needed for gender agreement. Because there was marked improvement on the production task, and evidence of some improvement on the interpretation task, the learners have reset the parameters for the noun, acquiring the [+gender] feature, but have not yet acquired the process of Agree that extends those features to the adjective.

Figure 5.1. Processing instruction and the developing system (VanPatten 1996, Wong 2004).

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3 This is assuming that parameters can be reset in accordance with the full transfer full access hypothesis (Schwartz & Sprouse, 1994, 1996) that argues that L2 learners have full access to abstract features made available by UG and that new parameters are acquirable. There is a conflicting hypothesis, the failed functional features hypothesis (Hawkins & Chan, 1997) that argues the opposite: that features are set based on the speaker’s native language, and cannot be reset.
There are other variables that could also explain why participants seem to show no improvement on the SPR task: the level of the participants, the nature and difficulty of the task itself, and the length of treatment.

The first variable that should be considered is the level of the participants. The participants in this study were beginning learners in their second semester of Spanish at the university level. This level was chosen to parallel the level of participants in Benati (2004). Yet, Atchley and Leeser (in progress) found that beginning learners do not recognize gender mismatches in a self-paced reading task. They used a SPR task to investigate the effects of noun class (semantic gender agreement vs. grammatical gender agreement) and gender congruency (match vs. mismatch) on L2 learners’ reading comprehension. The participants in their study were beginning and intermediate L2 Spanish learners and native speakers of Spanish. The participants read sentences such as *La mujer necesita un abrigo largo/*larga para el invierno* (‘The woman needs a coat long/*long for the Winter’) in a word-by-word fashion and answered comprehension questions following each sentence. Half of the sentences used semantic gender agreement, or gender that refers to the biological characteristics of the referent, and half of them used grammatical gender agreement, or gender that is grammatical in nature and does not refer to biological characteristics. Reaction times were analyzed at the adjective and spill-over regions. The results revealed that neither beginning nor intermediate learners were sensitive to violations of grammatical gender, and that only intermediate learners were sensitive to violations of semantic gender. The authors concluded that only at intermediate stages do learners begin to recognize gender mismatches in an SPR task and even then, they only recognize it when the gender is semantic in nature (i.e., referring to the biologic gender of the referent). In a similar study investigating grammatical gender agreement using eye-tracking, Keating (2009) found that
only advanced learners recognized gender mismatches. Perhaps the lack of results on the SPR task in this study is simply due to the low level of the learner, and does not have any bearing on the effectiveness of PI for helping learners create better intake data.

The nature of the SPR task itself is also a possible factor that contributed to these results. The SPR task is not a structured task, so it is not attempting to guide or influence what learners are paying attention to like a structured input task does. Learners are simply asked to read and comprehend a sentence. However, recall that based on the model of Input Processing, L2 learners use a set of strategies to aid their comprehension of the language. During a self-paced reading task, learners may be using multiple strategies (see Table 1.1) to try to make form-meaning connections in the input. One of the strategies in particular that could hinder their interpretation is the Sentence Location Principle, which states that “learners tend to process items in the sentence initial position before those in final position and those in medial position.” The design of an SPR task is such that target regions should not be the first or last regions of the sentence because in these locations, reading times could include the time participants spend looking at another location on the screen and bringing their gaze to the location of the beginning or end of the sentence (Jegersky, 2014). Thus, target regions are usually placed in the middle of the sentence, which creates greater difficulty for the learner. Perhaps eye-tracking then, is a better measure of L2 reading comprehension, and could be explored for future research.

Another variable that is, again, worth mentioning is the difficulty of the task. Like the interpretation task, the SPR task could be asking beginning learners to hold too much information in their working memory. The SPR task asks learners to read a sentence in Spanish and then respond to a question about the sentence. Although the sentence is not long, this can be a difficult task for beginning learners, especially if the sentences contain unfamiliar vocabulary.
Although every effort was made to use words in the sentences that the participants would recognize (all of the words are found in the beginning chapters of the Spanish textbook used for first and second semester Spanish classes), it can still be a daunting task for beginning learners who not only have limited capacity processors, but that also have limited lexicons. In addition, the presentation format (i.e., word-by-word, moving window) is different from the type of reading that happens outside of a laboratory environment, and may present an additional processing load. Jegersky (2014) points out that regressions (as measured with eye-tracking), or movements of the eye to points earlier in a sentence, account for about 15% of eye movements in normal college-level reading. Thus, the fluency and working memory required to complete an SPR task may be too much for beginning learners.

Similar to this argument, Clahsen and Felser (2006) proposed that during sentence processing, L2 learners make use of lexical (meaning) but not of syntactic (form) information, whereas native speakers are able to rely on both lexical cues and structure-based parsing strategies (i.e., syntactic cues). Clahsen and Felser (2006) critically reviewed several existing on-line studies that investigated grammatical processing in children and adults, and found that L2 learners were able to make use of lexical information (meaning) but not of syntactic information (form) when parsing sentences (Felser et al., 2003; Papadopoulou & Clahsen, 2003). They also found that native speakers were able to use both lexical (meaning) and structure-based (form) information to parse sentences. This is now their famous “Shallow Structure Hypothesis”, which states that adult L2 learners are able to rely on lexical, semantic, and pragmatic information in the same way as native speakers, but that in addition to lexical, semantic, and pragmatic information, native speakers were also able to rely on syntactic information, which was not seen in L2 learners. Therefore, from the perspective of the Shallow Structures Hypothesis, the
findings suggest that the beginning learners are relying exclusively on meaning-based or “shallow” processing strategies, which is why they do not recognize gender mismatches in the SPR sentences.

The last variable, and possible explanation for why it seems that PI is unable to have an effect on learners’ developing system, is the length of the treatment. Perhaps 50 structured input items targeting gender agreement is not enough to affect a learners’ developing system. Jiang (2004) discusses the idea of automaticity in L2 competence, which he defines as “knowledge that has been internalized and can be automatically put to use in spontaneous meaning-oriented L2 use” (p. 606). He continues his discussion stating that this competence, or internal knowledge, is “subconscious and does not require attentional resources” and that explicit knowledge, or knowledge about something (i.e., knowledge about a grammatical structure such as gender) may become part of one’s internal competence through “the exposure to L2 input, or it may be first obtained through explicit formal instruction and later integrated into one’s L2 competence through extensive practice and use in spontaneous communication.” If we think of SPR as not only a measure of processing, but as an indirect measure of L2 competence (Jegersky, 2014), then perhaps a conclusion can be reached that for this study, PI was not able to alter the learners’ developing system because the treatment did not provide the extensive, focused practice necessary to result in a change in L2 competence. In other words, the participants have not yet had enough exposure to the form to result in automaticity that can be detected in an online task such as self-paced reading. Results do suggest that perhaps the participants are beginning to get intake data, but wasn’t enough to incorporate into automatic knowledge that can be seen in SPR.
Research Question 2

The second research question for this study asks whether the effects (if any) from PI targeting gender agreement would transfer to subject-verb agreement. Specifically, it asks if PI targeting gender agreement affects L2 Spanish learners’ interpretation of subject-verb agreement, accuracy on subject-verb agreement on a production task, and noticing of agreement mismatches on a self-paced reading task.

**Interpretation.** It was predicted that the PI group would improve from pre- to posttest on subject-verb agreement, but that the control group would not improve. The results are partially supported in that the control group made no significant improvements. However, the PI group also made no significant improvements from the pretest to the delayed posttest. Looking only at the mean scores for the interpretation task, it is clear that both groups improved their scores from pretest to delayed posttest and that the scores for the PI group were higher than for the control group, but none of the increases in scores were significant, and the increase was only seen at the delayed posttest and not the immediate posttest. These results are different from other studies investigating secondary effects. Both Benati and Lee (2008) and Leeser and Demil (2013) show that learners improved on the interpretation tasks for the secondary form and concluded that PI is successful at changing learners’ processing strategies as evidenced by this transfer-of-training effect.

The possible reason for this difference, is the same as mentioned previously for gender agreement: the interpretation task was too difficult for learners.

**Production.** For accuracy in production for subject-verb agreement, it was predicted that learners in the PI group would improve from pre- to posttest, but that the control group would not improve. These predictions were partially supported. The PI group made significant gains
from the pretest to the delayed posttest on meaning scores, but not on form scores. The control
group however made marginal gains from pretest to the delayed posttest on form scores, but no
gains for meaning scores.

It is interesting that the control group made improvements on their form scores but the PI
group did not. One possible explanation for this finding is that the control group improved on
form scores on the delayed posttest due to the input they received from the distractor activity.
The distractor activity was a serious of four reading passages that described situations in the lives
of four fictitious characters using the future tense in Spanish. The future tense was chosen
because it is a form that the participants had not yet studied in detail in their Spanish courses.
However, reading of these passages is still input, and as Jiang (2004) alludes to, exposure to L2
input can become part of L2 competence. In addition, the participants use subject-verb
agreement on a daily basis in their Spanish classes, which also contributes to the idea of L2 input
becoming part of their developing system because they are receiving ample amounts of L2 input
on a daily basis. That being said, it is unusual that the control group improved but the PI group
did not. Although the PI group did not read the same passages using the future tense, they
completed the structured input activity, and had the same classroom input as the control group.

**Self-Paced Reading.** For noticing mismatches in a self-paced reading task, it was
predicted that learners would improve from pre- to posttest. Improvement was identified by the
participants’ ability to recognize mismatches of subject-verb agreement at the target regions. The
expected result was that participants would not recognize mismatches in target regions on the
pretest, but that they would recognize mismatches in target regions on the posttests. This
hypothesis was not supported.
The result that requires the most attention is for the PI group. The results show that the PI group had longer reading times for ungrammatical sentences on the pretest, but not on the posttests. This is interpreted to mean that the PI group was able to recognize mismatches in subject-verb agreement on the pretest, but not on the posttests. Why? Why do we see this on the pretest but not on the posttests? One explanation, though not theoretical in nature, is participant fatigue. During the second session of testing, the participants completed: a vocabulary activity and quiz (20 items), they read explicit information about gender agreement, they completed the structured input treatment (6 practice + 50 items), and then completed the posttest which included 80 self-paced reading sentences, 20 structured input items, and 16 fill-in-the blank items for production. On average, it took participants in the PI group 45-50 minutes to complete all of the tasks. In addition, on the delayed posttest, many participants expressed frustration at the repetition of the self-paced reading activity and tended to click through the sentences without reading each one in detail. In the book *Research Methods in Second Language Psycholinguistics*, Papadapoulou, Tsimpli, and Amvrazis (2014) discuss the elimination of outliers in the data analysis to filter out data that may be erroneous due to fatigue, inattention or other variables. The data for the present study was filtered to eliminate outliers, so the results are not a reflection of a few outliers, but are a true reflection of the group. This sensitivity to mismatches on the pretest, then, is either a spurious finding, or it is accurate, and the explanation for the lack of this finding on the posttest is due to group fatigue.

Another explanation for this finding is that the participants in the PI group already have subject-verb agreement incorporated into their developing systems. Recall that the purpose of an online self-paced reading activity is to give insight into what learners are doing during comprehension, and to determine if they are sensitive to ungrammaticality of the structures...
investigated. Sensitivity to this ungrammaticality is often interpreted as a representation of the participants’ underlying or internal grammar. In other words, longer reaction times on ungrammatical sentences means that the form (i.e., subject-verb agreement) is part of the participants’ internal grammar, or developing system, or as Jiang (2004) calls it, their L2 competence. This is not surprising if one considers the difficulty of acquiring Spanish morphemes. Van Naerssen (1981) identifies 13 morphemes in Spanish, and orders them based on the difficulty with which the participants\(^4\) in her study had in acquiring these morphemes. The present indicative morphemes (i.e., subject-verb agreement in the present tense) are number five, and noun-adjective gender agreement is number 12. Taking this into consideration, it is likely that the participants in the present study already have some representation of subject-verb agreement in their developing systems, but it is simply not substantiated to a point of automatization. In other words, the participants are still in the process of acquiring subject-verb agreement, so the effects of this acquisition (i.e., recognition of mismatches) are not consistently seen in the SPR data, which is why it seems they only recognize mismatches on the pretest and not on the posttests.

**Limitations, Directions for Future Research and Conclusions**

As with many PI studies, the present study is limited by the choice of target language and grammatical forms. Thus, results from this study may not be generalizable to other languages or other grammatical forms, which is why PI research remains an ongoing area of study. There are other specific limitations of this study that I would like to address. To begin with, certain aspects of the methodology need to be addressed. First is the design of the structured input task. As

\(^4\) The participants in this study were followed over three quarter terms of a college Spanish I course, and data was collected via six oral exams given at equal intervals during the course.
mentioned previously, the SI activity in this study was considerably more difficult than the activities used in word order studies (i.e., VanPatten and Cadierno, 1993) or in the similar gender study by Benati (2004). The participants were asked to focus on both the meaning and form of the noun pictures as well as the meaning and form of the noun that they heard in order to match the two. The second methodological aspect is that of length. Participant fatigue seems to have played a role in the lack of and variability of results that were found, especially for the SPR data. In future studies, I would like to replicate the current study with these two corrections. It would be interesting to see if the data would offer more robust results for interpretation and SPR if the SI activities were simplified and the SPR task shorter.

Another limitation of the present study is that it used a mixture of nouns with semantic gender (referring to biological gender – e.g., muchacha_{FEM} ‘girl’ versus muchacho_{MASC} ‘boy’) and grammatical gender (not referring to biology – purely grammatical in nature – e.g., casa_{FEM} ‘house’ versus caso_{MASC} ‘case’). In Benati (2004), only nouns with semantic gender were used. Atchley and Leeser (in progress) found that learners recognized semantic gender mismatches earlier in acquisition than grammatical gender mismatches. Perhaps using a mixture of these structures, one of which seems to be acquired at later stages of learning (grammatical gender), affected the results. In addition, the use of these structures makes the creation of materials quite difficult, as explained in the previous paragraph. Because PI requires that SI activities keep both meaning and form in focus, this is a challenge when using a form such as grammatical gender, which is meaningless. Consider the phrases in the following example:

(18)  a. \textit{la casa alta}

\textit{the}_{FEM} \textit{house}_{FEM} \textit{tall}_{FEM}

b. \textit{la muchacha alta}
The Meaning before Nonmeaning Principle of IP states that, “learners are more likely to process meaningful grammatical markers before nonmeaningful grammatical markers.” This is what Atchely and Leeser (in progress) showed – that L2 learners process gender agreement that is meaningful (semantic – referring to biology) sooner than gender agreement that is nonmeaningful (grammatical – having no biological referent). In an SI activity like Benati’s (2004), which used semantic gender like in (Xb), if the participants heard “È alta” it was easy to determine that alta matched the woman and alto would match the man without having to really consider the meaning of the word itself. However, if the picture were of a house, both alto and alta would describe the house in terms of the meaning of the adjective. It is not the gender morpheme itself, then that carries the most meaning, it is the adjective. The gender marker is present as a grammatical function of the Agree feature, and changes according to the noun. Thus, creating materials with a structures that is meaningless presents a challenge for the researcher and creates a potentially complicated task for the learners. However, future research could provide more assessment items that target these two types of genders and compare these forms in the statistical analysis to determine if PI is affects each type of gender structure separately.

Alternatively, research could investigate the gender structures in isolation, with one group focusing purely on semantic gender and the other on grammatical gender. Perhaps PI is able to alter the processing strategies used for semantic gender as shown in Benati (2004), but not for grammatical gender. Or perhaps the study would show that one structure simply requires more time than another, which is the next point.

Recall that Jiang (2004) discussed exposure to input and that the more exposure that learners receive, the more likely the form will be incorporated into L2 competence. More tokesn
means more exposure to input. As mentioned in Chapter 1, and previously in the discussion of results, input is necessary for acquisition, and it is possible that if learners had been exposed to more sentences using gender agreement, the results would have been more robust for both the primary and secondary forms, especially for interpretation. In the future, it would be interesting to use more tokens during treatment to see if this affects the outcome of participants’ scores on interpretation measures.

A final limitation is the selection of subject-verb agreement as the secondary target form. This is a form that the participants had considerable experience with and exposure to. Following Benati and Lee (2008) future research could replicate the present study using a tense such as Spanish future tense that is similar in its redundancy to gender agreement, but with which participants have less experience.

While we wait for future studies to address some of the issues mentioned here, the findings of this study provide some evidence for the effectiveness of PI as an instructional treatment, even though the results are not as consistent as those of previous studies. The participants in this study made significant improvements on production tasks at the delayed posttest, which suggests a positive effect for the PI treatment. On the other hand, in order to promote a change in second language learners’ underlying representation or developing system, learners are likely to need many more opportunities to process redundant and non-meaningful morphology than they were provided with the present study.
Dear Spanish Instructor:

I am looking for several sections of SPN1121 to participate in a research project that examines the Spanish reading and grammar abilities of your students. If you are willing to participate in the project, it would require you to bring your class to the lab for two 50 minute sessions. The second session will take place 3 weeks after the first session. During the study, your students will be asked to perform several computer-based tasks.

I would ask that you provide an assignment that is related to the content of your course for those students who do not wish to participate.

At the conclusion of the first session, I will hand out a flyer to your students for them to volunteer to come (during their own time, that they will schedule with me) and participate in a second session of testing. I would ask that you add participation in this second session of testing as one of the several extra credit opportunities that you are offering your students this semester.

Your participation is totally voluntary, and you may stop participation at any time. There is no expected risk during the sessions. However, you have the right to terminate the session at any time without any penalty.

If you would like to participate in the study and/or have any questions, please contact:

Patricia Atchley
Dr. Michael Leeser
APPENDIX B

STUDY ANNOUNCEMENT FLYER

Spanish Reading and Grammar Experiment – Session 2

You have just participated in the first session of this three-session study. We are looking for volunteers to participate in the second session of this study investigating the Spanish reading comprehension abilities and grammar abilities of Spanish learners. If you are willing to participate, the study will last no more than 70 minutes. During the study (which will take place in Diffenbaugh 104), you will be asked to perform several computer-based tasks.

The following is a brief description of the tasks you will complete:

- A computer-based task involving pictures: you will see a picture and hear a sentence in Spanish and will be asked to indicate whether the sentence describes the picture by pressing yes/no
- A computer-based task involving reading comprehension: you will read a series of sentences in Spanish and will answer comprehension questions in English about those sentences
- A computer-based task involving grammar skills: you will see a picture and a paragraph on the computer, and will be asked to fill in the blank spaces in the paragraph using words given to you.

No minimum Spanish requirement is necessary. Any student of Spanish at any level is welcome to participate.

Your participation is totally voluntary, and you may stop participation at anytime. There is no expected risk during the sessions. However, you have the right to terminate the session at any time without any penalty.

If you choose to participate in the study, you will have the opportunity to receive extra credit in the form of 4 percentage points added to your final homework grade. Your instructor will offer several opportunities for extra credit, and participation in this session of the study is just one of the opportunities. You will be given a paper to show your instructor that proves you participated in the study.

If you would like to participate in the study and/or have any questions, please contact:

Patricia Atchley

Dr. Michael Leeser
APPENDIX C

INFORMED CONSENT FORM

This study is part of my proposed dissertation research and is conducted under the supervision of my major professor, Dr. Michael Leeser, Associate Professor, FSU Department of Modern Languages and Linguistics. The study “Processing Instruction and Redundant Morphology in Spanish as a Second Language” is part of research intended to provide information about the way people learn and process Spanish. If you agree to participate in this study, you will be asked to perform several different tasks over the course of 3 sessions.

For the first and third testing sessions, you will complete three tasks. For the first task, you will read a series of sentences in Spanish and will answer comprehension questions in English about those sentences. For the second task, you will see a picture and hear a sentence in Spanish and will be asked to indicate whether the sentence describes the picture by pressing yes/no on the button box. The computer will record the data for the first and second tasks. For the third task, you will see a picture and a paragraph on the computer, and will be asked to fill in the blank spaces in the paragraph using the words given to you. You will also be given a piece of paper on which you can record your answers. Your confidentiality will be protected by entering a participant code instead of your name. You will also complete a questionnaire asking about your past experience learning Spanish. You may decline to answer specific questions. Sessions 1 and 3 are expected to last between 20 and 35 minutes each.

For the second testing session, you will participate in tasks related to one of several conditions. You will be asked to complete some of the following tasks: a computer-based task in which you will see a picture and hear a sentence in Spanish and will be asked to indicate whether the sentence describes the picture by pressing yes/no on the button box; a computer-based task in which you will read a series of sentences in Spanish and will answer comprehension questions in English about those sentences. At the conclusion of those tasks, you will complete tasks that are identical to what you will complete in session 1 and 3 (see previous paragraph for a full description). Session 2 is expected to last between 50 minutes and 1 hour 10 minutes. For your participation in Session 2, you will receive extra credit in the form of 4 percentage points added to your final homework grade. You will receive a signed note at the conclusion of session 2 that you can give to your instructor indicating that you participated in the study, and s/he will award the extra credit.

Your participation is totally voluntary, and you may stop participation at any time. There is no expected risk during the session. However, you have the right to terminate the session at any time without any penalty.

Your performance and any information obtained will remain confidential, to the extent allowed by law. Your name will be replaced with a number for the purpose of coding and analysis of data. Only the primary researchers will have access to the codes and the data, and all data will be stored electronically on a flash drive, which will be kept in a locked file drawer in Diffenbaugh 356 when not being analyzed. In accordance with standard procedure, all data will be destroyed by May 1, 2021.

You are encouraged to ask any questions that you might have about this study before, during and after your participation in the study. However, answers that could influence the results of the experiment will be
deferred to the end of the experiment. You will also receive a debriefing form upon completion of the study, fully explaining the goals of the research.

There are benefits for participating in the research project. First, you may increase your awareness of your second language abilities. Also, you will be providing second language acquisition researchers with valuable information about how individuals process a foreign language. This knowledge will assist researchers to improve second language learning methods.

If you have any questions about this research or your rights as a participant in this study or if you feel you have been placed at risk please contact Patricia Atchley or Dr. Michael Leeser, Florida State University, Dept. of Modern Languages and Linguistics. You can also contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research.

I understand the above information and voluntarily consent to participate in this study of my own free will. I am 18 years of age or older and a student and/or employee at Florida State University.

I understand that I am free to discontinue participation at any time without explanation. I understand that this form will not be used in conjunction with the results of the study so that my identity will be protected to the extent allowed by the law. I understand that I will receive a signed copy of this consent form.

_____________________________________   ________________________
Signature       Date
APPENDIX D

LANGUAGE HISTORY QUESTIONNAIRE

Part. # ____________ Date ____________

Language History Questionnaire
This questionnaire is designed to give us a better understanding of your experience with other languages. We ask that you be as accurate and thorough as possible when answering the following questions.

General Background Questions:
1. Gender
   - Female
   - Male

2. Age: _______ years

3. Do you have any known visual or hearing problems (corrected or uncorrected)?
   - No
   - Yes [Please explain] __________________________________________

4. Native Country
   - United States
   - Other ___________________
     If other, at what age did you come to the US? _________________

Home Language:

5. What is your native language?
   - English
   - Other: ____________________

6. Language spoken at home:
   - English
   - Spanish
   - Other __________

Education:

7. Please indicate where you have studied Spanish.
   Please check all that apply and indicate length of study.
8. Please check the Spanish course in which you are currently enrolled:
   - SPN 1120
   - SPN 1121
   - SPN 2220
   - SPN 2240

Rate your Spanish Skills:

9. Please rate your Spanish reading proficiency. (1=not literate and 10 = very literate)
   not literate: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10

10. Please rate your Spanish writing proficiency. (1=not literate and 10=very literate)
    not literate: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10

11. Please rate your Spanish speaking ability. (1=not fluent and 10=very fluent)
    not fluent: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10

12. Please rate your Spanish speech comprehension ability. (1=unable to understand conversation and 10=perfectly able to understand)
    unable to understand: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10

13. Rate how comfortable you feel expressing yourself in Spanish:
    Not comfortable at all: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10
    Very Comfortable

14. Is there anything else that we should know about your language abilities? Other languages you may speak, etc. Please explain:

   ___________________________________________________________
   ___________________________________________________________

   Thank you for participating!
APPENDIX E

TARGET SENTENCES FOR SELF-PACED READING – PRE- AND POSTTESTS

Self-Paced Reading Sentences: Gender Agreement
El equipo busca a un muchacho exitoso/*a para comprar los uniformes.
El niño busca a un amigo listo/*a para jugar a fútbol.
La profesora busca a una alumna alta/*o para llevar los libros.
La madre busca a una hija lista/*o para arreglar la computadora.
El hombre tiene un vecino simpático/*a para lavarle el coche.
La abuela tiene un nieto destacado/*a para llevarla al mercado.
El hombre tiene una esposa orgullosa/*o para comprarle muchas cosas.
El tío tiene una sobrina inquieta/*a para practicar el béisbol.
El hombre necesita un cuñado sencillo/*a para ver el partido.
La maestra necesita a un adulto divertido/*a para visitar al museo.
La escuela necesita a una adulta anciana/*o para enseñar una clase.
El niño necesita una hermana pequeña/*o para jugar con él.
La familia elige a un chico arriesgado/*a para pintar la casa.
El estudiante elige a un compañero chismoso/*a para completar la entrevista.
La compañía elige a una muchacha confiada/*o para dirigir el departamento.
El departamento elige a una alumna vieja/*o para organizar la oficina.
La persona quiere un novio guapo/*a para salir de fiesta.
La niña quiere un primo travieso/*a para esconderle los juguetes.
El bebé quiere una abuela contenta/*o para leerle un cuento.
La esposa quiere una suegra sabia/*o para darle los consejos.
La mujer necesita un abrigo largo/*a para el invierno.
La profesora necesita una pizarra limpia/*o para escribir.
La casa tiene un baño limpio/*a para los invitados.
La chica compra una falda corta/*o para ir a la fiesta.
La muchacha busca un trabajo divertido/*a para el verano.
La niña limpia un cuarto sucio/*a para ayudar a su madre.
La familia vende una casa pequeña/*o para comprar otra.
El padre almuerza una comida barata/*o para ahorrar dinero.
La abuela prepara una fiesta divertida/*o para su cumpleaños.
El profesor busca una tiza blanca/*o para escribir en la pizarra.
La muchacha toma un refresco barato/*a para la merienda.
El hombre limpia una ventana sucia/*o para ver la calle.
La abuela lee un cuento corto/*a para pasar el tiempo.
La mujer quiere una mesa nueva/*o para la cocina.
La secretaria busca un escritorio nuevo/*a para su jefe.
La estudiante prepara una tarea larga/*o para su clase de literatura.
La estudiante encuentra un cuarto pequeño/*a para estudiar.
El hombre lleva una camisa negra/*o para ir al funeral.
La novia quiere un vestido blanco/*a para su boda.
La mujer compra un vestido negro/*a para la fiesta.
Self-Paced Reading Sentences: Subject-Verb Agreement
Ahora Pedro toma/*tomo el refresco en el salón.
Ahora yo tomo/*toma el refresco en el salón.
Ahora Víctor escucha/*escucho el ritmo de mucha música.
Ahora yo escucho/*escucha el ritmo de mucha música.
Ahora Diego comienza/*comienzo el trabajo en la oficina.
Ahora yo comienzo/*comienza el trabajo en la oficina.
Ahora Alejandro saca/*saco el libro de la mesa.
Ahora Verónica revisa/*reviso el examen con el profesor.
Ahora yo reviso/*revisa el examen con el profesor.
Ahora Isabel mira/*miro el programa con varios amigos.
Ahora yo miro/*mira el programa con varios amigos.
Ahora Sancho busca/*busco el lápiz en el otro escritorio.
Ahora yo busco/*busca el lápiz en el otro escritorio.
Ahora Adriana enseña/*enseño el cálculo en otro edificio.
Ahora yo enseño/*enseña el cálculo en otro edificio.
Ahora tú sacas el libro de la mesa.
En este momento tú pagas el alquiler de este mes.
En este momento tú lavas el auto con los hermanos.
En este momento tú tocas el piano para muchas personas.
En este momento tú pasas el fútbol con los pies.
En este momento tú acabas el libro en el parque central.
En este momento tú encuentras el lugar en varios mapas.
En este momento tú recuerdas el momento sin mucha dificultad.
En este momento tú criticas el plan de muchos políticos.
Ahora tú tomas el refresco en el salón.
APPENDIX F

VOCABULARY PRACTICE ACTIVITY AND VOCABULARY QUIZ

Note. All drawings done by Maria Olivella.

<table>
<thead>
<tr>
<th>Image</th>
<th>Word</th>
<th>Image</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Building" /></td>
<td>edificio</td>
<td><img src="image" alt="Cross" /></td>
<td>símbolo</td>
</tr>
<tr>
<td><img src="image" alt="Scarf" /></td>
<td>bufanda</td>
<td><img src="image" alt="Statue" /></td>
<td>estatua</td>
</tr>
<tr>
<td><img src="image" alt="Boy" /></td>
<td>muchacho</td>
<td><img src="image" alt="Card" /></td>
<td>tarjeta</td>
</tr>
<tr>
<td><img src="image" alt="Hat" /></td>
<td>gorra</td>
<td><img src="image" alt="Door" /></td>
<td>puerta</td>
</tr>
<tr>
<td><img src="image" alt="Pen" /></td>
<td>bolígrafo</td>
<td><img src="image" alt="Girl" /></td>
<td>muchacha</td>
</tr>
</tbody>
</table>
## APPENDIX G

### STRUCTURED INPUT ACTIVITY FOR PRE- AND POSTTESTS

Note. All drawings done by Maria Olivella.

<table>
<thead>
<tr>
<th>Drawing</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Statue of Liberty" /></td>
<td>Es histórica/*o.</td>
</tr>
<tr>
<td><img src="image2.jpg" alt="Dance" /></td>
<td>Es activa/*o.</td>
</tr>
<tr>
<td><img src="image3.jpg" alt="Dance" /></td>
<td>Baila/*Bailan.</td>
</tr>
<tr>
<td><img src="image4.jpg" alt="Basket" /></td>
<td>Es anaranjado/*a.</td>
</tr>
<tr>
<td><img src="image5.jpg" alt="Students Studying" /></td>
<td>Estudian/estudia en la biblioteca.</td>
</tr>
<tr>
<td><img src="image6.jpg" alt="Old Person" /></td>
<td>Es vieja/*o.</td>
</tr>
<tr>
<td><img src="image7.jpg" alt="Reading" /></td>
<td>Leen los libros /* lee el libro.</td>
</tr>
<tr>
<td><img src="image8.jpg" alt="Ugly Person" /></td>
<td>Es feo/*a.</td>
</tr>
<tr>
<td></td>
<td>Juega/*juegan afuera.</td>
</tr>
<tr>
<td>---</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td>Es alto/*a.</td>
</tr>
<tr>
<td></td>
<td>Es limpia/*o.</td>
</tr>
<tr>
<td></td>
<td>Hacen/*hace ejercicio.</td>
</tr>
<tr>
<td></td>
<td>Es estricta/*o.</td>
</tr>
<tr>
<td></td>
<td>Bailan/*Baila.</td>
</tr>
<tr>
<td></td>
<td>Es gordo/*a.</td>
</tr>
<tr>
<td></td>
<td>Estudia/*Estudian.</td>
</tr>
<tr>
<td></td>
<td>Juegan/*Juega afuera.</td>
</tr>
<tr>
<td></td>
<td>Es rubio/*a.</td>
</tr>
<tr>
<td>Hace/*Hacen ejercicio.</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Lee/*leen el libro.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

PRODUCTION TASK FOR PRE- AND POSTTESTS

Note. All drawings done by Maria Olivella.

---

GENDER AGREEMENT
La mujer juega con su hijo afuera. Ellos juegan afuera cerca de un arbol grande. La mujer es ____________ y su hijo es ________________.

Ellos tienen juguetes (toys). La madre tiene una pelota ____________ y el hijo empuja (pushes) un carro ________________.

SUBJECT-VERB AGREEMENT
La mujer _____________ con su hijo afuera. Ellos ___________ afuera cerca de un arbol grande. La mujer es alta y su hijo es bajo. Ellos ______________ juguetes (toys). La madre ______________ una pelota roja y el hijo empuja (pushes) un carro amarillo.
GENDER AGREEMENT
La madre es ____________________ y se viste en un vestido ____________________.
El bebé está ___________________ porque bebe leche de su botella.
El bebé lleva una camiseta ______________________.

SUBJECT-VERB AGREEMENT
La madre _____________ pelirroja y se viste en un vestido ____________________.
El bebé ______________ contento porque __________________ leche de su botella.

GENDER AGREEMENT

SUBJECT-VERB AGREEMENT
GENDER AGREEMENT
El chico y la chica juegan en la casa. El chico lee un libro _______________. El chico está _______________ porque le gusta el libro.
La chica no está muy _______________ en el libro.
Ell prefiere jugar con la muñeca _______________. Ellos son muy felices.

SUBJECT-VERB AGREEMENT
El chico y la chica _______________ en la casa. El chico _______________ un libro denso.
El chico está contento porque le gusta el libro. La chica no está muy interesada en el libro.
Ella _______________ jugar con la muñeca pequeña. Ellos _______________ muy felices.
GENDER AGREEMENT
El chico y la chica estudian matemáticas en la biblioteca. Ellos estudian juntos (together). El chico está __________ porque no le gustan las matemáticas. Piensa que el libro no es ______________. La chica es ______________ y ayuda al chico. Ella piensa que la tarea no es ________________.

SUBJECT-VERB AGREEMENT
El chico y la chica __________ matemáticas en la biblioteca. Ellos __________ juntos (together). El chico __________ confundido porque no le gustan las matemáticas. Piensa que el libro no es claro. La chica es lista y ayuda al chico. Ella __________ que la tarea no es complicada.
APPENDIX I

STRUCTURED INPUT – TREATMENT

Note. All drawings done by Maria Olivella.

<table>
<thead>
<tr>
<th>Image</th>
<th>Spanish Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image of a man" /></td>
<td>Es guapo/*a.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image of a barn" /></td>
<td>Es antiguo/*a.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image of a woman" /></td>
<td>Es timida/*o.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image of a glass" /></td>
<td>Es limpio/*a.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image of an older man" /></td>
<td>Es viejo/*a.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image of an older woman" /></td>
<td>Es artística/*o.</td>
</tr>
<tr>
<td><img src="image7.png" alt="Image of a woman with short hair" /></td>
<td>Es corta/*o.</td>
</tr>
<tr>
<td><img src="image8.png" alt="Image of a New York City skyline" /></td>
<td>Es famoso/*a.</td>
</tr>
<tr>
<td>Icon</td>
<td>Spanish</td>
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<td>------</td>
<td>---------</td>
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</tr>
<tr>
<td><img src="image3" alt="Saint" /></td>
<td>Es santo/a.</td>
</tr>
<tr>
<td><img src="image4" alt="Redhead" /></td>
<td>Es pelirroja/o.</td>
</tr>
<tr>
<td><img src="image5" alt="Fast" /></td>
<td>Es rápido/a.</td>
</tr>
<tr>
<td><img src="image6" alt="Short" /></td>
<td>Es baja/o.</td>
</tr>
<tr>
<td><img src="image7" alt="Romantic" /></td>
<td>Es romántica/o.</td>
</tr>
<tr>
<td>Imagen</td>
<td>Descripción</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image1" alt="Gordo/a" /></td>
<td>Es gordo/*a.</td>
</tr>
<tr>
<td><img src="image2" alt="Largo/a" /></td>
<td>Es largo/*a.</td>
</tr>
<tr>
<td><img src="image3" alt="Cómica/o" /></td>
<td>Es cómica/*o.</td>
</tr>
<tr>
<td><img src="image4" alt="Romántica/o" /></td>
<td>Es romántica/*o.</td>
</tr>
<tr>
<td><img src="image5" alt="Caro/a" /></td>
<td>Es caro/*a.</td>
</tr>
<tr>
<td><img src="image6" alt="Anaranjada/o" /></td>
<td>Es anaranjada/*o.</td>
</tr>
<tr>
<td><img src="image7" alt="Rico/a" /></td>
<td>Es rico/*a.</td>
</tr>
<tr>
<td></td>
<td>Es religioso/*a.</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>Es delgado/*a.</td>
</tr>
<tr>
<td></td>
<td>Es activa/*o.</td>
</tr>
<tr>
<td></td>
<td>Es festiva/*o.</td>
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<tr>
<td></td>
<td>Es gordo/*a.</td>
</tr>
<tr>
<td></td>
<td>Es rojo/*a.</td>
</tr>
<tr>
<td></td>
<td>Es amarilla/*o.</td>
</tr>
<tr>
<td></td>
<td>Es alto/*a.</td>
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<tr>
<td>Descripción</td>
<td>Imagen</td>
</tr>
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<td>---------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Es denso/*/a.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>Es ambiciosa/*/o.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>Es automática/*/o.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
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<tr>
<td>Es estricto/*/a.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
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<tr>
<td>Es honesta/*/o.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>Es estudioso/*/a.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>Es vieja/*/o.</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>[Image 74x642 to 151x720]</td>
<td>Es blanca/*o.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>[Image 74x557 to 158x641]</td>
<td>Es negro/*a.</td>
</tr>
<tr>
<td>[Image 74x396 to 156x556]</td>
<td>Es hispano/*a.</td>
</tr>
<tr>
<td>[Image 74x312 to 157x396]</td>
<td>Es alcohólica/*o.</td>
</tr>
<tr>
<td>[Image 74x150 to 155x311]</td>
<td>Es curiosa/*o.</td>
</tr>
<tr>
<td>[Image 74x150 to 155x311]</td>
<td>Es morado/*a.</td>
</tr>
<tr>
<td>[Image 74x150 to 155x311]</td>
<td>Es feo/*a.</td>
</tr>
<tr>
<td>Icon</td>
<td>Spanish Description</td>
</tr>
<tr>
<td>------</td>
<td>---------------------</td>
</tr>
<tr>
<td>🎩</td>
<td>Es Mexicano/*a.</td>
</tr>
<tr>
<td>👑</td>
<td>Es negra/*o.</td>
</tr>
<tr>
<td>💡</td>
<td>Es creativa/*o.</td>
</tr>
<tr>
<td>🧘‍♂️</td>
<td>Es atlético/*a.</td>
</tr>
<tr>
<td>📵</td>
<td>Es vieja/*o.</td>
</tr>
</tbody>
</table>
APPENDIX J

DISTRACTOR ACTIVITY – TREATMENT

Passage 1

El futuro de John: Su primera semana de la Universidad

John tiene 17 años y vive en casa con sus padres. Ahora él está en su último año de la escuela secundaria, pero en agosto del 2014, es decir, en el futuro asistirá a la universidad. Viajará lejos de casa. John está nervioso porque ir a la universidad será una experiencia totalmente nueva. John llegará a un campus nuevo y el campus le parecerá mucho más grande que su escuela secundaria. John usará un mapa y buscará las clases, la librería y la biblioteca. En la librería, John esperará mucho tiempo porque habrá mucha gente allí. Comprará los libros y pagará demasiado dinero por ellos. Otra experiencia nueva es que John dormirá por primera vez en una residencia estudiantil. Él vivirá con un compañero de cuarto que no conoce. Pero John conocerá a estudiantes de muchas partes diferentes. En la residencia, comerá comida muy diferente. Como a muchos estudiantes, no le gustará la comida. El preferirá la comida de su madre. Durante esa primera semana, John pensará mucho en su familia y en sus amigos. Pero, después de unas semanas, estará contento con la vida de un nuevo estudiante.

Passage 2

El futuro de Kathy: La publicación de su artículo


Passage 3

El futuro de Jenny: Su licencia de conducir
Jenny tiene 15 años y en agosto de 2014, es decir, en el futuro cumplirá 16 años. Para su cumpleaños Jenny quiere su licencia de conducir. Pero antes, ella tomará una clase en su escuela secundaria. En esta clase, Jenny estudiará las reglas básicas de conducir. Al final de la clase, el maestro le dará un examen. Si Jenny pasa el examen escrito, recibirá un permiso para conducir un coche con otra persona. Seguramente ella practicará con su padre. Será un poco difícil al principio para Jenny, pero ella aprenderá poco a poco. El día de su cumpleaños, Jenny irá al departamento del secretario del estado. Llevará su certificado de nacimiento y otra identificación. Después de esperar mucho tiempo, Jenny conducirá su coche con un oficial. El oficial mirará todo lo que Jenny hace. Por fin, Jenny aparcará el coche, y el oficial le dirá si pasó el examen o no. Si pasa el examen, Jenny entrará en la oficina con los papeles necesarios. Una persona le sacará su foto y luego Jenny esperará unos minutos más. Por fin, obtendrá su licencia y volverá a su casa muy contenta.

Passage 4

El futuro de María: Su permiso de trabajo

María trabaja para una compañía en los Estados Unidos, pero ella es de Colombia. En agosto de 2014, es decir, en el futuro terminará su permiso para trabajar legalmente en este país. Entonces, María empezará un largo proceso para obtener un permiso de trabajo permanente. Consultará con un abogado primero. El abogado le explicará el proceso y María escuchará todo lo que el abogado diga. La compañía ayudará mucho a María. Mandará la información apropiada al departamento de inmigración. Luego, el departamento de inmigración revisará los documentos de María y leerá la petición de su compañía. María esperará un año para obtener una respuesta de inmigración. Si recibe buenas noticias, María visitará a un médico para hacer un examen completo. El médico verificará que María no tiene problemas de salud. Después, María viajará a Chicago y hablará con un agente de inmigración. El agente le preguntará muchas cosas. Luego, María tendrá que esperar más tiempo. El departamento de inmigración procesará todos los papeles de María. Su permiso de trabajo permanente llegará por correo, y por fin María será una residente legal de los Estados Unidos.
APPENDIX K

HUMAN SUBJECTS APPROVAL MEMORANDUM

The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 5/21/2014

To: Patricia Atchley

Address: MC 1540 (Department of Modern Languages & Linguistics)
Dept.: MODERN LANGUAGES AND LINGUISTICS

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Processing Instruction and Redundant Morphology in Spanish as a Second Language

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and one member of the Human Subjects Committee. Your project is determined to be Expedited per per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 5/19/2015 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition,
federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Michael Leeser, Advisor
HSC No. 2014.12641

Office of the Vice President For Research
Human Subjects Committee
P O Box 3062742
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM (for change in research protocol)

Date: 12/19/2014
To: Patricia Atchley
Address: MC 1540 (Department of Modern Languages & Linguistics)
Dept: MODERN LANGUAGES AND LINGUISTICS

From: Thomas L. Jacobson, Chair

Re: Use of Human subjects in Research
Project entitled: Processing Instruction and Redundant Morphology in Spanish as a Second Language

The application that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referred project has been reviewed and approved.

Please be reminded that if the project has not been completed by 05/19/15, you must request renewed approval for continuation of the project.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.
The Florida State University
Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 3/31/2015
To: Patricia Atchley
Address: MC 1540 (Department of Modern Languages & Linguistics)
Dept.: MODERN LANGUAGES AND LINGUISTICS

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research
Processing Instruction and Redundant Morphology in Spanish as a Second Language

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 3/29/2016, you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Michael Leeser, Advisor
HSC No. 2015.15219
REFERENCES


Doughty, C. (2004). Commentary: When PI is focus on form it is very, very good, but when it is focus on forms. . . . In B. VanPatten (Ed.), *Processing instruction: Theory, research, and commentary* (pp. 257–270). Mahwah, NJ: Erlbaum.


BIOGRAPHICAL SKETCH

Patricia is originally from Milton, FL, and moved to Tallahassee, FL in 2001 to pursue a BA in Spanish. In the Spring of 2005, Patricia completed her Bachelor’s degree in Spanish at the Florida State University. After completing her degree, she worked as a high school Spanish teacher until the Spring of 2009, when she decided to return to FSU to complete her Master’s degree. Under the supervision of Dr. Michael J. Leeser, she obtained her Master’s degree in Spring of 2011 and her Doctoral degree in 2015.

Patricia’s research interests include various avenues of second language acquisition research such as sentence processing, second language acquisition, instructional second language acquisition, bilingual language acquisition, and heritage speaker language acquisition among others.