VERBAL MORPHOLOGY IN SECOND LANGUAGE SPANISH ACQUISITION: THE ROLES OF DECLARATIVE AND PROCEDURAL MEMORY SYSTEMS

By

JUAN PABLO RODRÍGUEZ PRIETO

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To my sister Estela, for teaching me to enjoy life and to keep moving forward even in the most adverse situations, and to my grandmother Maura, as I will always remember the happy summers we spent together in Vilovieco during my childhood
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This study analyzed the oral production and recognition of complex verb forms in Spanish as a second language by 60 learners at varying proficiency levels and with varying ages of initial exposure to the language to investigate the mental mechanisms second language (L2) learners employ when representing and accessing verbal morphology. Participants completed an oral elicitation task, an oral and visual lexical decision task, and produced an oral narrative in which the third person singular preterite verb form of an equal number of regular, irregular, and stem change verbs of high and low frequency was tested.

Results indicated that frequency effects, when present, were limited to the irregular and stem change forms for the most part. The patterns of results in the accuracy scores and the reaction times to the test items generally support dual-mechanism models for morphological processing in which regulars are initially memorized before rules are identified. Then, as learners become more proficient, regulars are computed online by mental rules in the procedural memory, while the declarative memory continues to handle irregularities. The advanced and intermediate groups of learners produced regular verbs significantly faster than the beginning group, irrespective of the frequency of the verb forms. These results were not observed for irregular or stem change verbs. The accuracy scores for the irregular and stem change verb forms were
significantly higher in the advanced learners when compared to those by the beginning learners, especially for high frequency items. Finally, overregularizations showed the incorrect attachment of two mental rules based on verb class, not simply the most frequent regular rule encountered in the input.

This is the first study providing support in favor of a shift of reliance from the declarative to the procedural memory system by late L2 learners in the computation of regular verb forms only. Both a mental lexicon and a mental grammar seem to explain better the results found in the present study than purely memorization or associative memory effects.
CHAPTER 1
INTRODUCTION AND THEORETICAL MODELS

Learners of Spanish as a second language (L2) often struggle when they have to provide a correct verb form in Spanish, even at advanced proficiency levels. This research project aims to uncover some of the mechanisms that L2 learners at varying proficiency levels employ in the production of Spanish preterite verb forms, and to track developmental gains and patterns cross-sectionally, i.e., from the beginning, through the intermediate, and up to the advanced proficiency levels. The error types these English-speaking learners of Spanish make when producing verb forms incorrectly (e.g., overregularizations, no vowel stem changes, incorrect person and number suffix, and so on) will also be considered. This study investigates the frequency with which learners make such errors, in order to shed light on the developmental patterns that different groups of L2 learners follow when acquiring verbal morphology in Spanish. Spanish was selected for the present study because it is a language that has more inflectional endings than English and multiple ways to indicate a past meaning. The main goal of the tasks selected (an oral elicitation task, a cross-modal lexical decision task, and an elicited narrative) is to test whether single-mechanism or dual-mechanism models for the processing of inflectional morphology can better account for the data from L2 learners.

Montrul (2004) has claimed that inflectional morphology is “one of the most fragile areas of linguistic development in which L2 learners display considerable variability” (p. 25). A quick contrastive analysis between the English and the Spanish verb inflectional systems suffices to illustrate the challenge for L2 learners of Spanish. In English, the verb to be is the most irregular verb in the language. But the different forms this verb takes are limited to: to be, am, is, are, being, been, was, and were. With those eight verb forms and the help of auxiliary and modal verbs, anyone can master the most irregular verb in the English language quickly, at least from a
purely morphological account. Turning to Spanish, if we take a regular verb such as *amar* (‘to love’), the full present tense paradigm coupled with the infinitive form are enough to match the number of forms of the English verb *to be*:

1. **amar** ‘to love’ (the infinitive form)
2. **amo** ‘I love’
3. **amas** ‘you-informal love’
4. **amás** ‘you-informal love’ (another version\(^1\) of you-informal)
5. **ama** ‘s/he loves’ / ‘you-formal love’
6. **amamos** ‘we love’
7. **amais** ‘you-informal plural love’
8. **aman** ‘they love’ / ‘you-formal plural love’

Unfortunately for L2 learners, these eight forms are simply the beginning of dozens of verb forms they will encounter for every Spanish verb. The list continues with future, preterite, imperfect, present subjunctive, as well as nonfinite and other verb forms. For a speaker of English as the first language (L1), the learning challenge is evident. However, the difficulty does not stop here, as Spanish contains a number of other irregularities such as suppletive verb forms (e.g., *fue* ‘s/he went’ for the verb *ir* ‘to go’), internal vowel changes (e.g., *pidió* ‘s/he ordered’ for the verb *pedir* ‘to order’), and spelling changes due to syllable structure (e.g., *busque* ‘that I search’ for the verb *buscar* ‘to search’), among the most frequent ones. The challenge for English is getting the verb form and the word order correct. Consequently, the contrast between English and Spanish is syntactic encoding for the former and morphological encoding for the latter.

Of course, all languages have regular and irregular morphology (Pinker, 1999). Inflected verbs in Spanish usually follow the prototype: root + thematic vowel + inflectional suffixes. The thematic vowel is used to determine the class to which the verb belongs: 1\(^{st}\) conjugation for infinitives ending in –*ar*, 2\(^{nd}\) conjugation for those ending in –*er*, and 3\(^{rd}\) conjugation for –*ir*

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1 This form is used in all regions of Central America and most of the South American Spanish-speaking countries.
verbs. Each class has a set of regular morphology, e.g., for the third person singular preterite tense of verbs of the 2nd conjugation, first the root must be accessed (beb– for beber ‘to drink’) and then the suffix is added –ió. A key question for the present study is whether the resulting verb forms, e.g., bebió (‘s/he drank’), are produced by mental rules in a similar way as just described, or if they are stored in memory as a new item for retrieval at a later time. In the case of irregular verb forms, given that for the most part they are not predictable by derivation from the root by any obvious process (e.g., puso is the third person singular preterite form of the verb poner ‘to put’), most theoretical models agree that they must be memorized and stored in memory, unless they follow a subpattern (Seidenberg & Gonnerman, 2000). In fact, it is posited that these verb forms are usually high in frequency because, otherwise, they would have disappeared from the language (Bybee, 1985; Pinker, 1999).

The previous issues are at the center of an ongoing theoretical debate on the nature of the processing and storage of regular and irregular morphology as a window to a better understanding of two language capacities, a mental lexicon and a mental grammar. The main claims for two of the most important theoretical positions are described in the following sections. The main goals and questions explored in this dissertation relate to the acquisition of a language other than the first one. The processing and storage of Spanish morphology as an L2 was chosen because its rich inflectional system provides an excellent opportunity to test the main hypotheses concerning the acquisition of regular and irregular morphology while, at the same time, allowing us to extend the debate beyond the regular-irregular dichotomy on which it has focused for the most part. Spanish vowel stem change verbs in the preterite tense suffer a vowel change in some verb forms, which is usually conceived of as an irregularity to be memorized. However, they also attach the regular inflectional suffixes. These verbs are included in this study as a separate group
to test whether L2 participants treat them like new irregularly inflected forms which are stored in memory, or as regular products with an additional internal rule to master.

If complex Spanish verb forms are processed by different mental systems with different neural substrates, then we should observe dissociations in behavioral measures such as accuracy scores or reaction times (RTs), based on the degree of regularity of the verb forms as well as their frequency in the language. This cross-sectional study aims at uncovering some of these potential dissociations in the developmental stages of adult late L2 learners. This study also includes a group of English/Spanish bilinguals to compare data from two groups of advanced speakers with varying amounts of practice in the L2, a variable which may affect the way they process and/or access complex verb forms.

In the following sections, the main tenets for each theoretical framework are discussed by using specific examples from one model for each framework. The Connectionist model (Rumelhart & McClelland, 1986) is briefly described in section 1.1.1. as an example of a single-mechanism model, and the Words and Rules model (Pinker, 1999) in section 1.1.2. as an example of a dual-mechanism model, before introducing the Declarative/Procedural (DP) model (Ullman, 2001a, 2001b)\(^2\) in section 1.2. The DP model is the theoretical model used to frame the research questions for the present investigation, as it is hypothesized in section 1.2. that it is the strongest theoretical framework to account for the data from L2 learners, although, as noted below, there is still a need for data from languages such as Spanish to further the evidence for this model. This dissertation attempts to provide such support. At the end of this chapter there is a brief outline for the remaining chapters of the present research study.

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\(^2\) Ullman (2001a) is the main reference for the Declarative/Procedural model in language acquisition in general, whereas Ullman (2001b) is the model in relation to L2 acquisition.
1.1. Competing Models for Morphological Processing

In the study of language acquisition and representation in the brain there is a fundamental distinction between a mental lexicon and a mental grammar. The mental lexicon is a metaphor for the list of memorized arbitrary pairings between sounds and meanings, i.e., a list of the words, bound morphemes, and idiomatic phrases and everything we know about them. The mental grammar, on the other hand, is usually referred to as a set of rules (operations and constraints) that specifies how words may be arranged into possible and meaningful combinations, whether we are dealing with complex words, phrases, or sentences.

There are two primary competing frameworks that describe the issues surrounding the storage and processing of regular and irregular morphology. One of these frameworks, called the hybrid or “dual-mechanism” framework, argues that these two mental abilities, the lexicon and the grammar, are both implicated in the processing of complex verb forms. The mental lexicon handles the storage of arbitrary pairings for verb forms whose internal structure is opaque and cannot be easily explained by rules. The mental grammar, on the other hand, is implicated in the operations necessary to attach multiple suffixes to roots. There are other theoretical frameworks, though, which predict that all complex words are processed via associative learning mechanisms, irrespective of their internal decomposition or predictability. For these unitary or “single-mechanism” frameworks, the frequency of the word and its membership in a family of words with similar inflectional patterns is of greater importance. Among the best known single-mechanism models are the Network model (Bybee, 1995) and the Connectionist model (Rumelhart & McClelland, 1986), while two of the best known dual-mechanism models are the Words and Rules model (Pinker, 1999) and the DP model (Ullman, 2001a).

Over the last few decades, our understanding of how speakers/hearers process inflected forms in real time has increased considerably, thanks to a large body of experimental research
which has used both innovative psycholinguistic techniques and neurolinguistic methods. However, the interpretation of results of morphological processing is still controversial. There is an ongoing debate about the mental representation and production of inflectional morphology using the two broad theoretical frameworks mentioned before, i.e., the single-mechanism models and the dual-mechanism models. The debate’s main focus has centered on the representation and processing of regular and irregular English past tense verbal morphology by native speakers of English\(^3\), although some studies occasionally refer to Dutch and German. As a consequence, there is a need to conduct new research to provide additional empirical evidence on the mental representation and processing of complex verb forms to test the main claims of the different theoretical models in this long-standing debate, a debate which stems from the very roots of linguistic study: the role of the mental lexicon and grammar.

Cognitive processing research within the domain of language has focused on inflectional morphology extensively, especially in the English past tense. But complex words in languages with richer morphology can be used to test whether they are the result of combinations of meanings or simply new memorized lexical items, irrespective of their internal structure. Data from L2 learners and from languages with a richer verbal inflectional morphology system than English are necessary to extend this debate beyond the boundaries to which it has traditionally been confined. Two of the most widely used theoretical models in this debate are described in the following sections, along with an examination of how their hypotheses have been applied to the acquisition of L2s.

\(^3\) A brief summary of the main claims, theoretical argumentation, and empirical evidence provided by each framework can be found in the sixth volume of the journal *Trends in Cognitive Sciences* (2002).
1.1.1. Connectionism and Single-Mechanism Models

Connectionism and the use of artificial brains stem from the basic principles of how a human brain actually learns. These principles are outlined by Altmann (1997) in his introductory book to psycholinguistics entitled *The Ascent of Babel*. Altmann states that an average adult human brain weighs around 1.3 kilograms and that it contains little else but neurons. Neurons are responsive cells in the nervous system that process and transmit information by electrochemical signaling. Their range of connections varies from a few hundred to about 100,000 other nerve cells. If one neuron is sufficiently stimulated, it will stimulate the other neurons to which it is connected. But the key faculty of the human brain is that the connections between the neurons are constantly changing, allowing us to learn from experience. There are three principles at work that underlie neural transmission: (a) neurons send impulses to the other neurons to which they are connected; (b) the connections can be excitatory or inhibitory, i.e., an impulse makes it more or less likely that another neuron will generate an impulse of its own; and (c) connections can change, i.e., new ones can grow, existing ones can die, and the sensitivity of each connection can be adjusted (Altmann, 1997, p. 206-7). When it comes to language, there is nothing unique:

The meanings which we evoke with the words of our language are simply patterns of neural activity. These patterns reflect the accumulated experience of the contexts in which those words are used, and as such they have gradually changed with those experiences (Altmann, 1997, p. 205).

Having these principles in mind, connectionist models explain mental processes in terms of networks of interconnected units which resemble brain cells in a very rudimentary way. There is no implicit knowledge of rules; instead, Rumelhart & McClelland (1986) claim that “lawful behavior and judgments may be produced by a mechanism in which there is no explicit representation of the rule” (p. 217). In fact, regularity is a key distinction between single-
mechanism and dual-mechanism models, the former rejecting rules for regular morphology. The connectionists’ account of mental rules was summarized by Ellis (2003) in this way:

(…) structural regularities of language emerge from learners’ lifetime analysis of the distributional characteristics of the language input and, thus, that the knowledge of a speaker/hearer cannot be understood as an innate grammar, but rather as a statistical ensemble of language experiences that changes slightly every time a new utterance is processed (p. 63-64).

The parallel distributed processing (PDP) model employed by Rumelhart & McClelland (1986) is introduced in the remaining paragraphs of this section to illustrate some of the main claims of single-mechanism models for inflectional morphology, with an emphasis on language learning and second language acquisition (SLA).

In 1986, Rumelhart and McClelland devised a computer model capable of simulating the acquisition of the past tense by children whose L1 is English. More specifically, they wanted to capture the three stages of acquisition which are usually observable in children learning English: (1) the use of a small set of high frequency verbs, mostly irregular, and no evidence of use of a rule, (2) a larger number of verbs in the past, mostly regular, and evidence of implicit knowledge of a regular rule so that they can produce past tense forms for invented words and incorrect verb forms, which were correct in stage one, because of attachment of the implicit rule to either the root or the irregular past tense form, and (3) the coexistence of regular and irregular verb forms, used correctly most of the time.

Before carrying out the simulations, the authors selected 506 English verbs from the Kučera & Francis (1967) word list and classified them into three groups: 10 high frequency verbs (out of which there were two regular and eight irregular verbs), 410 medium frequency verbs (334 regular and 76 irregular), and 86 low frequency verbs (72 regular and 14 irregular). The model they designed contained units and connections. The units represented both the input
pattern of the root of the verbs and the output pattern or past tense forms corresponding to each input root. The connections were modifiable links among units. The heart of the model was a simple pattern associator network which gradually learned the relationships between the input form and the past tense form. During the learning process, the model only received input and compared what it generated internally as the possible past tense form to the expected correct output. When the model generated a wrong answer, it adjusted the strength of the connections between the input and output units to increase the probability of successful suppliance of the correct past tense form the next time the input pattern was presented. Figure 1-1 is a reduced version of the pattern associator network with units and connections.

![Pattern Associator with Modifiable Connections](image)

**Figure 1-1. Basic structure of the PDP model.** [Adapted from McClelland, J., & Patterson, K. (2002). Rules or connections in past-tense inflections: What does the evidence rule out? *Trends in Cognitive Sciences*, 6 (Page 466, Figure 1).]

The phonological representation of the root form in the first column, e.g., /kΛt/ ‘to cut,’ is connected to the input units column which contains 460 neuron-like units (the second column) which can be either on or off. Each unit represents a small stretch of sound that might appear (on) or might not (off) in the root. Each input unit contains three segments (including word boundaries), e.g., the root /kΛt/ ‘to cut’ would be represented as #kΛ, kΛt, and Λt#. Input units have no idea which root they are representing and similar sounding verbs will obviously share
most of the input units that are turned on and to which they are connected (e.g., English verbs *drink* and *shrink* share most of their input units for the last sounds). The third column has an identical set of units in that this time they represent the sounds of the past tense form. Each input unit is linked to each output unit for a total of 211,600 connections (460 × 460). These connections were initially set to 0 and during the learning trials the pattern associator modified the strength of the interconnections via excitatory (an input unit tends to turn on an output unit), neutral (no effect) or inhibitory (an input unit tends to turn off an output unit) connections. When the phonological representation of a root is entered, it sends a signal to every one of the 460 input units, turning them on or off. These input units trigger excitatory, neutral or inhibitory signals to all 460 output units, also turning them on or off. With the information of the activated output units and the help of a decoding/binding network (another mathematical/statistical formula), the model generates a target output which is compared to the actual past tense form it should have generated. By adjusting the values on these thousands of connections a little bit at a time, the model learns to gradually generate the expected past tense form for every root being fed. The model thus simulates what happens in our brains, but obviously on an exponentially smaller and more rudimentary scale.

In their simulation of the learning of the English past tense forms, Rumelhart & McClelland (1986) first fed their PDP model with their 10 high frequency verbs for 10 training presentations, after which the authors claimed that the model produced the past tense forms at a quite good performance rate. Then they fed the network with their 410 medium frequency verbs during 190 training sessions, after which the model exhibited errorless performance on the 420 total verbs. During the last phase, the model was challenged with the 86 low frequency verbs, and produced three quarters of the new regular verbs correctly and made overregularization
errors (e.g., *caught* instead of *catch* for most of the new irregular verbs. Since the model associated properties of a word to properties of another word, it could automatically generalize by similarity. The most remarkable finding was that the model mimicked some of the behaviors observed in children when they are acquiring English, namely: it produced incorrect forms such as *gived* during some training sessions when the model had previously generated the correct past form *gave* (U-shaped pattern); it produced irregular past forms correctly based on analogy to similar-sounding irregular verbs previously learned, e.g., *cling* – *clung*; it inhibited overregularization to a greater extent for irregular verbs from a large family (*feel*) than those from a small family (*blow*); and it inhibited attaching *-ed* to verbs which ended in *t* or *d*. A single computer operation, the pattern associator, was capable of learning and producing regular and irregular past tense forms after intensive training sessions. No rule-like operations were ever introduced to the model, only repeated input items. Based on these observations, McClelland & Patterson (2002) claimed that if an input-output relationship is fully regular, connectionists’ computer network simulations can closely approximate a categorical, symbolic rule.

The main argument against the computer-generated pattern associator model of Rumelhart & McClelland (1986), however, stems from what it did with regular verbs. Pinker & Ullman (2002) claimed that Rumelhart & McClelland’s simulation failed very frequently for regular verbs, generating errors which children never make, e.g., *sept* as the past for *to sip*, or *membled* as the past for *to mail*. This is the primary difference between single-mechanism and dual-mechanism models. These examples are the result of the model’s associations and Pinker & Ullman (2002) posited that “language cannot be treated as just a collection of ‘regularities in the input’ that can be approximated by some mechanism” (p. 474). Instead, regularities are products of the human mind which need to be explained in a different way and that is why Pinker &
Ullman disagree with the claims of single-mechanism models in relation to regular morphology. Additionally, Pinker & Prince (1988) mentioned that Rumelhart & McClelland’s connectionist simulations were not capable of handling homonyms, which are words that share the same spelling and pronunciation but have different meanings and, more importantly for the current discussion, they also have different past tense forms. For example, they cannot handle the differences between *to lie* (not to tell the truth) vs. *to lie* (to be in a resting position). Another argument is that the pattern associators usually failed to exclude changes that do not exist in any human language, e.g., reversing all phonemes from a root input as the past tense output, like producing *pit* as the past tense form for *to tip*.

A more recent connectionist model, the Simple Recurrent Network (SRN) by Elman (1990, 1991), used recurrent links to provide networks with a dynamic memory. Elman carried out simulations in which hidden units were also linked to context units, which were used to remember the previous internal state of the network “so that the subsequent behavior can be shaped by previous responses” (Elman, 1990, p. 182). That way, the hidden units mapped both an external input and the previous state of some desired output. The network was trained on simple sentences using a limited lexicon; the task of the network was to predict the order of words in sentences. When Elman analyzed the ways in which the hidden unit representations clustered, he discovered that the network learned to represent words by categorizing them as nouns or verbs, with further subdivisions of nouns as human/non-human, animate/inanimate, and the like, even though these representations were not explicitly taught to the network. Interestingly, Elman (2004) mentioned that the different tokens of a given word type (e.g., the different grammatical cases of the same verb) occupied different regions of memory space which corresponded to number, inflection, grammatical role (subject vs. object), and the like. For
example, *John* (subject) occupied the same spatial relationship to *John* (object) as *Mary* (subject) to *Mary* (object). This mechanism gave rise to the discovery of categories based on specific behaviors of classes within those categories. In sum, Elman’s (1990) SRN simulation demonstrated that distributed representations used a space which was richly structured, not only for categorical relationships but also for type/token distinctions. In a different simulation, Elman (1991) trained a network to discover the regularities which underlie the order of the words in sentences. Using a limited lexicon and grammar, a network was trained with simple sentences as well as with complex multi-clausal sentences. Even though words were not marked for number, class, or grammatical role, the network achieved a high level of performance in the prediction of the words that followed in the sentence. For example, after the word *boy* the network predicted a singular verb or the relative pronoun *who* as the following word, whereas it predicted a plural verb or the relative pronoun *who* after the word *boys*. To put it differently, the network found a mechanism for representing agreement and exhibited behavior which was highly regular as it learned to respond to contexts which were defined by abstraction. In 1998, Elman showed that SRNs also generalized to novel inputs and to novel uses of inputs, by showing that when a network was trained in sentences in which a given noun appeared only in subject position, it could also deal appropriately with novel sentences in which that noun appeared in object position, i.e., in another syntactic context. In sum, not only does input frequency play a key role in connectionist simulations for morphological processing, but more recent models also address the notions of class, inflection, number, grammatical role, and the like.

In the next section, the main claims on morphological processing by the Words and Rules theory are described. The Words and Rules theory is introduced in some detail as an example of a dual-mechanism model.
1.1.2. Words and Rules Theory and Dual-Mechanism Models

In broad terms, dual-mechanism morphology refers to a family of psycholinguistic models which hold that morphologically complex word forms can be processed both associatively, i.e., through stored full-form representations, and by rules that decompose or parse inflected or derived word forms into morphological constituents (Clahsen, 2006, p. 2).

According to Pinker’s (1999) Words and Rules theory, irregular verb forms are stored words, which have nothing in particular when compared to other words in the language, except for the hypothesis that in their lexical entries they contain a grammatical feature such as [past tense]. However, regular verb forms are handled differently, because they can be productively generated by the application of an abstract rule which attaches an inflectional suffix to a verb root; i.e., regular verbs can be generated in a similar way to which phrases and sentences are generated. In sum, irregular verbs are words stored in a lexicon, whereas regular verbs are generated by grammar rules (see Figure 1-2). There are some special cases in which regular verbs are stored (Pinker & Prince, 1994); e.g., when children have not inferred the regular rule, they need to store fully inflected regular verbs to be used in past tense contexts, or when some rule products have a meaning other than the intended meaning after decomposition (such as the plural version of drink, i.e., drinks, which means alcoholic beverages).

When there is a need to satisfy a given grammatical feature such as [past tense], both systems (the lexicon and the grammar) try to compute it from the verb stem, as shown in Figure 1-2. If the lexicon generates an irregularly inflected form, it blocks the rule application, i.e., the attachment of the inflectional suffix to the stem; e.g., puso blocks *pon-ió (‘s/he put’). This is usually called the blocking principle.
Spanish verb roots: *canta-*‘to sing’ (regular) & *pone-*‘to put’ (irregular) +
Grammatical feature which must be expressed overtly: [3 sg. preterite]

Figure 1-2. Generation of regular and irregularly inflected verb forms under the Words and Rules
theory. [Adapted from Pinker, S., & Ullman, M. (2002). The past and future of the
past tense. *Trends in Cognitive Sciences, 6* (Page 457, Figure 1).]

On the other hand, the rule can be applied to any word which is identified as a verb stem or with
the feature “V,” which explains why most new verbs in a given language get regular inflections,
e.g., *fax–ed*. This is usually referred to as the elsewhere principle. These two phenomena can
satisfy the demands for a syntactic/semantic representation when a feature such as [past tense]
must be expressed overtly in the language (Pinker & Ullman, 2002).

Regular verb forms are predictable and new ones are newly created: *download–ed,*
*googl–ed,* and so on.Irregular verbs are idiosyncratic and form a closed list. Pinker (1999)
pointed out that in modern English there are about 150-180 irregular verbs and that there have
been no recent additions. According to Pinker (1999), there are not regular vs. irregular verb
forms across the board because regularity is perceived with respect to certain inflections. In fact,
most present-day English past tense irregular verb forms were regular verb forms that suffered
phonological changes from one generation of speakers to the next, e.g., \(bend + de = bende > bend > bent\). Other irregular verbs suffered similar changes such as \(spend, build, send\), and so on. When at a given moment an irregular verb is not frequent, the link to the memorized irregular form may become weaker and people can easily compute the stem as regular and generate a rule product. This is what happened with doublets, i.e., two words in a language which have the same etymological root but have entered the language through different routes, e.g., \(dived/dove, learnt/learned\), and so on. It is posited that the regular form in these doublets is also stored in memory because, if not, the irregular form should block the rule application (Pinker & Prince, 1994).

The Words and Rules theory claims that memory, from which irregular verbs are retrieved, is not simply a list of unrelated words but is associative. This concept is similar to the pattern associator proposed by Rumelhart & McClelland (1986) except that not only are words linked to words but also to substructures of words such as stems, vowels, features, suffixes, and the like. According to Pinker (1999), this explains why people find families of similar irregular verbs easier to store and recall, since their associations have been strengthened. This also accounts for the occasional generalizations of irregular patterns that people produce in response to new similar-sounding verbs (Pinker, 1999). In 1993, Prasada & Pinker carried out three experiments with 20, 22 and 24 native speakers of English, respectively, in which participants were asked the following: (1) to rate the naturalness of regular and irregular past tense forms, (2) to rate how likely it was that an item was a past tense form of a given verb, or (3) to produce their past tense form to fill in the blanks in test sentences. The test items were regular and irregular nonce verbs under three conditions: prototypical, intermediate or distant pseudo-verbs from real verb forms. Results indicated that participants were more likely to accept as correct,
and to produce, irregular past forms for novel verbs when they were more similar to the
prototype of an irregular family, based on phonological distance to existing forms. But their
acceptance of and attachment of regular suffixes to novel regular verbs were independent from
the stem’s phonological structure (Prasada & Pinker, 1993). The researchers also created three
analogy-based computer models, similar to those developed by Rumelhart & McClelland (1986),
but the computer models failed to generalize the regular pattern to nonce verbs for which they
had not been trained before. Human participants always obtained higher scores for all types of
verbs, which, coupled with the previous results, lend support for the application of rules in the
production of regular verb forms, thus differentiating single-mechanism from dual-mechanism
models.

Pinker (1991) predicted that regular and irregular forms should be dissociable from
virtually every point of view since regular verbs are handled by a computational component
(rules + representations), whereas irregular verbs are handled by an associative memory system
(with properties of connectionist models). If irregular verb forms are memorized items, they
should be better remembered the more often they are encountered. As predicted, these frequency
effects have been found for irregular verbs but not for regular verbs:

When subjects see verb stems on a screen and must utter the past form as quickly as
possible, they take significantly less time (16- to 29-msec difference) for irregular verbs
with high past frequencies than irregular verbs with low past frequencies (stem
frequencies equated), but show no such difference for regular verbs (<2-msec difference)

Additionally, Pinker & Prince (1994) claimed that low frequency irregular verbs: are more likely
to be the less preferred in doublets; are more likely to coexist with regular versions in doublets;
are more likely to drop out of a language diachronically (Bybee, 1985); are more likely to be
produced incorrectly by adults under time pressure; and are more likely to be overregularized by
children. Regulars and irregular verbs should differ in similarity effects too. The application of the regular past tense should apply as a default, irrespective of similarity to existing regular verbs. In fact, English regular verbs can have any sound pattern: e.g., even though in English no verb ends in a neutral vowel, the following past tense form could be naturally generated: *We rhumba’d all night* (Pinker, 1991). In addition, the Rumelhart & McClelland (1986) model could not produce an output for many novel regular verbs which did not resemble other regular verbs in the training set. However, similarity effects were found experimentally for irregular verbs. Bybee & Moder (1983) found that their subjects produced *splung* as the past form of the verb *spling* 44% of the time (based on phonological similarity to *string, sling, etc.*), *shunk* in response to *shink* 24% of the time, but only 7% *sud* in response to *sid*, with each previous example resembling existing irregular verbs of prototypical families less. Based on their results, they claimed that speakers form categorizations of linguistic objects in the same way that they form categorizations of natural and cultural objects, by properties of their form, in this case, by their phonological properties (Bybee & Moder, 1983).

In 1999, Gordon & Alegre provided evidence in favor of a weaker version of Pinker’s (1991) rule/associative model, in which regular inflections are never stored. Gordon & Alegre’s (1999) results characterize lexical access for regular verb forms as occurring via either a whole-word route (associative) or a compositional route (rule). Thirty native speakers of English responded to visual stimuli (regular verbs) by deciding whether each stimulus was a word or not. The authors found frequency effects for regularly inflected words. However, when they divided the items in two groups, regular verbs below or above the median frequency of six instances per million words, only items with frequencies above six showed significant effects. The authors explain that the whole-word route wins over the compositional route when the frequency of the
regular form is high. The whole-word access route is faster unless the item frequency of the complex word is very low (Gordon & Alegre, 1999), and in those cases the compositional route wins. That explains why, for their regular verb forms below the median frequency of six, they found no frequency effects.

The Words and Rules theory posits that the parts of the brain that handle the storage of memorized words should be implicated in the retrieval of irregular forms, while the parts of the brain that handle grammar rules should be implicated in the use of regular forms (Pinker, 1999). Michael Ullman’s DP model (2001a) makes stronger predictions for regular/irregular forms in relation to different brain structures and its claims are examined in detail in the next section. After introducing the main claims of the DP model, mainly in relation to morphological processing, the predictions for the acquisition of verbal morphology by L2 learners are described.

1.2. The DP Model

1.2.1. The Mental Lexicon and the Mental Grammar

Ullman’s (2001a) DP model begins with the simple premise that language can be defined as a relation between form and meaning. This concept is very similar to the notion of Saussure’s linguistic sign, which Matthews (1997) outlined as a relation of mutual dependence between a concept that is ‘signified’ and an ‘acoustic image’ of the form that ‘signifies’ it, i.e., the union of an invariant form with an invariant meaning. According to Ullman (2001a), some relations between a particular form and a particular meaning are arbitrary and idiosyncratic and, as a consequence, they need to be memorized. One example is the relation between the Spanish form gato (‘cat’) and the meaning “cat” or, better, the meaning “a small domesticated carnivorous mammal with soft fur, a short snout, and retractile claws,” as defined by the online Compact Oxford English Dictionary of Current English (Soanes & Hawker, 2005). In fact, the set of
memorized form-meaning pairings can be defined as the mental lexicon (Ullman, 2004), which is a repository of all idiosyncratic word-specific information. According to Ullman (2001b, 2004), this lexicon contains the following elements (see Figure 1-3): (a) all non-compositional simple words whose forms and meanings cannot be derived from each other, such as *gato* (‘cat’); (b) any irregular word-specific information, such as the argument structure of a verb (e.g., *amar* ‘to love’ takes a direct object in Spanish); (c) any unpredictable forms that a word takes, such as the preterite form *fue* (‘s/he went’) for the verb *ir* (‘to go’); (d) bound morphemes which cannot stand as a word on their own, like the Spanish suffix –*ano* in the noun *americano* (‘American’), which comes from the Spanish noun *América* (‘America’); and (e) idiomatic phrases or complex linguistic structures whose meanings cannot be derived from the meanings of the individual words, like *hablar por los codos* (‘to talk a lot’; literally: ‘to talk out the elbows’).

![Figure 1-3. Types of lexical forms stored in the mental lexicon.](image)

Besides this mental lexicon, language also consists of regularities which can be captured by rules of grammar (Ullman, 2001a, 2001b, 2004, 2005). These rules specify and/or constrain how lexical forms can combine to make complex representations whose meanings are predictable and can be easily interpreted, even if we have not heard or seen them before. Rule-derived forms can be computed in real-time and thus do not need to be memorized in the mental lexicon (Ullman, 2001b) because grammatical processing is fast as well as automatic (Ullman, 2004). In fact, this mental knowledge allows us to produce and comprehend an infinite number of complex forms, whether they are sentences, phrases, or complex words (Chomsky, 1965). The
grammar rules specify (see some examples in Figure 1-4): (a) the sequential order of lexical forms, e.g., the definite article *el* (‘the,’ masc.) precedes nouns in Spanish as in *el gato* (‘the cat’); (b) the hierarchical relations between lexical forms, e.g., that a verb phrase can contain a noun phrase, as in *comió la paella* (‘s/he ate the paella’); (c) the structure of phrases and sentences, i.e., syntax; and (d) the internal composition of complex words, i.e., morphology, as in *comía* (‘s/he used to eat’) = *com*– (root of the verb *comer* ‘to eat’) + –*ía* (suffix for the past progressive tense, 3rd person, singular). The learning and use of grammatical knowledge are generally implicit (Ullman, 2004, 2005), i.e., not available to conscious awareness or access (Fodor, 1983). And it is often argued that aspects of the ability to learn, represent, and compute rules and constraints depend on innately-specified mental constructs (Chomsky, 1965), so that “the learner is innately equipped with *a priori* probabilities for all grammars” (Pinker, 2004, p. 951).

Figure 1-4. Types of rule-governed behavior found in various aspects of language.

These two language capacities, the mental lexicon and the mental grammar, interact in a number of ways (Ullman, 2004). First, as shown in Figure 1-4, the mental grammar combines lexical forms into complex structures, such as the definite article *el* (‘the,’ masc.) and the noun *gato* (‘cat’) into a noun phrase (NP). Second, even though certain complex structures with idiosyncratic meanings may be stored in the lexicon, such as the idiom *hablar por los codos* (‘to
talk a lot’), their structures generally follow the rules of grammar. In this example, the verb *hablar* is followed by the optional prepositional phrase *por los codos* (literally, ‘through the elbows’) whose internal structure follows the rules of any prepositional phrase in Spanish, i.e., preposition + NP, as in *por la mañana* (‘in the morning’), *en la mesa* (‘on the table’), and the like. Third, although regular complex representations could be computed every time they are used, especially if they are encountered for the first time, in principle they could also be stored in the mental lexicon after being encountered. For example, if a Spanish native speaker tells you: *Ayer mi hermano googleó esa información* (‘Yesterday my brother “googled” that information’), the meaning of the new verb form *googleó* should be extracted by detaching the regular preterite suffix –ó from a potential verb root and interpreting the remaining material *google*– as the root of a newly created verb, i.e., *googlear*, created in reference to the famous online search engine. Once this preterite form has been encountered and computed by the grammar rules for the first time, you could simply store it in the mental lexicon. Finally, a general pattern observed in languages is that idiosyncratic, memorized forms and meanings take precedence over general, derivable ones (Ullman, 2004).

1.2.2. The Declarative and the Procedural Memory Systems

The DP model gets its name from the premise that important aspects of the difference between the mental lexicon and the mental grammar are tied to the distinction between two memory systems implicated in other, non-language, functions: the declarative and the procedural memory systems (Ullman, 2004). Various characteristics of these two memory systems provide important predictions about language because, as we will see in the following paragraphs, they share a number of features with the two language capacities just described, i.e., the mental lexicon and the mental grammar (Ullman, 2004).
The first memory system is the declarative memory, which is at least partially explicit and mainly refers to the conscious recollection of facts and events, as Squire (1994) described:

This is the kind of memory that is usually meant when the terms “memory” and “remembering” are used in ordinary language. “Fact-and-event memory” refers to memory for words, scenes, faces, and stories, and it is accessed by conventional tests of recall and recognition. This kind of memory was termed “declarative” to signify that it can be brought to mind and that its content can be declared (…) (p. 203).

“Declarative memory is fast, accessible to conscious recollection, and flexible, i.e., available to multiple response systems” (Squire, 1994, p. 214). This memory system is important in the learning of semantic knowledge or the learning of arbitrary relations (e.g., a watch is a portable device which tells me the time) and also of episodic knowledge or the recollection of personal and contextually bound events (e.g., yesterday I had pizza for dinner) (Ullman, 2005; Walenski & Ullman, 2005). Pieces of information that are connected arbitrarily are handled by this memory system, which is able to learn new associations fast, e.g., arbitrarily-related information can be learned based on a single stimulus presentation (Ullman, 2004). Knowledge learned in declarative memory can be generally accessed and retrieved consciously (Walenski & Ullman, 2005). The main language function of the declarative memory is to back up knowledge about words, including their sounds and meanings, and other memorized information (Ullman, 2001b). It handles all idiosyncratic word-specific information (Walenski & Ullman, 2005), i.e., the lexicon, including complex structured expressions with no transparent meanings, such as idioms. Additionally, the result of word formation rules in morphology can also be memorized and stored in the lexicon, e.g., cantó (‘s/he sang’), although it is expected to be handled by grammar rules in the procedural memory system, which results in the possibility for redundant representations for certain forms (Walenski & Ullman, 2005). Evidence suggests that the lexicon is capable of computing a limited amount of associate-based information (Pinker & Ullman,
2002). For example, new forms such as *condujo* (‘s/he drove’) for the verb *conducir* (‘to drive’) can be computed by generalizing patterns from previously stored arbitrary associations or memory traces, such as *produjo* (‘s/he produced’) for *producir* (‘to produce’); *redujo* (‘s/he reduced’) for *reducir* (‘to reduce’), and similar forms. According to Walenski & Ullman (2005), the reliance on either memorized representations or on computed representations seems to depend on multiple factors such as item-specific information (the frequency of use of a specific form), task-specific factors (if the language was learned in childhood or after puberty), and subject-specific factors (the individual’s sex and even her/his current hormonal status).

The second memory system is the procedural memory, which is involved in “the learning of new, and in the control of long-established, motor and cognitive skills and habits, especially those involving sequences” (Ullman, 2005, p. 146). This memory system “(…) embraces several kinds of memory and depends on multiple brain systems” (Squire, 1994, p. 205).

Nondeclarative memory includes information that is acquired during skill learning (motor skills, perceptual skills, and cognitive skills), habit formation, simple classical conditioning (including some kinds of emotional learning), priming, and other knowledge expressed through performance rather than recollection. Experience can cumulate in behavioral change but without affording conscious access to any previous learning episodes or to any memory content (Squire, 1994, p. 205).

“Nondeclarative memory is nonconscious and less flexible, i.e., it provides limited access to response systems not involved in the original learning” (Squire, 1994, p.214). Learning by this memory system is gradual and incremental, not implicated in the learning of novel associations. Procedural knowledge is not available to conscious access and for that reason the system is often referred to as an implicit memory system (Ullman, 2005; Walenski & Ullman, 2005). Once knowledge is learned in this memory system, the procedures apply fast and automatically (Walenski & Ullman, 2005). In the domain of language, this underlying system aids in the acquisition, knowledge, and processing of aspects of grammar, particularly the rule-governed
combination of morphemes, words and phrases into more complex and hierarchically structured larger units (Ullman, 2004; Walenski & Ullman, 2005).

These two mental systems interact in a number of ways, learning and processing information both cooperatively and competitively so that memory functions can be optimized (Ullman, 2005; Walenski & Ullman, 2005). On the one hand, both systems can work cooperatively in order to learn a given task; e.g., the declarative system may acquire knowledge first due to its fast learning speed and then the procedural system can gradually learn the same or analogous knowledge. In fact, very young children memorize complex forms first in declarative memory before they gradually abstract the grammatical information of rule-governed complex forms in procedural memory (Walenski & Ullman, 2005). On the other hand, the competitive interaction can be observed in the “see-saw effect” (Ullman, 2004), which states that learning in one system inhibits the functionality of the other, and that if there is a dysfunction in the learning of one system, the other one will be enhanced. Evidence further suggests that the lexicon blocks grammar, e.g., the access of a memorized irregular past form (vino ‘s/he came’) blocks the grammatical computation of the erroneous corresponding overregularized past form (*ven-ió).

In the same way, the availability of a memorized regular past form (caminó ‘s/he walked’) blocks its grammatical computation (camin-ó). What pushes children to abstract the grammatical information of rule-governed verb forms and to move beyond the memorization stage of all verb forms is the economy principle. That way, children do not store each and every verb form when they can compute them online through the application of a mental rule, thus having a more compact memory system.

What truly distinguishes the DP model from other traditional dual-mechanism theories, such as Pinker’s (1999) Words and Rules, as well as from the single-mechanism theories, like
Rumelhart & McClelland’s (1986) Connectionism, is the notion of double dissociations (Ullman, 2005). This is the belief that there is one set of links among neurocognitive markers of stored linguistic representations, conceptual-semantic knowledge, and declarative memory brain structures, which is separate from another set of links among neurocognitive markers of grammar, motor and cognitive skills, and procedural memory brain structures. This belief diverges from the Words and Rules model, which posits that domain-specific components underlie each language capacity (mental lexicon and grammar). According to the DP model, lexical and grammatical functions are associated with distinct computational and neural substrates which are not dedicated exclusively to language, but are domain independent (Ullman, 2005). The concept of double dissociations also diverges from the Connectionism model, which holds that both language capacities are linked to a single computational mechanism. Instead, the two memory systems just described play analogous roles, working both cooperatively and competitively in the computation of language.

1.2.3. The DP Model and Inflectional Morphology

The main claims of the DP model focus on inflectional morphology. According to Ullman (2001a), overt morphological transformations are at least of two types. By morphological transformations the author refers to the mapping between the word stem or root and its inflected forms for a specific syntactic configuration. Affixation is the first type of morphological transformation, which involves the sequencing of segments, i.e., the sequencing of stems or roots and inflectional suffixes, as in cocin–ó (‘s/he cooked’). The second type of morphological transformation involves an arbitrary relation between the base and the inflected form, whether it is the whole base (or suppletion) as in fue (‘s/he went’) from the infinitive ir (‘to go’), or whether it is the modification of only particular segments, usually phonological stem changes, as in pid–ió (‘s/he ordered’) from the base ped–ir (‘to order’). Consequently, the DP model does not posit
a different category of morphological transformations for stem change verb forms, as Ullman (2001a) stated:

Thus, in the (presumed) absence of a third component, stem-readjustment rules can only be instantiated in the associative memory system and are therefore not mental rules, but only descriptions of patterns in the language (p. 43).

As we can see from the previous examples, any given word can undergo one type of these overt changes (like suppletion in fue ‘s/he went’) or more (such as affixation and vowel stem change in pidió ‘s/he ordered’). A given English word can also undergo none of these transformations, as in hit (bare infinitive) – hit (preterite form), but this is not possible in Spanish because finite or inflected verb forms are always different from their corresponding nonfinite base, which indicates the verb class (–ar, –er, or –ir).

The DP model proposes that regularly and irregularly inflected verb forms are handled by two different mental systems, the procedural and the declarative systems, respectively. In English, regular and irregular verb forms are matched in complexity because they are all made up of a single word, they are matched in syntax because they are all tensed, and they are also matched in meaning since all of them make reference to a past event (Ullman et al., 1997). But their main difference is that regular verbs are predictable in their internal structure, i.e., verb stem + ed, and new ones are being added constantly, such as fax-ed, while irregular verbs are unpredictable, such as hit–hit, bring–brought, or sing–sang, and they constitute a fixed list. The DP model claims that the rule system subserves those morphological transformations that involve sequencing operations, such as affixation and compounding, while the memory system underlies those morphological transformations which do not involve sequencing, including vowel stem changes (Ullman, 2001a).
For a given syntactic configuration, the two systems attempt to compute an appropriate morphologically complex form from the base. The declarative memory attempts to access a form in associative memory while the procedural memory attempts to compute a rule product. If the declarative memory retrieves an irregular form (such as *vino ‘s/he came’ for the verb *venir ‘to come’), then it will inhibit or block the computation of the rule product (*\textit{ven}-\textit{ió}, incorrect ‘s/he came’). But when a memorized form is not successfully retrieved, the rule may apply by default, sometimes even if the end product is incorrect, resulting in overregularization errors such as *\textit{traió} instead of *\textit{trajo} (‘s/he brought’).

**1.2.4. The Neural Basis of the DP Model**

Ullman and his colleagues have provided converging evidence that largely supports the view of the DP model from a wide range of studies of different natures, i.e., psycholinguistics, neurology, electrophysiology, developmental studies, and neuroimaging studies (Ullman, 2001a, 2001b, 2001c, 2004, 2005; Ullman et al., 1997). What follows is a summary of the brain structures which have been identified to play an active role either for the declarative or the procedural memory systems, as well as some examples.

The brain is the human organ for computation. Despite rapid scientific progress, much about how the human brain works remains a mystery. Fairly recent methods of observation such as event-related brain potentials or functional brain imaging tell us that brain operations are highly organized, but they do not reveal the activity of individual neurons. So even the most fundamental principles of neural network computation may remain unanswered for some time until they are finally deciphered. Furthermore, our knowledge about how the brain processes language is still rudimentary. If words and rules are the ingredients of language (Pinker, 1999), then we should be able to tell them apart in the brain, i.e., there should be cues that the
computation of irregular verb forms depends more on the system for word memory while the
computation of regular verb forms depends more on the system for rules.

According to the DP model (Ullman, 2001a, 2004), there are specific brain regions
implicated in particular language functions, as related to inflectional morphology. What follows
is a summary of the brain structures for the processing of regular vs. irregular morphology.
Table 1-1 gives a summary of the functional and biological bases of the declarative and
procedural memory systems.

Table 1-1. Outline of the functional and biological bases of the declarative and procedural
memory systems.

<table>
<thead>
<tr>
<th></th>
<th>DECLARATIVE MEMORY</th>
<th>NONDECLARATIVE/PROCEDURAL MEMORY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXPLICIT</td>
<td>IMPLICIT</td>
</tr>
<tr>
<td>Specialized for the learning of…</td>
<td>Arbitrary associations</td>
<td>Sequences</td>
</tr>
<tr>
<td>Learning speed</td>
<td>Fast</td>
<td>Gradual, incremental</td>
</tr>
<tr>
<td>Learned knowledge is consciously accessible?</td>
<td>Typically, but not necessarily</td>
<td>No</td>
</tr>
<tr>
<td>Non-language functions</td>
<td>Learning and use of fact (semantic) and event (episodic) knowledge</td>
<td>Learning and use of motor, cognitive and perceptual skills; habit formation; simple classical conditioning including some kinds of emotional learning; priming; knowledge expressed through performance rather than recollection</td>
</tr>
<tr>
<td>Language functions</td>
<td>Acquisition, representation and processing of lexical knowledge, including memorized complex forms; conceptual semantics</td>
<td>Acquisition, representation and processing of complex structures, across syntax, morphology, and possibly phonology and compositional semantics</td>
</tr>
<tr>
<td>Inflectional morphology</td>
<td>Irregular verb forms</td>
<td>Regular verb forms</td>
</tr>
<tr>
<td>Subcortical/Medial brain structures</td>
<td>Hippocampus</td>
<td>Basal ganglia</td>
</tr>
<tr>
<td>Neocortical brain structures</td>
<td>Mainly temporal lobe regions</td>
<td>Mainly frontal lobe regions, especially premotor and associated cortex, including posterior Broca’s area</td>
</tr>
</tbody>
</table>

On the one hand, the declarative memory system is subserved by medial temporal lobe regions such as the hippocampus and related structures, which are largely connected with temporal and parietal neocortical regions (Ullman, 2001a, 2001b, 2005). Brodman’s areas (BA) 45 and BA47 also play a role in the selection or retrieval of declarative memories while parts of the right cerebellum may underlie the searching for declarative knowledge (Ullman, 2005). On the other hand, the procedural system is rooted in frontal/basal ganglia structures, with a possible role for inferior parietal regions (Ullman, 2001b). This system depends mainly on brain structures in the left hemisphere of the cerebrum (Ullman, 2005). In particular, the basal ganglia and the supplementary motor area seem to play an important role in the processing of sequences (Ullman, 2001b). In the frontal cortex, in addition to the supplementary motor area, Broca’s area (or BA44) also forms part of the procedural system network (Ullman, 2005).

The DP model is one of the dual-mechanism theories which posits that the parts of the brain that handle the storage of memorized words should be implicated in the retrieval of irregular forms, while the parts of the brain that handle grammar rules should be implicated in the use of regular forms. This model predicts that it should be possible to find one neural system impaired by injury/trauma while the other remains untouched or fully functional. And it makes strong predictions for regular/irregular forms in relation to different brain structures. For example, anomia is impairment in word finding, usually associated with damage to temporal/temporo-parietal regions in the brain (Pinker & Ullman, 2002). When patients with anomia are asked to produce past tense forms, they do worse with irregular verbs than with regular verbs. Their production shows overregularization errors such as *swimmed and the generation of novel regular forms like plammed at high frequencies, along with low frequency of extending irregular patterns to novel verbs which are phonologically similar to existing irregular...
verbs like *spling*. The opposite is true for patients with damage to brain regions associated with grammatical sequences, such as in the case of agrammatism. These patients evidence more trouble inflecting regular forms than irregular forms and show great difficulty suffixing novel words. Most of Ullman’s (2001a, 2004) evidence stems from cases of a variety of language impairments due to damage to one of the neural systems involved in handling either the mental grammar or the mental lexicon. Chapter 2 includes a section with key studies that employed neurolinguistic techniques to assess whether these two mental systems are implicated in the learning and processing of an L2. It is worth mentioning here, though, that other researchers do not agree with Ullman’s conclusions.

1.2.5. The DP Model and the Acquisition of Inflectional Morphology

There is a large body of SLA literature suggesting that initial age of exposure to the L2 affects final linguistic abilities. Penfield & Roberts (1959) were the first researchers to state that children are more efficient L2 learners than adults, based on biological and neurological differences such as cerebral flexibility. Lenneberg (1967) coined the term *critical period* for the biological predisposition for language acquisition during the time span between age two and puberty. The main claim of what is known today as the Critical Period Hypothesis was summarized by Birdsong (1999) as follows:

(…) there is a limited developmental period during which it is possible to acquire a language, be it L1 or L2, to normal, nativelike levels. Once this window of opportunity is passed, however, the ability to learn language declines (p. 1).

Many researchers, e.g., Ullman (2001b), believe that when someone starts learning an L2 past late childhood or puberty, s/he will not generally acquire the language as well as younger

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5 Birdsong (1999) and the following sources are quoted in this section because they are the ones Ullman (2001b) used to talk about a critical period in SLA, even though it must be acknowledged that there are perhaps better resources for that topic, e.g., DeKeyser (2000).
learners. However, the piece of evidence which is of interest to the claims of the DP model is that grammar is usually affected much more negatively by later ages of exposure than lexical items. Since the learning and use of grammar depends largely upon procedural memory, age of exposure sensitivity in the L2 will affect the procedural memory system, rather than the declarative memory system. The main piece of evidence for this claim is the study conducted by Johnson & Newport (1989). Their 46 Korean and Chinese learners of English had lived in the United States for three years or more at the time of testing, but they differed in their age of arrival: late arrivals (after age 17) vs. early arrivals (before age 15). Participants listened to 276 English sentences presented on an audiotape, roughly half of which were ungrammatical, and had to provide grammaticality judgments on an answer sheet. Of great interest to the DP model is the result for the past tense morphological rule, one of the 12 rule types tested. Results indicated that there was a significant positive correlation between age of arrival and number of errors in this rule (r = .79, p < .01). More interestingly, the researchers found a consistent decline in performance as age increased for early arrivals but a lack of performance differences by age among late arrivals (Johnson & Newport, 1989, p. 79). Overall, these findings support the conclusion that a critical period for language acquisition extends its effects to SLA. The earlier the initial age of exposure to the L2, the better the accuracy on rules, which depend on the procedural memory system. The performance by late L2 learners was affected to a greater extent, which is why significant differences in accuracy scores in the group of late arrivals were not seen, because their opportunity to achieve native-like competence in grammatical computations was significantly affected or even lost. Again, the use of lexical items or L2 vocabulary is less affected by age of initial exposure to the L2 than grammatical computations. In this respect, Singleton (1995) concluded that:
(...) there is no evidence with regard to second language learning any more than with regard to first language learning that the capacity to acquire new vocabulary disappears at any particular maturational point, or that it necessarily becomes radically impaired even in old age (p. 20).

Since grammatical computations which rely on procedural memory become relatively difficult to learn, while the declarative memory function remains relatively strong, the DP model proposes that later learners of an L2, particularly those who begin to learn after late childhood or puberty, will tend to shift to declarative memory for the processing of linguistic forms that are computed grammatically by procedural memory in the L1 (Ullman, 2001b). To put it differently, later learners will depend to a greater extent upon declarative memory in the L2, as a function of age of exposure. However, practice with the L2, in addition to age of exposure, should affect both grammatical proficiency and the degree of dependence on procedural memory for grammatical computations. The later the initial age of exposure to the L2 and the less the practice with it, the weaker the dissociations should be (perhaps even to the point of absence) between the declarative/procedural memory systems for the computation of verb forms.

According to Ullman (2001b), the greater dependence on the declarative system by later learners will occur in two forms. First of all, forms which are normally compositionally computed by the mental grammar in the L1 may simply be stored as memorized forms in the L2 lexicon. Thus regular verb forms like cant-ó (‘s/he sang’) or even phrases and sentences, especially those of high frequency, may be stored in the lexicon and accessed from the declarative memory system rather than being computed by the mental grammar. However, the representations for these forms might be structured (cant-ó ‘s/he sang’) rather than unanalyzed (cantó). And since the declarative memory is associative in nature, it can generalize patterns from memorized forms or linguistic signs to new ones. This ability to generalize patterns to new forms could lead to productivity in the L2. Secondly, some rules may be consciously/explicitly
learned (e.g., in a formal instructional context) and applied in the declarative memory, although they need not be. What these rules specify could differ radically from the implicitly learned grammatical rules of the L1 and, more importantly, they do not depend at all upon the procedural computations. These learned explicit rules may be used by L2 learners to construct linguistic forms and have an impact in the present study since there is usually an emphasis on stem affix rules in foreign language (FL) teaching.

The previous predictions for L2 learners led Ullman (2001b, p. 110-1) to the following specific empirical hypotheses for SLA with respect to morphological processing:

1. L2 speakers should show less separability between regular and irregular verb forms than L1 speakers since it is posited that only for L1 processing do regular and irregular verb forms distinctively rely on either grammar or lexicon, respectively.

2. Both types of forms (regulars and irregulars) may be learned in and computed over associative memory and, as a consequence, both may show associative memory effects, i.e., frequency effects and phonological neighborhood effects.

3. Both types of forms should tend to pattern with facts and events, and neither with skills and habits.

4. Medial temporal lobe structures as well as neocortical temporal/temporo-parietal regions (declarative/associative memory system) are expected to underlie the use of both types of forms with a general decrease in left-lateralization (procedural/grammatical system) in the L2.

1.3. Outline

Before discussing the specific research questions that guided this study, described at the beginning of Chapter 3, it is necessary first to review what progress has been made so far in the study of the developmental patterns in the acquisition of verbal morphology by L2 learners,
which is done in the next chapter. Chapter 2 is a review of previous studies dealing with the acquisition of verbal morphology in an L2 under the three theoretical models outlined in the previous sections. It is claimed that research findings are still inconclusive about the processing of inflectional morphology by L2 learners and that there is a need to conduct new research to evaluate data from L2 learners and from languages with a richer verbal inflectional morphology system than English as a necessary next step to extend the debate beyond the boundaries to which it has traditionally been confined. At the end of the second chapter there is additional information from L2 Spanish studies that include the acquisition of regular/irregular verbal morphology in their design. The main focus of the chapter is on SLA; information from L1 acquisition is only included when it provides data that are relevant to the SLA process.

Chapter 3 covers the methodology of this investigation. Once the research questions are specified, information about the participants, the design of the tasks they completed and the protocols for data collection are included. Special attention is given to describing the main variables of the present study and how they were measured. At the end of the chapter, I describe the main statistical tests used to check whether differences between the groups and/or the independent variables reached statistical significance.

In Chapter 4 the results from the different tasks are reported. Results include, but are not limited to, significant differences in the RTs to the test items based on the frequency and regularity of the verbs, the accuracy rates for the test items by each proficiency group, and the main cognitive strategies and/or error types attested by the participants. At the end of the chapter, the main findings from all tasks are summarized. This methodological triangulation of data will be helpful for identifying the main dissociations of results based on frequency and/or regularity.
of the verbs, which will be used later to support and/or reject the main hypotheses under consideration.

The significance of the main findings is discussed in Chapter 5, based on the claims of the different theoretical models, outlined in this chapter, for the acquisition of inflectional morphology by L2 learners. Specific examples are provided from the results of this study to support the main findings. This is the section where explanations and interpretations of the main data are provided based on the predictions of the single-mechanism and dual-mechanism models.

The sixth and final chapter includes some concluding remarks and contains the following closing sections: (a) the main limitations of the study, (b) future directions for the current state on the debate about inflectional morphology and language acquisition and representation by L2 learners at large, and (c) some pedagogical implications based on the results, along with suggested activities for implementing these recommendations in Spanish classes of various levels.
CHAPTER 2
REVIEW OF THE LITERATURE

2.1. Introduction

This chapter provides a review of previous studies that tested the main hypotheses from the theoretical models described in Chapter 1, specifically with respect to the acquisition of inflectional morphology by L2 learners. What follows is a selection of studies that applied the predictions from the Connectionism model, the Words and Rules model or the DP model to SLA, introduced in that same order in the following sections. The main findings of these studies helped in the design of the present investigation as well as in the selection of hypotheses included at the beginning of Chapter 3. In addition, a final section of Spanish SLA studies is included in which verb regularity was a variable in the methodology and/or the results, even if the researchers did not use any of the predictions from the three theoretical models considered in this investigation. Regularity is a key variable when evaluating results from L2 learners because the theoretical models have different claims for the acquisition of inflectional morphology based on the regularity of specific verb forms, as described in the previous chapter.

2.2. Connectionism and SLA

Connectionism has been employed in a number of simulations for SLA, although there has not been much connectionist work directly concerned with SLA (Ellis, 2003, p. 87). Previous work has dealt with the acquisition of L2 word order (Gasser, 1990), the constraints of critical periods in language acquisition (Sokolik & Smith, 1992), the effect of input frequency and the interplay between source/target languages in processes of SLA (Blackwell & Broeder, 1992), gender processing (Taraban & Kempe, 1999), or the acquisition of case-marking (Kempe & MacWhinney, 1998). In the following paragraph, the main findings of a study that employed simulations of PDP models in the acquisition of L2 morphology are summarized.
Ellis & Schmidt (1998) studied the acquisition of L2 morphosyntax using a miniature artificial language, named MAL, under laboratory conditions. MAL consisted only of 20 words, and the authors controlled their frequency (amount of input delivered, 10 high and 10 low frequency plural markers) and their regularity (10 regular plural markers vs. 10 idiosyncratic affixes). Seven speakers of English first learned the stem forms in blocks of 20 trials until they orally produced all test items with 100% accuracy on two consecutive blocks. Then, participants learned the plural of the words in blocks of 80 trials in random order, including singular versions only (similar to the first learning stage, once per item for a total of 20 items) as well as singular and plural versions in the same screen for plural acquisition. Frequency was controlled for, so that high frequency plurals appeared very frequently (five times for each regular plural and five times for each irregular plural for a total of 50 items) while low frequency plurals only appeared scarcely (one time for each regular or irregular plural for a total of 10 items). The presentation of blocks continued until after the participant achieved 100% accuracy on all plural forms. Interestingly, Ellis & Schmidt (1998) found that regularity played a role in the acquisition of this artificial language. The regular plurals were acquired better than the irregular verbs and, in fact, in the last four blocks of training, they found no frequency effects in the RTs for regular items whereas the effect of frequency was maintained for the irregular items. Ellis & Schmidt (1998) conducted a new experiment using four connectionist models of learning with varying computational capacity and trained them in a similar way to their human participants. Results indicated that frequency played a role in the acquisition of the test items (high frequency items were learned faster) as did regularity (regular items were learned faster). The computer simulations performed somewhat better than human participants on the regular items and worse on the irregular items but their simulations explained close to 80% of the relevant human data
and demonstrated effects which broadly paralleled those found in humans. These results were interpreted as a direct outcome of a basic associative mechanism or power law of learning, i.e., the idea that the probability of an item occurring at a particular time is a power function of its past frequency of occurrence. Ellis & Schmidt claimed that there is no need for a dual-mechanism model because they were able to demonstrate that some aspects of L2 morphology acquisition were explicable using simple associative learning principles. The connectionist simulations duplicated the human “rule-like” behavior, yet there were no rules in the connectionist networks. As a result, their main contribution was to show that rule-like behavior does not necessarily imply rule-generation or the existence of mental rules.

In addition to this classical example for the acquisition of L2 morphology using a PDP model, and before turning to the dual-mechanism models, some studies whose main findings are claimed to support the hypotheses put forth by single-mechanism models are also included in this section (Albright & Hayes, 2003; Bybee & Moder, 1983; Murphy, 2004; Orsolini & Marslen-Wilson, 1997). Their designs did not include PDP simulations but their results can be better accounted for by unitary models. They concentrate on languages other than the L1 and their main findings are reported in chronological order.

Bybee & Moder (1983) gathered some evidence in favor of a model based solely on analogy for both regular and irregular verb forms. They asked 34 native English speakers to write the past tense form of 93 nonce verbs in sentence contexts, as well as for 16 real verbs, presented orally. The main results indicated that participants’ responses were greatly influenced by the phonological similarity of the nonce verb to a prototype from a particular verb family. Regularity was never a factor affecting participants’ responses and, as a consequence, Bybee &
Moder claimed that participants may have processed the nonce roots as whole words, i.e., irrespective of their internal decomposition and/or the application of mental rules:

The decisions which our subjects made about how to form the past tense of a particular nonce verb may have been based on how the whole resulting word would sound. Evaluations of how the word sounds may be based on comparisons with whole existing words (p. 264).

Orsolini & Marslen-Wilson (1997) conducted an experiment with 24 native speakers of Italian, in which nonce words were included in the study design. In this experiment, the researchers created an elicitation task using nonce verbs that varied with respect to their similarity to actual regular and irregular Italian verbs: high similarity, root similarity or low similarity. Under dual-mechanism models, one would only expect phonological similarity effects for irregular verbs because they are the only ones being stored in associative memory. However, Orsolini & Marslen-Wilson (1997) found phonological similarity effects for both regular and irregular nonce verbs, i.e., the less similar the nonce verb was to an actual regular or irregular verb form, the less likely it was to be made regular or irregular. Results were more robust for irregular verbs, but they were still statistically significant for regular verbs too, providing evidence against dissociations between regular and irregular verb forms, and thus favoring a single-mechanism model.

In 2003, Albright & Hayes carried out a similar study to Bybee & Moder (1983) and Orsolini & Marslen-Wilson (1997). They conducted two experiments with a list of nonce verbs. In the first experiment they presented the nonce verbs orally to 20 participants who had to rate the stem on how “good” or “natural” it sounded. They also had to give the past tense form for the nonce test items. In the second experiment, 24 new participants had to produce the past tense form for the nonce verbs and then they had to listen and rate how good the inflected form, regular or irregular, of the test items sounded in sentence contexts. If regular verbs are generated
by a rule, the ratings for them should not differ significantly. However, if all irregular verbs are stored in a mental lexicon, nonce verb ratings should differ significantly based on their similarity to existing forms. However, Albright & Hayes found that the ratings for both nonce regular and irregular verbs differed significantly based on their similarity to existing forms, which lends support to a simple associative memory in the processing of inflectional morphology.

Murphy (2004) tested the claims of the dual-system model of Pinker & Prince (1994) in the L2 learning context. The main research question was whether nonnative speakers (NNSs) of English from a variety of L1s (such as Spanish, Croatian, Italian, and other L1s) manifested the same kind of dissociations in performance as native speakers (NSs) of English: one system used as a symbolic default or rule (for regular verbs) that applies when retrieval from memory is missing, and an associative system (for irregular verbs) that accounts for exemplar-based linguistic features. Murphy administered to 20 NS children, 20 NS psychology undergraduates, and 20 adult beginning ESL students a sentence completion task with 30 nonce verbs accompanied by a figure performing an ambiguous action. Participants were asked to provide the past tense form. There were 10 prototypical nonce verbs that rhymed with real English regular and irregular verbs (e.g., slace, plare). Another 10 intermediate nonce verbs shared the CCV_ or _VCC sequences with real English regular and irregular verbs (e.g., ploab, ning). The last 10 were distant nonce verbs (e.g., ploamph, trisp). Results indicated that all groups of participants treated regular verbs and irregular verbs differently, i.e., they were more likely to suffix a nonce regular verb than a nonce irregular verb. Participants produced more suffixed irregular verbs the further away the nonce verb was from the prototypical English verb. The only exceptions were the intermediate nonce verbs in the NNS group since they were suffixed less often than the prototypical verbs. The effect of similarity was in the opposite direction from the regular nonce
verbs because there was a decrease in suffixation in all groups for those that were distant.
Finally, when participants produced a nonsuffixed past tense, most of the time it involved vowel
changes rather than no changes at all. Murphy claimed that NNSs used similarity to make past
tense generalizations for both regular and irregular verbs. She indicated that any difference
between regular and irregular features could be a direct result of the increased frequency and
amount of exposure that learners had with the regular features (Ellis & Schmidt’s power law of
practice, 1998), and that there are a number of indications that a single set of associative learning
mechanisms could account for the development of inflectional morphology: “a single-route
associative explanation seems to be able to capture the phenomena manifested in both the L1 and
L2 learning contexts” (Murphy, 2004, p. 456).

As described, all these previous studies (Albright & Hayes, 2003; Bybee & Moder, 1983;
Ellis & Schmidt, 1998; Murphy, 2004; Orsolini & Marslen-Wilson, 1997) used nonce verbs or
an artificial language to test the main claims of their research questions. One of the biggest
challenges for these types of experiments is to create items that unequivocally belong to a single
verb type. For example, Murphy (2004, p. 442) chose *brip* as a prototypical regular verb whereas
*blip* was selected as a distant irregular. The question here is on what grounds do these nonce
verbs really belong to different verb types, especially as perceived by a NNS of English.

The way regular verb forms are processed is what sets apart single-mechanism from dual-
mechanism models and the results of these studies provided evidence against mental rules for
regular forms. Instead, purely associative learning mechanisms influenced by features of the
input, such as frequency and phonological similarity to family resemblance, seem to be the best
predictor for the pattern of results accumulated in these studies.
In the following section, SLA studies under the Words and Rules theory are introduced. In a dual-mechanism model, regularity plays a role in the processing of complex verb forms, and the Words and Rules theory claims that regular and irregular verb forms are processed differently because irregular verbs are stored as fully inflected words but regular verbs can be computed online by the application of grammar rules.

### 2.3. Words and Rules and SLA

According to the Words and Rules theory, overregularizations of irregular verbs in the acquisition of L1 by children around age three are not the result of children being overwhelmed by an increasing number of regular verbs, as connectionists would suggest. Instead, they accompany the appearance of regular tense marking (Pinker, 1991); i.e., the child starts using the regular suffix for items which were previously produced as bare infinitives (in past tense contexts) and, in the case of irregular verbs, the occasional overregularization errors are the result of rule application to verbs in sentences which require a past tense form but for which the child failed to access the irregular form. This is a good example of U-shaped behavior; i.e., if we track the accuracy rates for irregular verbs by children over time, the shape of the graph will look like a U, starting high, then decreasing for a period of time, and then increasing again to the starting point or even higher. The main argument, as posited by Pinker (1998), is as follows:

Before the first error, children leave regular verbs unmarked most of the time (e.g., *Yesterday we walk*); then there is a transitional phase in which the child begins to mark these verbs most of the time (e.g., *Yesterday we walked*). It is in this transitional phase that the first overregularization of an irregular form is produced (p. 236).

In fact, at the transitional stage at which children make their first overregularization of an irregular, irregular verbs are produced with an accuracy rate of about 95%. Clahsen et al. (2002) found similar results in the spontaneous speech of Spanish children. They generalized regular patterns to irregular items but the opposite was never the case. Additionally, children started to
overregularize after a period of correct performance; these errors decreased as children got older. These overregularization rates followed the U-shaped developmental curve Pinker (1998, 1999) previously discussed. These results indicate a sharp regular/irregular distinction in the inflectional errors made by children, which are compatible with the difference posited by this dual-mechanism model between rule-based and memory-based representations for morphologically complex words (Clahsen et al., 2002, p. 618). This error pattern can also be accounted for by single-mechanism models, as described in section 1.1.1.

However, the Words and Rules model as described by Pinker (1999) did not account for the linguistic systems of L2 speakers. Yaden (2004) pointed out:

The main question of Pinker’s approach, whether native speakers use a dual-mechanism or a unitary approach for processing and storing morphologically complex words, is unanswered for L2 speakers in his book (p. 52).

In fact, there is a limited number of studies testing the main claims of the dual-mechanism models using languages with a richer verbal inflectional system than English. Clahsen (2006) noted two factors in the English language that favor dual-mechanism models for inflectional morphology: the frequency of the regular rule is higher in English and there is only one suffix attached to regular verbs, i.e., the –ed suffix. Yaden (2003) specifically mentioned the case for Romance languages, as well as the dearth of work in the area of L2 speakers. As a consequence, her research focuses on the acquisition of Spanish regular/irregular morphology by L2 learners (Yaden, 2003, 2007).

In the remainder of this section, the main findings of key studies dealing with the acquisition of L2 inflectional morphology are described (Beck, 1997; Lalleman et al., 1997; Leung, 2006; Wolfram, 1985; Yaden, 2003, 2007), particularly those results which are
compatible with the dual-mechanism models and the Words and Rules theory. They are discussed in chronological order.

Wolfram (1985) interviewed 16 Vietnamese participants, learners of English and residents in the US from one to seven years who had no knowledge of English prior to their arrival in the US. He found that past tense marking was favored with irregular forms in the earlier stages of L2 learning, mainly because of the saliency of the irregular verb forms. He also found frequency effects for the irregular verbs, with frequently occurring irregular verb forms being marked for tense more often than their infrequent counterparts. These data seem to support the dual-mechanism model outlined before and also what Wolfram (1985, p. 247) called the principle of saliency, which states that the more distant phonetically the past tense irregular form is from the bare infinitive, the more likely it will be marked for tense, as a result of the ease with which it is noticed in the input.

Beck (1997) measured the reaction times for producing regular and irregular verbal morphology by NSs and NNSs of English. In the last of a series of experiments that Beck (1997) carried out, her 32 NNS participants were asked to orally produce the past tense form of a given verb. She used regular verbs as well as nonce verbs that did not resemble any other word in the language. The most interesting finding was that there were no frequency effects for the regular test items. Beck (1997) concluded that her NNSs had been successful at internalizing a rule for generating inflectional morphology but, given their greater difficulty in terms of the overall grammatical correctness of the items as compared to the NSs, she hypothesized that her NNSs had what she called a Type II deficit: a problem with feature checking or with the ability to allow for verb raising in the L2. Dual-mechanism models posit that there should not be frequency effects for regular verb forms because the computation of the regular suffix and its attachment to
the verb root can be learned by L2 learners, provided that they have a high proficiency in the target language. The participants in her study had either scored 530 on the TOEFL exam or passed a university’s English exam for faculty whose L1 is not English, in addition to showing a range of length of residence in an English-speaking country from 5 months to 17.6 years, further attesting to their overall proficiency.

Lalleman et al. (1997) addressed the question of whether advanced L2 learners of Dutch employ two distinct processes (lexical lookup vs. rule application) when producing regular and irregular past verb forms. The researchers presented their participants with Dutch verbs in the infinitive form and asked them to produce their past tense as quickly and accurately as possible. They had 64 test items, 32 regular and 32 irregular, further divided into even numbers of high and low frequency items per group. They found frequency effects on the production time of irregular verbs only, which favors the Words and Rules model. An error analysis showed that the most frequent error type was overregularization of irregular verbs. Lalleman et al. (1997) concluded that their advanced L2 learners of Dutch had been able to acquire the Dutch past tense rule since they applied this rule during online language production.

Yaden (2003) was interested in how NNSs of Spanish process regular and irregular morphology, to test the dual-system models in contrast to the unitary accounts. She used 15 intermediate/advanced L2 Spanish learners who began acquiring Spanish beyond the critical period. She used a sample containing regular and irregular verbs from all three verb classes, of high and low frequency, appearing in their infinitive forms on the computer screen. Participants had to orally produce the 1st person singular form of the present tense. Her hypothesis was that there would be no difference in RTs between high and low frequency forms for regular verbs but that there would be for irregulars. She found no significant differences for irregular verbs for
NNSs but she found a statistically significant difference for the regular verbs, the opposite results of what she predicted. Participants regularized the low frequency irregular verbs over 54% of the time but with longer RTs than for the regular verbs and the irregular verb forms conjugated correctly. Yaden suggested that these results could mean that they had a sense that these verbs might be irregular, and so they searched their mental lexicon longer before applying the default rule. In contrast, there were only six cases out of 225 where a NNS applied the regular pattern to a high frequency irregular verb. There were several instances of overirregularizations, but they were few and far between (4/7 instances). In this study, frequency played a role for both regular and irregular verbs. However, it was considered that the results supported the dual-mechanism models because if all irregular verbs were stored in memory but the form was so infrequent that it could not be accessed for production, then the default “rule” of adding –o (1st singular present) to the root took place.

Leung (2006) tested the representation of Spanish inflectional verbal morphology by 10 Chinese and nine English learners of Spanish under the dual-mechanism model. This model suggests that morphologically regular verbs are rule-based products, whereas irregular verbs are listed individually in the mental lexicon. Consequently, during interlanguage (IL) development we may find regularization of irregular forms but not irregularization of regular forms. Leung (2006) gave the participants an elicited written production task with 60 regular or irregular-based nonce verbs for which they had to provide the corresponding past participle form in a sentence context. For regular-based nonce verbs there were very low rates of irregularization, while for irregular-based nonce verbs there were high rates of regularization. The regularization rates were claimed to be related to the fact that the target irregular forms had not yet been acquired and were thus non-existent in the mental lexicon of the learners for retrieval or analogy.
In 2007, Yaden conducted another research study with 13 L2 learners of Spanish\(^6\) who had completed at least two years of study of Spanish. Participants were presented with the 3\(^{rd}\) person singular present form on a computer screen and had to produce the 1\(^{st}\) person singular present form orally, as fast as possible. Test items included regular and irregular verb forms of both high and low frequency. Again, her data showed that L2 speakers were significantly faster at producing a high frequency than a low frequency regular verb. However, participants took about the same amount of time for irregular verbs of high and low frequency, even when she considered stem change verb forms separately. She hypothesized that frequency played a role for all test items because L2 participants searched their mental lexicon for a correct memorized form even if the unknown verb was regular. This initial check slows down the processing for unfamiliar items before applying the regular rule. The lack of frequency effects for irregular verb forms was explained as a result of the low accuracy rates for low frequency irregular verbs.

Again, the main error type was overregularization of irregular verbs, especially those of low frequency. There were only a few instances of overirregularization. These accuracy patterns support dual-mechanism models in that when participants do not retrieve a fully inflected irregular form from memory, they can add the regular rule as a default, resulting in overregularization errors. Low frequency items are affected to a greater extent due to weaker memory traces for them.

In sum, there is cumulative evidence that the time to react to irregular verb forms by L2 learners is affected by the frequency of the irregular items, while these frequency effects were not usually observed in the group of regular verb forms. When retrieval of an irregular verb form fails, especially due to its low frequency, and if L2 learners have internalized a mental rule in

\(^{6}\) She also included data from L1 speakers but in this section only the data for the L2 speakers are reported.
their ILs, then overregularization errors occur. The online attachment of the regular suffix to the stimuli stem can also be explained as the way L2 learners can test their developing hypotheses for low frequency items since an error will probably be followed by correct suppliance from the interlocutor. If the L2 learner notices the error, this may trigger a restructuring of the L2 learners’ IL grammar. What is interesting is that even though language learning is ultimately viewed as a matter of change in an individual’s internal mental state (Doughty & Long, 2003), these SLA studies did not account for changes over a period of time, not even cross-linguistically or among different proficiency groups of L2 learners, as they were all limited to a single proficiency group.

The following section describes research results from L2 studies under the DP model, which is used to frame the research questions of the present study as it is the theoretical model hypothesized to have the strongest predictive power for the study of the processing of verbal morphology in SLA. The above studies in support of the Words and Rules theory are also compatible with the main claims of the DP model and their main findings should therefore also be taken into account when discussing new SLA studies under the DP model.

2.4. The DP Model and SLA

This section reviews key studies whose main findings support the claims for SLA under the DP model. The main evidence in favor of the DP model for SLA (Ullman, 2001b) is that both types of verb forms are usually learned over associative memory at earlier stages of acquisition, and that the greater the practice with the L2 the greater the probability for the acquisition of L2 rules and the greater the separability between regular and irregular verb forms in terms of frequency effects, neighborhood effects, and the like. For the most part, the following studies: Birdsong & Flege, 2001; Brovetto & Ullman, 2001, 2005; Flege et al., 1999; Rodriguez, in press, support these claims. Previous work on L2 psycholinguistic and neurolinguistic evidence, i.e., L2 RT studies and L2 morphological processing and the brain, is also discussed in some detail.
because the DP model emphasizes that two mental systems are implicated in the processing of regular and irregular verb forms. Finally, it is proposed that the main findings for SLA studies using the DP model can contribute to the Cognitive Approach (Skehan, 1998) to language learning because both theoretical constructs share key features that allow for some comparability of research findings.

2.4.1. Previous SLA Studies Using the DP Model

Flege et al. (1999) conducted a study to evaluate the Critical Period Hypothesis in SLA. They looked at the end-state of 240 Korean learners of L2 English in relation to phonology and morphosyntax. Participants arrived in the US between the ages of one and 23 years and had lived in the country for at least eight years. They were assigned to one of 10 groups based on their age of arrival (AOA). The researchers assessed participants’ knowledge of English morphosyntax using most of the sentences from Johnson & Newport’s test (1989, reviewed in Chapter 2).

Participants listened to 144 test sentences and decided if they were correct in English. From this grammaticality judgment test, Flege et al. isolated a subset of 44 items which represented rule-based and irregular forms, e.g., the rule-based set included sentences involving case or number assignment on nouns and person or tense markers on verbs, such as Sandy fill a jar with cookies last night (incorrect) or A snake bit her on the leg (correct). In the lexical set there were irregular verbs marked for past tense, plural nouns and lexical idiosyncrasies such as choice and placement of particles and prepositions, e.g., The horse jumped the fence over yesterday (incorrect) or The policeman was talking to a woman (correct). Accuracy rates indicated that late learners with AOA greater than 12 obtained significantly lower scores for the lexically-based than rule-based sentences. Flege et al. (1999) argued that if their Korean participants were able to deduce a simple rule with widespread application such as “add –ed to form the past tense,” they were able to identify it with greater accuracy than those items whose learning was based on
associative or probabilistic representations. Since late learners had received less English input, the limited frequency of verb forms in the input contributed to the greater difficulty for irregular forms only. The participants’ accuracy figures revealed a clear dissociation in performance as a function of age, but in the unexpected direction based on the claims of the DP model.

In 2001, Birdsong & Flege wanted to replicate the results from Flege et al.’s (1999) study by reducing the test items to regular/irregular forms only. More specifically, they wanted to check if input frequency was a factor in the knowledge of irregular, but not regular, forms (Beck, 1997). They recruited 30 Spanish and 30 Korean natives, L2 learners of English, distributed over three groups, based on their AOA in the US. Participants completed a multiple-choice judgment task with 80 items of regular vs. irregular inflection, high vs. low stem frequency, and noun plural vs. verb past tense morphology. For example: Yesterday the little girl (a. swim / b. swam / c. swummed / d. swims / e. swammed) for the first time. Birdsong & Flege (2001) found frequency effects to be significantly higher for irregular items than for regular ones. They also found both a decrease in accuracy and an increase in RT with increasing AOA, which was more pronounced for irregular verbs than for regular verbs. In addition, no significant age-related declines were observed for the regular items. When they related their results to Ullman et al.’s (1997) DP model, Birdsong & Flege claimed that they found evidence that the declarative system may be more susceptible to aging effects than the procedural system.

Brovetto & Ullman (2001), as cited in Birdsong (2004), found frequency effects for both regular and irregular verb forms in a study of oral production of regular and irregular English past tense forms by 32 Spanish and 32 Chinese natives with a minimum of three years of residence in the US and with AOA of 17 years or greater. These results (Birdsong & Flege, 2001; Brovetto & Ullman, 2001) taken together support Ullman’s (2001b) DP model for L2
learners in that, for learners at age stages leading up to the end state, most target language forms are bits of idiosyncratic information stored in declarative memory. As a consequence, there are observed frequency effects for both regular and irregular verb forms (Brovetto & Ullman, 2001).

Brovetto & Ullman (2005) conducted two experiments in which 33 adult native Spanish speakers were asked to provide inflected forms of verbs in appropriate sentence contexts in Spanish. There were 80 nonce verbs, 40 ending in –ar and 40 ending in –er, 40 containing class I rhymes and 40 with class II rhymes. Rhyme was defined as the identity in sound of an accented vowel in a word and all consonantal and vowel sounds following it. In Spanish, certain rhymes are more present in class I verbs (–ar verbs), while others typically appear in class II and III verbs (–er and –ir verbs); e.g., rhyme I –ant– usually appears in verbs of the 1st conjugation class, such as cantar ‘to sing,’ plantar ‘to plant,’ and the like. There were an equal number of novel verbs for these groups based on rhyme and class:

<table>
<thead>
<tr>
<th>Rhyme I</th>
<th>Rhyme II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verb class I</td>
<td>“vantar”</td>
</tr>
<tr>
<td>Verb class II</td>
<td>“balter”</td>
</tr>
</tbody>
</table>

Results indicated that conjugational class was the best predictor of the choice of the suffix –aba (suffix for the 3rd person singular imperfect tense for –ar verbs), if verbs were presented as class I (–ar nonce verbs). In addition, the highest irregularization rates were obtained among verbs of conjugational class II/III (–er nonce verbs) with irregular rhymes (43%). Verbs across both classes containing irregular rhymes yielded neighborhood effects which, for Brovetto & Ullman, suggested that irregular verbs were memorized on the basis of phonological similarity. They concluded that the interaction of two different mental systems was necessary to explain the representation and processing of Spanish verbal morphology: a system based on the
manipulation of abstract symbolic categories and a system for associative memory (Brovetto & Ullman, 2005).

By following the predictions of the DP model for L2 late learners, Rodríguez (in press) analyzed, from a purely morphological point of view, the oral and written production of the Spanish copular verbs from nine beginning learners during their first year of formal instruction at the university level. The distribution of ser and estar (both ‘to be’) verb forms across regularity groups showed a heavy reliance on the declarative memory, e.g., 366 of the tokens were the verb form es (‘s/he/it is’), which accounted for more than half of the dataset (57.1% of the 641 inflected tokens). I claimed that this form was favored because it is a suppletive irregular verb form that can be easily learned and computed over associative learning mechanisms, and because the verb ser (‘to be’) appears more frequently in the input than estar (‘to be’), and, as a consequence, it usually appears earlier and with higher accuracy in the production of L2 learners. Except for the 1st person singular, all present tense estar (‘to be’) forms are regular if one considers morphology only. However, when present tense forms appear in the production of L2 learners, it does not always necessarily mean that they are good examples of rule learning mechanisms. In fact, from the 14 examples of the regular verb form estás (‘you are’), all but two tokens were used for the greeting ¿cómo estás? (‘how are you?’) and it was argued that learners memorized this fixed expression as an unanalyzed chunk that they inserted into their speech, which may explain the perfect accuracy rate on this verb form. For the most part, preterite, imperfect and future tense ser and estar verb forms were consistently used by each participant either correctly or incorrectly all the time. Interestingly, verb forms such as estaba (‘s/he/I used to be’) should have been absent in the participants’ production for the first semester because these tenses are introduced later in the Spanish program, and participants had already indicated
that they had not learned any Spanish prior to entering college. The occurrence of these tokens can be better understood if we think of them as unanalyzed vocabulary items in the declarative memory which were inserted in the production of these participants when they had to provide a word with a given semantic feature, e.g., [+ past]. I concluded that the initial stages for the acquisition of ser/estar are also a morphological challenge in nature, not only a semantic challenge.

Previous work on the acquisition of complex L2 verbal morphology in languages with an inflectional system richer than that of English is inconclusive. There is a need to conduct more longitudinal studies in SLA working under either single-mechanism or dual-mechanism models if our goal is to track change in the learners’ internal mental state. Most previous SLA studies contributing to the present debate did not account for changes over longer periods of time (especially longitudinal studies over several years with the same participant pool), or even among different proficiency groups of L2 learners. Most of the time, these limitations hinder comparability among research findings because we miss the broader picture of their results. This study is a step towards that goal, i.e., to provide data from different groups of L2 learners at varying proficiency levels and in a language with richer morphology than English.

2.4.2. L2 Morphological Processing and the Brain Under the DP Model

Language processing occurs at an extremely fast rate (Kaan, 2007) and cognitive linguists need a method capable of capturing not only the timing but also the different stages involved in language processing. Since the 1980s, various linguistic phenomena have been investigated during language comprehension and production thanks to the discovery of a number of event-related brain potential (ERP) components. In addition to ERPs, there is another method capable of capturing the brain activity that occurs during human learning, functional magnetic resonance imaging (fMRI). Both methods have also been used in SLA research to test whether
L2 learners employ the same neural and cognitive mechanisms as native speakers for language learning (Kaan, 2007). Since what makes the DP model different from any other dual-mechanism theory is its heavy reliance on two mental systems with both language and non-language functions, it is necessary to review previous work on SLA using psycholinguistic and neurolinguistic methods to test the DP model for L2 processing, which is addressed in the following sections.

2.4.2.1. ERP studies of L2 morphological processing

In this section, the previous work on L2 processing using ERPs is covered. An electroencephalogram (EEG) is an electrical brain response that is the result of either an internal stimulus, i.e., a thought, or of an external stimulus, i.e., a perception. By placing 16 to 128 electrodes simultaneously on a person’s scalp, the electrical brain activity can be recorded while the participant is being exposed to stimuli or simply carrying out a certain task. At the onset of the event of interest, e.g., the presentation of an overregularized verb form, the brain potentials from a large number of trials of the same type are averaged (Kaan, 2007). The ERP waveforms, which can be positive or negative, usually change due to the experimental manipulation. When there is activity from large groups of neurons situated relatively close to the skull, ERP data can be collected. There are three ERP components of interest for the claims of the DP model as well as for language processing in general: the N400, the early left anterior negativity (or ELAN), and the P600 components.

The first ERP component is the N400, which is typically elicited by unexpected linguistic stimuli. It is a negative-going component, peaking approximately at 400 ms. (300-500 ms.) after the presentation of the stimulus, usually a word or a picture. It is largest over posterior areas of the scalp, and either bilateral or right-lateralized. The N400 was discovered in 1980 by Kutas & Hillyard in the first study that used ERPs to examine language processing. This component is
often elicited by semantically inappropriate words in an otherwise acceptable sentential context, and has also been shown to occur in response to words at the end of a sentence when there was a problem earlier in the sentence. In general, the more difficult it is to "integrate" a word into the preceding context, the larger the N400 that word will elicit. The second component is ELAN, a negative-going wave that peaks around 200 ms. or less after the onset of a stimulus, and has been found in some studies to occur in response to linguistic stimuli that violate word category or phrase structure rules (e.g., *the on table instead of on the table). While ELAN is frequently used in such areas of neurolinguistic experiments as sentence processing, it is still controversial if this ERP component is a language-specific phenomenon (Kaan, 2007). The third and last component is the P600, a positive voltage deflection which occurs at 600 ms. after stimulus onset. This component is sensitive to the degree to which a syntactic continuation is expected; i.e., ungrammatical continuations elicit larger P600s than those that are grammatical. There is no evidence yet that it is necessarily a language-specific phenomenon.

The DP model predicts that ERP components associated with grammatical processing in L1 should be absent or modified in L2 speakers; ERP effects associated with lexical-conceptual processing should differ minimally between L1 and L2, and L2 speakers may show ERP components associated with lexical-conceptual processing for grammatical computations (Ullman, 2001b, p. 114). The following studies (Hahne, 2001; Hahne & Friederici, 2001; Hahne et al., 2006; McLaughlin et al., 2004; Osterhout & McLaughlin, 2000; Rossi et al., 2006; Tokowicz & MacWhinney, 2005; Weber-Fox & Neville, 1996) are arranged chronologically and are evaluated to the extent to which they support these claims.

Weber-Fox & Neville (1996) conducted an ERP study on syntactic and lexical-conceptual violations in bilingual learners. Their study included 61 adult Chinese/English
bilinguals with varying ages of initial exposure to English: 1-3, 4-6, 7-10, 11-13, and greater than 16. Participants were asked to read sentences in English which had semantic anomalies or syntactic violations (either phrase structure violations, specificity constraints or subjacency constraints). Weber-Fox & Neville found that later age of exposure to English was associated with worse behavioral performance than native speakers when judging syntactically anomalous sentences. When compared to monolinguals, these L2 learners also showed a different pattern of ERP components to syntactic phrase structure violations, such as no early left negativity component or symmetric bilateral negativity. In contrast, only the participant group with the latest exposure showed worse performance than monolinguals when judging the lexical-conceptual anomalies. In fact, these violations yielded a typical N400 component whose distribution and amplitude were not affected by age of initial exposure except for a slight increase in the latency of the N400 for participants in the 11-13 and greater than 16 age of exposure groups. This study shows that L2 grammatical processing yields different ERP components than evidenced by L1 speakers while L2 lexical-conceptual processing yields similar components to those of L1 speakers.

In 2000, Osterhout & McLaughlin, as cited in Ullman (2001b), provided evidence supporting the DP model for SLA. They presented sentences with semantic or syntactic anomalies to native French speakers as well as to adult L2 learners of French while they collected ERPs. Semantic anomalies yielded an N400 effect and syntactic anomalies produced a P600 effect for the group of native speakers. However, for the group of L2 learners, both semantic and syntactic anomalies yielded an N400 effect after four weeks of instruction, although sometimes syntactic anomalies did not yield any effect. Interestingly, Osterhout & McLaughlin (2000) reported that after four months of instruction, i.e., after a longer period of
practice in the L2, their L2 learners showed a P600 component for syntactic anomalies while keeping the N400 effect for semantic anomalies, a result which corroborated that the P600 remains robust for L2 learners with greater practice while the ELAN usually evaporates in late learners (Ullman, 2001b, p. 117). This study supports the DP model, in that there was a shift of ERP components for syntactic anomalies that depend on grammatical computations, a shift of reliance similar to the one from the declarative to the procedural memory systems posited by the DP model for regular verb forms, as a result of greater practice in the L2.

Hahne (2001) was interested in whether L1 and L2 processing are based on the same neural substrate. She investigated the semantic and syntactic processes in spoken sentence comprehension with a group of 16 L2 learners of German, whose L1 was Russian, and a group of 16 native speakers of German. Both groups were asked to judge the grammaticality of correct sentences (e.g., the door was being closed), semantically incorrect sentences (e.g., the ocean was being closed), syntactically incorrect sentences (e.g., the shop was being on closed), and filler sentences (e.g., the store was being on Saturday closed), which were presented orally via headphones. The sentences from the experimental conditions always ended with a regular German participial verb form. The EEG was recorded using 19 tin electrodes and RTs and error rates were also noted. The main results indicated that the L2 learners made more errors and showed longer RTs than the L1 group. In the L2 group, the correct sentences elicited a larger early anterior negativity (100-250 ms.) and also in the time range of the N400 effect. This N400 effect was interpreted as a reflection of semantic integration of the sentence final participle in both groups. It was suggested that the semantic integration of the sentence final word was more difficult for the L2 learners than for the native speakers. For semantically incorrect sentences, the

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7 This sentence structure is the corresponding literal German translation, although it is odd in English.
N400 effect was longer (between 400 and 700 ms.) than that found in the correct sentence condition. It was more pronounced, as well as found earlier, for the L1 group than for the L2 learners, but overall, there were similar semantic integration problems in both groups. For syntactically incorrect sentences, there was an early anterior negativity in the L1 group only, reflecting first-pass parsing processes. For the second time window (500-1200 ms.), there was a reliable posterior P600 component in both groups, which was slightly delayed in the L2 group. In previous studies, the P600 was attributed to processes of syntactic integration, reanalysis, and repair, among other things. This P600 component seems to come into play the higher the proficiency of the L2 learners, as observed in previous research studies. These results support the DP model in that syntactically incorrect sentences elicited a delayed P600 component without ELAN for L2 learners, while semantically incorrect sentences elicited the same behavioral and functional problems (N400 effect) for L1 and L2 participants.

In 2001, Hahne & Friederici reported cumulative data in favor of the DP model similar to the previous study (Hahne, 2001). Although they used similar stimuli to those employed by Hahne (2001), their participants were different: native German speakers and 12 Japanese speakers, learners of German as an L2. These L2 learners began to learn German at a mean age of 21 (after puberty) and they had lived in Germany for about two and a half years on average. ERPs were collected from the participants while they listened to correct, semantically incorrect, syntactically incorrect, or both semantically and syntactically incorrect sentences. After each test item they had to decide if the sentences were grammatically correct or incorrect. This kept participants focused, although the main interest of the researchers was to collect their ERPs. Semantically incorrect sentences elicited in both the L1 German speakers and the L2 learners the same ERP patterns: a centro-parietal N400 component, which lasted a little bit longer for L2
learners. However, the ERP components present for L1 speakers in reaction to syntactic violations were absent in the L2 group: an ELAN and a P600. Late learners, as evidenced by these results, may not be able to achieve native-like competence for syntactic processing (procedural system), while their semantic processing (declarative system) seems to be similar to that observed in L1 speakers. The DP model also stated that for regular verb forms L2 learners may never achieve native-like competence in that L2 learners may never handle them procedurally, especially those L2 learners whose age of initial exposure to the target language was after puberty.

McLaughlin et al. (2004) conducted a longitudinal study on L2 word learning by English learners of French. Participants were presented with pairs of letter strings and they had to indicate whether the second string was a real word or not in French. ERPs were collected after 14, 63 and 138 hours of classroom instruction on average. The main result was that behavioral performance on the first session, after 14 hours, was at chance level, but, more importantly, the ERPs elicited different responses to pseudowords vs. real words, with the former yielding larger N400 components. McLaughlin et al. (2004) concluded that even though behavioral results were not beyond chance level, the L2 participants seemed to have learned some aspects of French word forms at a more automatic stage of processing since the nonce words simply had one or two of their central letters replaced.

Tokowicz & MacWhinney (2005) investigated explicit and implicit processes during L2 sentence comprehension. Nineteen L2 Spanish learners who were enrolled in one of the four semesters of beginning Spanish at the college level (five in the first semester, three in the second, nine in the third, and two in the fourth) participated in their study. Participants had to judge whether 360 sentences were syntactically appropriate in Spanish, as the explicit measure, while
their electrical activity in the brain was being recorded, as the implicit measure. They responded
to the test items by pressing buttons on a computer keyboard. Tokowicz & MacWhinney (2005)
predicted that beginning L2 learners would only be sensitive to violations of particular types
based on L1-L2 similarity. In fact, L2 learners were marginally sensitive (P600 component) to
auxiliary omissions (similar syntactic characteristic in the L1 and the L2) and to violations of
determiner gender agreement (unique to the L2), but they were not sensitive to violations of
determiner number agreement (different in the L1 and the L2). L2 learners responded less
accurately to the unique construction in the L2 than to the other two types: 57.88% for
determiner gender, 70.13% for auxiliary omission, and 70.38% for determiner number. These
results demonstrated that beginning learners showed implicit online sensitivity to some
violations of L2 grammar during sentence processing, even when their grammaticality judgments
were at chance levels. This is one of the greatest strengths of ERPs, i.e., being sensitive enough
to obtain data when behavioral methods are not. These data may even suggest that L2 learners
were developing effective implicit processing for Spanish in the absence of an ability to make
use of explicit processes or grammaticality judgments.

Rossi et al. (2006) investigated the role of L2 proficiency (high versus low) in late
learners of German and Italian. Four experimental groups were considered (n = 69) on the basis
of the L2 as well as participants’ proficiency levels, i.e., groups 1 & 2 (n = 16 and 19,
respectively) were high- and low-proficiency L2 learners of German, whereas groups 3 and 4 (n
= 16 and 18, respectively) were high- and low-proficiency L2 learners of Italian. Additionally, a
group of 30 native speakers of German were included. The study used ERP recordings from 23
scalp positions while participants listened to 420 L2 sentences (three experimental conditions,
one control condition, and 180 fillers). Three types of violations were under investigation: (a)
category violation where a verb directly followed a preposition so that the expected noun was absent, (b) agreement violation where the verb took an incorrect affix in relation to person/number agreement, and (c) combined violation where the preceding agreement and category violations were united. For the morphosyntactic agreement violation, high-proficiency L2 learners showed the same ERP components as native speakers: left anterior negativity or LAN (for the detection of the morphosyntactic agreement error) and P600 (for the reanalysis processes); low-proficiency L2 learners failed to show a LAN component, since morphosyntax seems to be acquired later than word category information. Rossi et al. claimed that their results illustrate that high-proficiency L2 learners show native-like brain processing mechanisms during sentence comprehension, even at comparable timings. Furthermore, these findings provide evidence that there are universal syntactic processing mechanisms within Indo-European languages as observed in the German and Italian L2 groups. These results are interesting for the DP model in that only high-proficiency L2 learners were sensitive to the morphosyntactic agreement error, showing that they were processing grammar in a similar way to native speakers of the target language.

Hahne et al. (2006) investigated how L2 learners process inflected words online using ERPs. They concentrated on two German inflectional systems, participle formation and noun plurals. They presented to a group of late L2 German learners, with Russian as their L1, sentences containing two types of violations: overregularizations and incorrect regular verbs. After the EEG sessions, participants had to inflect the test items (produce the corresponding participle form for verbs or the appropriate plural for nouns) and results indicated that they were familiar with the test items (95% accuracy for the participles and 86% for the plurals). Interestingly, the L2 learners reacted differently to the violations of regular and irregular
inflection. The overapplications of the –s plural rule produced a P600 component while the overapplications of irregular patterns elicited an N400 component. Hahne et al. (2006) concluded that at least in those domains in which L2 learners are highly proficient, they can employ the same mechanisms for morphological processing as L1 speakers. The clear dissociations between regular and irregular inflection for participle and plural formations indicate that the two processing routes posited by dual-mechanism models of inflection are also employed by L2 learners, provided that they are highly proficient in the knowledge of the morphological domains under study.

In sum, adult L2 language processing (ERP studies) showed some striking differences to native speaker processing in the domain of syntax and morphology. Most ERP/EEG studies offered evidence that L2 learners are guided by lexical-semantic cues for language domains which are thought of as being handled by the declarative memory system, but they were less dependent on the procedural memory system for syntactic representations, unless they had achieved high proficiency in the L2 or after they had had extensive training and practice in the L2. This is an essential difference between L2 speakers and native speakers. In the next section, cumulative evidence for the DP model and SLA is provided, but from studies measuring neocortical brain activation with the help of a different neurolinguistic tool, fMRI scanners. This tool provides a means to see the internal activation of the brain to the smallest detail but at the expense of temporal precision, just the opposite of ERPs. Comparable findings on the same topic from both types of data collection are the best way to provide strong results.

2.4.2.2. fMRI studies of L2 morphological processing

One of the most recently developed forms of neuroimaging is fMRI. Since the early 1990s, fMRI has come to dominate the brain mapping field due to its low invasiveness, lack of radiation exposure, and relatively wide availability. When nerve cells are active they consume
oxygen, and the local response to this oxygen utilization is an increase in blood flow to regions of increased neural activity, occurring after a delay of approximately 1-5 seconds. FMRI scans measure the blood flow response related to neural activity in the brain. This method can inform neurolinguists about the brain regions which are active when participants carry out a specific task such as producing complex verb forms or reading ungrammatical sentences.

What follows is the summary of recent studies (Opitz & Friederici, 2003, 2004; Rüschemeyer et al., 2005; Sakai et al., 2004; Tatsuno & Sakai, 2005) that used an fMRI scanner to investigate brain activation patterns for L2 learners in relation to the acquisition of inflectional morphology. These studies are presented in chronological order. They are critically reviewed to check the extent to which they support the predictions of the DP model for L2 learners, which are outlined here:

1. The subcortical brain structures for the processing of irregular verb forms should be in the hippocampus, medial temporal lobe regions, BA45, BA47, and parts of the right cerebellum.

2. The subcortical brain structures for the processing of regular verb forms should be in the basal ganglia, the left hemisphere of the cerebrum, the supplementary motor area, and BA44.

3. Finally, medial temporal lobe structures (declarative/associative memory system) are expected to underlie the use of both types of forms with a general decrease in left-lateralization (procedural/grammatical system) for L2 learners.

Opitz & Friederici (2003) investigated the neural basis of the learning of a miniature artificial grammar BROCANTO. Its grammar was composed of eight words and several rules; two of the rules are absent in German (the L1 of the 14 participants considered for the analyses), or in any other natural language known by the participants in order to control for potential
transfer effects. Participants were instructed in BROCANTO visually via a computer for 15 blocks, each one composed of 70 sentences for learning (sentences for which they were instructed to extract the underlying grammatical rules), 70 testing sentences (a grammaticality judgment task that included phrase structure and determiner-noun agreement violations as well as word class repetitions), and 20 sensorimotor control stimuli. Behavioral results showed improved performance across the 15 training blocks from the chance level, 52% correct responses, on block 1, to 81% correct on block 15. The BROCANTO grammar was successfully acquired during the training blocks, and participants obtained 74% accuracy for the new sentences presented to them several minutes after scanning. During the learning process, there was a decreased blood flow activation on the left posterior hippocampal area as well as on the retrosplenial cortex and left anterior and posterior temporal areas (Opitz & Friederici, 2003, p. 1734). The authors explained these results in light of similarity-based learning during the initial learning state of this artificial grammar, a grammar which was no longer used once the grammatical rules had been acquired. The lateral temporal lobes are traditionally thought of as being engaged in lexical-semantic processing. The rapid decrease in these regions in this study was interpreted as the brain’s natural reaction to the irrelevance of the lexical-semantic aspects of BROCANTO, an artificial language. Participants also showed a pattern of increased activity during learning on the opercular part of the left inferior frontal gyrus (IFG), traditionally referred to as Broca’s area, and interestingly restricted to BA44. The involvement of these regions had been found previously in relation to abstract nonlinguistic rule learning as well as in a variety of tasks with high attentional demands. These results were interpreted by Opitz & Friederici (2003) as consistent with the DP model in that there is an initial involvement of the posterior
hippocampus (declarative memory) followed by a shift to left inferior frontal activity (procedural memory) which was interpreted as the proficient use of an artificial grammar.

In 2004, Opitz & Friederici again set out to examine whether the acquisition of grammatical knowledge depended primarily on abstract rules or on item-specific information. This time, 21 participants were trained in the artificial language BROCANOTO for 48 hours, on average, prior to the experiment, in which participants were assigned to one of two conditions. In the so-called WORD condition, nouns that were presented only in the sentence-initial noun phrase during training would later on appear in the sentence-final noun phrase, but the structure of the noun phrases were maintained. In the so-called RULE condition, a modifier was allowed to follow the noun to which it referred, although during training the modifier was always placed before the noun. Results indicated that participants in the WORD condition judged the new items as grammatical although they differed superficially from the training exemplars. Interestingly, there was observable but transitory increased brain activation in the left anterior hippocampus for the WORD condition. In contrast, the RULE condition triggered a gradual increased engagement on the left ventral premotor cortex caused by the introduction of the new phrase structure rule. Opitz & Friederici (2004) argued that their results pointed to a dissociation between similarity-based learning versus rule-based learning during language acquisition. Crucially, their results fully supported the DP model for SLA in that there was a shift to a gradual engagement of the left inferior frontal activity in the RULE condition, which is associated with the proficient use of the artificial grammar of BROCANOTO.

Sakai et al. (2004) studied whether learning new knowledge, in this case the English past tense, for beginning L2 learners over a period of two months was associated with brain plasticity and cortical changes. Seven pairs of native Japanese speakers, all 13 years old and all twins,
received intensive training in the English past tense formation for 64 regular and 64 irregular verbs via bingo games as part of their standard classroom education. They had 25 training sessions of about five minutes each. Participants completed two fMRI sessions, one before and one after the training period, in which they completed four tasks: an English and a Japanese verb-matching task (EM and JM, respectively) as well as an English and a Japanese past tense task (EP and JP, respectively). Once a symbol was displayed representing the task to be performed over a computer screen, a bare infinitive was presented and participants read it silently. The next screen displayed two stimuli for one second and participants had to either select the correct bare infinitive or the correct past tense form by pushing one of two buttons (participants always saw the correct regular/irregular verb form and an incorrect regular/irregular counterpart, such as *catched vs. caught). Images of their brains were obtained in 16 horizontal slices per test item and participant. In this study, the brain subcortical activations did not show dissociation between the regular and the irregular English past tense forms. For time 2, when the EP regular and irregular stimuli blocks were contrasted with the EM blocks, similar cortical regions were activated: the dorsal region of the left IFG, BA46 and the right cerebellum (Sakai et al., 2004, p. 1236). The only observed differences were present in the left angular gyrus and supramarginal gyrus for the EP irregular verbs as well as the wider activations on the left IFG for the irregular verbs than for the regular ones. When the cortical activations for the EP regular and irregular verbs were summed up, they exactly matched the regions activated for the Japanese (L1) past tense task only in the left dorsal IFG, suggesting that these paralleled increases represent the acquisition of past tense knowledge. In addition, Sakai et al. (2004) found a significant positive correlation between the increases in examination scores and the activation increases in the left dorsal IFG (Sakai et al., 2004, p. 1237), suggesting that this cortical
activation might be a good indicator of individual improvement in the acquisition of L2 past tense formation.

The following year, Tatsuno & Sakai (2005) conducted a similar study to Sakai et al. (2004) comparing the cortical activations in two groups of participants, taking age (13 vs. 19 year-old age groups), proficiency (high ‘H’ vs. low ‘L’), and language task demands (verb-matching ‘M’ vs. past tense verb identification ‘P’) into account during L1 Japanese and L2 English processing. The 14 participants in the 13 year-old age group had participated in the previous study (Sakai et al., 2004) while the participants in the 19 year-old age group were 15 undergraduate students who were new to this study. Each age group was further subdivided into the two proficiency subgroups, based on the median of their accuracy on the English irregular verbs. Tatsuno & Sakai (2005) used 24 regular and 24 irregular English verbs and 48 Japanese verbs matched in meaning for the data collection. Tasks and procedure were exactly the same as in the previous study (Sakai et al., 2004). Behavioral results showed that there were significant differences between the 19EL and 19EH subgroups in the accuracy and RTs to the irregular verbs in the EP tasks, even though the four subgroups of participants showed accuracy greater than 90% (Tatsuno & Sakai, 2005, p. 1639). The brain activation patterns were similar between age 13 and age 19 groups as well as between EPIrregular-EM and EPRegular-EM tasks because there were consistent activations in the left IFG. However, the main results stem from the different activation patterns found among groups. First, there were lower brain activations at the left F3t in the EPIrregular-EM and EPRegular-EM tasks for the age 19 group, suggesting that proficiency level plays a major role in this region during L2 acquisition (Tatsuno & Sakai, 2005, p. 1642). Previous studies have also reported that activation in the left F3t increases when participants first learn the grammatical rules of an L2. Second, there were greater activations in
the left F3t/F3O region in the EPirregular-EM task for the low proficient age 19 group than for the high proficient age 19 group, which may suggest that the left F3t/F3O activation is related to the sensitivity to specific language task demands rather than associated with cognitive development in general. In fact, this region was activated significantly more for the age 13 group during the JP-JM task than for the age 19 group, even though performance in this task was matched between the high proficiency age 13 group and the low proficiency age 19 group.

Tatsuno & Sakai (2005) concluded that the left IFG subserves language-specific functions and is specifically involved in the cortical plasticity for L2 acquisition.

Rüschemeyer et al. (2005) presented imaging data from advanced L2 learners when processing spoken sentences with either syntactic or semantic violations. Fourteen learners of German, NSs of Russian, participated in the study. They had been living in Germany for an average of five years. In the syntactically incorrect sentences, an auxiliary verb was followed directly by an inflected preposition that was immediately followed by the participle of the main verb instead of the necessary noun. In the semantically incorrect sentences, the meaning of the final sentence participle could not be integrated into the preceding sentence context. This group of L2 learners showed no significant differences in the processing of syntactically incorrect sentences when compared to the correct ones, although there was a reliable region of increased activation in comparison to the NSs in BA44 in response to correct and syntactically incorrect sentences. This same response did not occur with respect to the semantically incorrect sentences. According to Rüschemeyer et al., the increased BA44 activation reflected additional phonological processing for understanding speech signals in the target language. Results also indicated increased activation in the left anterior IFG for semantically incorrect sentences versus the correct ones, which was partially comparable to the brain activations by NSs in response to
the same stimuli. This finding led the authors to speculate that “processes underlying semantic processing seemed to be more similar in native and non-native speakers of a given language than did those underlying syntactic processing” (Rüschemeyer et al., 2005, p. 283).

What is clear from the studies reviewed here is, as Sakai et al. (2004) suggested, that “data have not been conclusive as to the regular/irregular verb distinction” (p. 1238). In general, though, tasks which involved grammatical processing showed greater temporal lobe involvement in both hemispheres of the brain (Ullman, 2001b) and the extent of temporal lobe involvement was greater for later than earlier L2 learners. For example, Tatsuno & Sakai (2005) found increased activity in the lower portion of the left IFG (BA 45/47) in the processing of irregular but not in the processing of regular past tense stimuli compared to the processing of similar items in a verb-matching task. There had not always been consistent brain activations across these studies but it is important to remember that experiment-specific factors such as processing difficulty, small number of stimuli or phonological complexity are usually cited as being responsible for some of the activation differences found in imaging studies. Nonetheless, there have been some areas of agreement for most studies, e.g., irregular verbs activated more brain areas than regular verbs, and there are common regions of brain activation in the production of regular and irregular past tense compared to baseline items. ERPs and fMRI scans are two powerful tools which are used in neurocognitive linguistics to test the claims of the main theoretical positions in the debate about the mental representation and production of inflectional morphology.

2.4.3. The DP Model and the Cognitive Approach to Language Learning

According to Doughty & Long (2003), research on SLA is increasingly viewed as a branch of cognitive science because language learning is ultimately a matter of change in an individual’s internal mental state. The DP model facilitates the integration of data from across
different disciplines, primarily theoretical linguistics, cognitive psychology and cognitive neuroscience (Walenski & Ullman, 2005), as we have just seen from the previous sections. What is interesting about the DP model is that it can be easily integrated into a broader SLA theory, the Cognitive Approach (Skehan, 1998), since both share key features with parallel hypotheses and predictions for L2 learners. These parallelisms are described in this section by providing specific examples from key research studies as well as components of working memory and long-term memory, all of which are fully compatible with the DP model.

The Cognitive Approach outlined by Skehan (1998) is primarily an information-processing account on how IL develops. Two assumptions underlie the main claims of this theory. First, the language acquisition device, i.e., Universal Grammar, is no longer available for L2 learners after a critical period. Second, meaning takes priority for older learners. Although in this theory meaning is considered the driving force for ongoing communication, this claim forces the model to search for an explanation of how it is possible that the IL develops and changes over time, since form is of secondary importance.

A main point in the Cognitive Approach is that normal communication is heavily based on the pressures of processing language in real time rather than on the use of complete and well-formed sentences. During ongoing conversation, we reduce the processing load by relying on time-creating devices, prediction skills, elliptical language, and so on. Furthermore, it is claimed that much adult conversation is incomplete in surface form, enabling inferences about intended meaning, speaker attitudes, and the like. Furthermore, the older we get, the more adept we become at developing such an analytic knowledge system. But language use, in itself, does not lead to the development of an analytic knowledge system, because meaning distracts attention from form. The traditional rule-based approach (starting every sentence from scratch and filling
the gaps in a given syntactic structure with appropriate words) is thought of as an imposition of the linguist that facilitates the expression of new meanings and enables the production of utterances which have never been created before (Skehan, 1998). Instead, the Cognitive Approach claims that most of the speech we produce is likely to have been produced before, at least in part, through the use of memorized chunks of information, even by the same speaker: *I’d like to…*, *I’m gonna try to…*, *It doesn’t matter how…*, *I don’t agree with…* As a result, an average native speaker knows hundreds of thousands of such lexicalized sentence stems which may be used during ongoing conversation to achieve fluency. It is argued that there is a parallel knowledge system which is primarily lexical in nature and very important for successful rapid communication. In such a way, a dual representation system (one rule-based and one exemplar-based) is used to satisfy a number of competing demands: improvisation, fluency, processing demands, creativity, syntactic constraints, rule generation, and the like. The rule-based system implies compact storage and powerful generative rules to compute well-formed sentences, while the exemplar-based system occupies a large redundantly structured memory system. The rule-based system and the exemplar-based system is a similar notion to the dual-mechanism models. Such a collection of fixed phrases can be adapted to convey different meanings, and individuals have the capacity of expanding their repertoires over time. It is further suggested that these fixed phrases will reflect the meanings that any particular individual is most likely to express, i.e., lexicalized ‘idiolects.’

Under this approach, the task of the L2 learner is that of appropriate selection of lexicalized sentence stems. There are L2 learners who produce grammatical and fluent utterances but still sound foreign because the choices they are making are not grammatically correct in the target language, such as *The project consists about…*, or *La tarea es por mañana* (‘The
homework is for tomorrow,’ wrong selection of the Spanish preposition, which should have been \textit{para}). Much of the time, learners are thought of as relying on large chunks of memorized language rather than starting every single sentence from scratch. For example, given a fixed phrase like \textit{why don’t you cancel class today?}, learners can easily adjust it to the communicative needs of ongoing conversation by changing the final words without the need to create the whole sentence by grammar rules: Why don’t you + VB (infinitive). Instead, its meaning is of primary importance. In fact, there is also the possibility that the learner still does not know how to form the contraction of a negative adverb with an auxiliary verb at all but will produce the previous example with accuracy and fluency, as in \textit{why don’t you come with me}? These memorized chunks of language are handled by the associate system (i.e., “our” declarative memory), which is considered to be organized for ease of use rather than for efficient compactness, even if that implies that the same word may be redundantly stored more than once. Syntax and the application of grammar rules are de-emphasized in this model for L2 learners, which fits perfectly with some of the claims for beginning L2 learners from the DP model, e.g.; adult L2 learners at earlier stages of acquisition rely primarily on associative memory because both regular verbs and irregular verbs will be stored initially as opposed to being handled by the two memory systems separately, which is how native speakers handle regular and irregular verb forms.

The Cognitive Approach claims that humans are thought of as possessing a limited-capacity memory system, and this limitation places a fundamental constraint on how input is handled. Working memory needs to extract what is relevant for ongoing comprehension. This notion has direct consequences on how morphology is processed. For example, learners process more meaningful morphology (imperfect suffixes in Spanish) before less meaningful
morphology (redundant verbal agreement) because learners process input for meaning before they process it for form, one of the principles for input processing proposed by VanPatten (1996). Input frequency and saliency are incorporated in this model to promote what Schmidt (1990) calls ‘noticing’ or ‘degree of awareness,’ meaning that the learner has to perceive a gap in her/his current IL grammar. This process can happen either during comprehension or production. For several reasons, though, the notion of noticing is more important during production because it forces learners to test their hypotheses about the L2 and to focus on form. As an example, Swain (1995, 1998) emphasized that one of the key functions of output is that of testing hypotheses about the target language, which may aid L2 learners to find discrepancies between their current IL state and the L2 linguistic system. There is evidence that the first stages in SLA are primarily lexical in nature (which explains why irregular verbs have an advantage at first) and there is a danger that learners will not progress beyond this stage. According to the Cognitive Approach, the internally generated pressure for syntactization (language which was available on a lexical basis becomes reorganized to be syntactically based, i.e., fixed expressions are understood now in terms of their constituent parts) will not come into play naturally once the critical period is past. Again, this is a claim fully compatible with the DP model in that, as we have seen before, age of exposure sensitivity in the L2 affects the procedural memory system, since the learning and use of grammar depends largely upon procedural memory.

Ultimately, the Cognitive Approach (Skehan, 1998) proposes a methodology that focuses on form while keeping meaning as its key component: task-based instruction. According to Long (1991), this approach is the most effective means of directing L2 learners’ attention towards L2 grammar. His focus-on-form approach proposes that the main focus of the lesson should be on meaning via plenty of comprehensible input and interaction in the L2, while form focus should
arise in context as needed, either explicitly by short grammar explanations or implicitly via recasts or negotiation of meaning.

Additionally, the Cognitive Approach makes strong assumptions related to individual learner differences: some learners may have a better talent specifically for language, and this natural talent is a stable and untrainable construct. For inflectional morphology, this simply means that some learners will have the capacity to infer word internal structure from a given language and make generalizations about how other linguistic material might be encoded, progressing more quickly; other learners will need more time, so that focused instruction will have greater importance for them. In fact, one of the roles of output is to develop automaticity, an essential notion for the acquisition of morphology (Skehan, 1998).

Empirical evidence that the first stages of SLA are usually lexical in nature is provided by Housen (2002). His analysis of 29,000 verb phrases from 46 learners of English showed three general stages. The first is characterized by missing verbs or verbs that appeared in rote-learned formulaic expressions, e.g., *I don’t know*. The second phase is one in which productive verbs show up as morphologically invariant forms (V-Ø), e.g., *eat, want*; some inflected forms, particularly highly frequent irregular past forms, e.g., *got*; and progressive forms (V-ing), e.g., *dancing*. The third phase is marked by diversification of verb forms. As exemplified, stages 1 and 2 can be claimed to be driven by lexical learning. However, even greater evidence in favor of a contrast between rule learning mechanisms for regular morphology and associative learning mechanisms for irregular morphology under the Cognitive Approach is Ellis’s (1987) study. He investigated the effect of planning opportunities on SLA performance among 17 post-beginner or early intermediate EFL students from different language backgrounds. Regular and irregular past tense forms were elicited through three narrative tasks involving story telling. In Task 1,
participants had to write a story from a set of six pictures. In Task 2, the author recorded the second attempt of an oral version of the same story. In Task 3, participants had to narrate a story to accompany a new set of pictures. Each task provided them with less planning time and, consequently, with fewer opportunities to attend to form. Results indicated that accuracy on the past tense morphemes declined as a function of less planning time being available. But the most interesting finding was that performance on the regular and irregular past tense forms differed significantly across tasks. Accuracy on the regular past tense forms decreased from 77% in Task 1, to 57% in Task 2, to 43% in Task 3. On the other hand, accuracy on the irregular past tense forms remained relatively constant across tasks: 60%, 57% and 55%, respectively. This dissociation in accuracy scores between regular and irregular morphology is based on the belief that when the online processing capacity becomes less available, attention to form decreases.

Rule application requires a considerable degree of online computation during language production and that is why regular past tense forms decreased in accuracy from Task 1 to Task 3. In contrast, irregular verbs maintained a constant level of accuracy across tasks because they do not require a high degree of processing. In fact, Ellis (1987) concluded that irregular verbs “have to be learned as separate tokens, each past tense form constituting a distinct lexical item in the learner’s interlanguage” (p. 11). Skehan (1998) further suggested that Ellis’ (1987) study illustrates the ability with which learners can switch between rule-based and exemplar-based representational systems.

As shown, the main advantage of the Cognitive Approach in providing an explanation of how verbal morphology is acquired is the integration into a unified model of external (comprehensible input) and internal factors (aptitude) that affect SLA, coupled with psychological factors that determine how real-time communication is carried out. Morphology is
no different from other grammatical features; the greater the learner’s aptitude, the faster s/he will notice a gap in her/his IL, which will push the IL grammar to move forward. The conceptualization of language learning by the Cognitive Approach is fully compatible with the Words and Rules theory and the DP model for regular and irregular past tense verb forms (Pinker, 1991, 1998, 1999; Pinker & Prince, 1994; Pinker & Ullman, 2002; Ullman, 2001a, 2001b, 2004, 2005). And even though the Cognitive Approach is not very specific concerning how verbal morphology is acquired in L2, the model can accommodate many of the arguments proposed here for the contrast between regular and irregular verb morphology, as shown in Figure 2-1. Input frequency, for example, is a key argument for the regular/irregular dissociation.

Figure 2-1. Main influences on noticing and components of working memory and long-term memory for the DP model from the Cognitive Approach. [Adapted from Skehan, P. (1998). *A cognitive approach to language learning*. (Page 57, Figure 3-6). New York: Oxford University Press.]

Pinker (1991, 1998) proposed that most surviving irregular verbs in English are used at high frequencies, and that irregular forms have to be memorized repeatedly, generation after generation, in order to survive in a language. In fact, low frequency irregular verbs were
converted to regular verbs over the centuries. For SLA, the prediction that would follow is that those forms that appear more frequently in the L2 input (irregular verbs), will be the first forms noticed and will be acquired with greater accuracy. That is generally observed in the L2 literature. Even though the model deals with larger chunks of information, at the sentence level, the dual-mode system in long-term memory can account for a rule-based analytical system that will be used for regularly-inflected verb forms, and a memory-based formulaic system that will be used for irregular verb forms. In the previous sections, some evidence that there are brain structures differentially implicated in either one or both of these memory systems has been provided. However, the debate remains unresolved, and there is a need for continued empirical evidence from different populations, linguistic systems, and task features.

In sum, the Cognitive Approach to L2 learning (Skehan, 1998) has many parallels to the DP model. The Cognitive Approach is a theory which is interested in interpreting SLA as the result of both a restructuring of linguistic material (McLaughlin, 1990), by the operation of a mental rule-based grammar or by other cognitive processes, as well as by the accumulation of useful chunks of language as formulaic items. This interplay between a rule-based analytical system and a memory-based formulaic system in long-term memory (refer back to Figure 2-1) mirrors the procedural and declarative memory systems in the DP model, which are posited to interact cooperatively and competitively in the processing of complex word forms. In Chapter 5, the extent to which the research results of this investigation corroborate the Cognitive Approach to language learning is also evaluated.

2.5. Additional Work on the Acquisition of Spanish Regular/Irregular Morphology

This final section of the review of previous studies is a summary of additional studies in Spanish SLA dealing with the acquisition of verbal morphology, in which regularity was a variable in the analysis and/or interpretation of the results (Bruhn de Garavito, 2003; Camps,
2005; Salaberry, 1999, 2000). These studies did not use the DP model or any dual-mechanism model to account for the main findings; nevertheless, they can be easily accommodated into the DP model to some extent. This review covers additional resources in the study of regularity in the acquisition of Spanish verbal morphology by L2 learners and it shows the extent to which the DP model can contribute to this area of research interest.

Salaberry (1999) tested the effect of inherent lexical aspectual value of verbal predicates in the use of past tense morphological marking in the L2 Spanish of 20 adult learners. The lexical aspect hypothesis states that the learners’ selection of verbal morphology is related to the inherent lexical semantics of the verb phrase. Sixteen of his 20 participants were enrolled in four different levels of Spanish courses, four participants per proficiency level. His data included oral narratives from a silent movie collected at two different times two months apart during the same semester. He found evidence that the preterite forms (used mainly for completed actions in Spanish) were gradually used for telic events (achievements and accomplishments), and that the use of imperfect forms (for background information, details and ongoing actions in the past) increased consistently towards correspondence with lexical aspect, i.e., stative events first. The relevant finding in this study for the present investigation was that the imperfect morphology was initially used with a restricted set of verbs, which was considered indicative of lexical learning instead of rule application, supporting the acquisitional route the DP model predicts for the beginning stages of SLA.

Salaberry (2000) examined the written and oral narratives from 14 L1 Spanish speakers learning L2 English in a classroom setting in Uruguay. Again, he found that all learners relied heavily on the use of irregular morphology to mark past tense in both written and oral narratives. In contrast, the use of regularized forms of past tense lagged behind in the production of most
learners. He cited Pienemann (1987) and Schwartz (1993) in order to account for his results. Pienemann (1987) stated that rules which require a high degree of processing capacity are acquired late, while Schwartz (1993) asserted that inflectional endings are among the most difficult features of non-native languages for adult learners, showing the highest amount of variability and the lowest degree of success. Salaberry (2000) claimed that the effect of inherent lexical aspect may be independent of the effect of the cognitive saliency of irregular morphology in languages such as English or Spanish. As mentioned earlier, and as predicted by the DP model, regularized past tense forms appeared later in the production of most learners because regular complex verb forms are expected to be handled by the procedural memory system, unless they are processed at the beginning stages of acquisition by the declarative memory system.

In 2003, Bruhn de Garavito examined tense distinctions in the initial state of L2 learners of Spanish. The main questions were whether a group of beginning learners provided evidence for knowledge of tense distinctions (present vs. preterite), and if they showed differences in accuracy between two types of verbs: regular and irregular. Fifty-three university students and 10 Spanish native speakers (as the control group) participated in an oral grammaticality judgment task in which the grammaticality of the sentences depended on the correct use of tense, either present or past. This format was used in order to decrease the processing load which is associated with production. The grammaticality of the sentences depended on the use of the correct tense, e.g., *Anoche no tengo tiempo de hacerla (la tarea) ‘*Yesterday night I don’t have time to do it (the homework)’ vs. Anoche no tuve tiempo de hacerla ‘Yesterday night I didn’t have time to do it.’ There were three verbs from the 1st class, three verbs from the 2nd/3rd class, and three irregular verbs. Each verb was used 12 times, with each person (first, second and third, singular or plural) appearing four times, together with eight distracter sentences for a total of 116 test
items. Participants used a 5-point rating scale. Both groups rated the ungrammatical sentences in the present and preterite significantly lower than the grammatical ones, but the L2 learners did so to a much lower degree. For the regular verbs, and in the past tense only, the acceptance rate for the grammatical sentences was significantly higher than for the ungrammatical sentences. A different picture emerged for irregular verbs, i.e., subjects clearly distinguished grammaticality in the case of the present tense and failed to do so in the past. Why would the present be a problem in the case of regular verbs and the past in the case of irregular verbs? Two possible explanations were offered. First, if learners were relying on stress to recognize the past tense and not on the verb endings, it’s reasonable that they had problems with irregular verbs only, given that irregular past tense verbs do not differ in their stress pattern from the present, e.g., [tú βe] ‘I had’ vs. [tén go] ‘I have’ or [í ðe] ‘I did’ vs. [á γo] ‘to do.’ But the regular stress pattern in the preterite is more salient when compared to that of the present tense, e.g., [kó mo] ‘I eat’ vs. [ko mi] ‘I ate.’ Second, irregular verbs in the present tense are generally the most frequent verbs, which may have helped learners to acquire them. Bruhn de Garavito (2003) recognized that the results of this experiment were difficult to interpret and that the best explanation is that these learners used the following properties in the input to make their judgments: stress saliency, adverb of time rather than tense of the verb, acceptability of a present tense in a past context when interpreted as a recent past, and frequency of the verb forms tested, the latter being a key variable in studies under the DP model.

Camps (2005) investigated the initial stages of imperfective morphology in the written production of 30 first-year learners of Spanish in writing activities using the same topic twice: at the end of one semester and at the beginning of the next one in the beginning courses. His data supported the predictions of the lexical aspect hypothesis (Andersen, 1991) in that when
imperfective forms appear in the production of L2 learners, they appear first with states, spreading later to activities, accomplishments, and finally to achievements. For example, in the second writing activity of this study, state verb types were appropriately marked in the imperfect with 85.1% accuracy, before any other aspectual class, followed by 68.1% accuracy for the activity aspectual class. Camps (2005) also found that irregular verbs were more frequent in the data overall, resulting in the highest percentage of both imperfect (47.5% were irregular verbs vs. 36.7% regular verbs) and preterite forms (42.4% vs. 30%, respectively). In the case of state verbs, the preterite appeared more frequently with irregular verbs than with regular verbs (which could be explained by associative memory learning), while regular and irregular verbs were more frequently marked with the imperfect than with the preterite (interpreted as a possible outcome of a rule-learning mechanism in both cases).

In sum, these additional resources corroborated the hypothesis that the initial stages of verbal morphology acquisition in L2 Spanish are generally lexical in nature, which can be accounted for by the predictions of the DP model, and that the appearance of forms which depend upon the application of complex rules is delayed to some extent in the production of L2 learners. Coupled with the previous work on SLA under dual-mechanism models (including section 2.3.), it is striking to observe that most studies did not track developmental changes over time. Instead, they generally studied the recognition/production of verbal morphology by L2 learners at a single point in time or at a single proficiency level. However, some of the attractiveness of the DP model for explaining L2 learners’ behavior is the hypothesized shift from declarative memory reliance to procedural memory reliance for forms which are compositionally computed in the mental grammar for L1 speakers, a shift which is usually delayed for L2 learners and which may even be absent for some learners. The use of longitudinal
studies or of cross-sectional studies is necessary if we want to find where and how this shift may occur in SLA. The present study aims to provide more information about the mental representation and production of inflectional morphology by L2 learners at varying proficiency levels.

2.6. Summary

In this chapter it has been shown that the acquisition of inflectional morphology by L2 learners under single-mechanism models could be explained by purely associative learning mechanisms without the need for explicit mental rules for regular verb forms. However, these studies typically used nonce words, i.e., not a real L2, or computer models, i.e., not human L2 participants, to test their hypotheses. In contrast, previous work under dual-mechanism models showed, although not always consistently, that the time to react to irregular verb forms by L2 learners is affected by the frequency of the irregular items, while these frequency effects were not usually observed for regular verb forms. They also found that when retrieval of an irregular verb form fails, overregularization errors occur. The DP model has not been widely tested in the study of SLA even though it posits clear and well-defined hypotheses for L2 learners, especially in relation to psycholinguistic and neurolinguistic variables. For this reason, previous work has yet to yield conclusive findings, and, unfortunately, the lack of longitudinal or cross-linguistic studies to track developmental stages among varying levels in the participants’ proficiency leaves a greater laguna in our understanding. The current investigation is a step forward to fill that gap in the literature review presented in this chapter.

The current cross-sectional study is interested in the speeded oral production and recognition of complex verbal morphology in L2 Spanish by English speakers, and isolates four key variables under the DP model: (a) the regularity of specific verb forms; (b) their frequency of occurrence in the target language; (c) participants’ proficiency level; and (d) participants’ age of
initial exposure to the target language. This study uses an oral production task as well as two psycholinguistic experiments measuring participants’ RTs on the test items of interest. It considers participants’ behavioral responses at large by including accuracy scores, RTs and the nature as well as the internal structure of errors they made, because little is known about specific processing strategies employed by L2 learners at varying degrees of proficiency levels when handling complex morphosyntactic transformations. The specific methodology and research questions that guided the present investigation are introduced in the following chapter.
CHAPTER 3
METHODOLOGY

3.1. Introduction

In this chapter, the main goals of my study are described, including the research questions which guided the investigation. The design of the tasks (participants, test items, materials, etc.) and the data collection procedure are also described. And at the end of the chapter the primary statistical tests used for the data analysis are explained.

The goal of this study is to investigate the acquisition of Spanish verbal morphology by L2 learners by looking at their processing and storage of complex verb forms in the L2. Behavioral data from adult late learners of Spanish as an L2 at three proficiency levels were collected to track qualitative and/or quantitative developmental changes in the mental representation of and access to inflectional morphology over time. Data from adult English/Spanish bilinguals were also collected to test whether there were differences between these advanced speakers and the advanced late learners in the mental representation of and access to inflectional morphology as a result of earlier exposure to the L2.

Two psycholinguistic experiments and a production task were used to address the research questions. Methodology in psycholinguistics takes the form of behavioral experiments in which participants are presented with some form of linguistic input and asked to perform a task, e.g., reproducing the stimulus, or pressing one of several buttons. RTs and the proportion of correct responses are overall the most frequently used measures of performance. To expand on the previous research, the types of errors produced by these groups of learners were also considered, because this information can provide additional evidence about the mental mechanisms at work when handling complex verb forms in an L2. Each experimental task is described in detail below; the paragraph that follows outlines the goals of each.
The first behavioral experiment was an oral elicitation task (Experiment 1) used to: investigate participants’ recognition of the accuracy of preterite verb forms after they saw their written infinitive as a stimulus; to analyze the nature of errors with Spanish regular, irregular, and vowel stem change verbs; and to measure the elapsed time between the presentation of the written stimulus and the oral response. The second behavioral experiment was an oral and visual lexical decision task (Experiment 2) used to: investigate the accuracy of stem recognition of the infinitive verb form after the oral presentation of a preterite form with the same or a different stem; and to measure the elapsed time between the oral stimulus and the button press for regular, irregular, and vowel stem change verbs. The production tasks used were two elicited narratives (Task 1 and Task 2) in which the participant’s voice was recorded while narrating the actions another person performed in the past, as shown on a storyboard. For the first task, participants had to use the verbs printed on the page below each drawing, while the second picture-story sequence did not have accompanying verbs. Only the results from the first task are included in the present study. As with Experiment 1, the number and rate of correct responses were examined by verb type and the nature of errors was discussed.

My ultimate goal with these tasks was to provide evidence of dissociations in the processing of inflectional morphology based on the degree of regularity of the verb. By looking at participants’ RTs, accuracy rates and errors when conjugating and/or recognizing complex Spanish regular, irregular, and stem change verb forms from the preterite tense, we should find clear dissociations if these verb forms are handled by and stored in different memory systems. If irregular verb forms are stored in the declarative memory system, RTs to high and low frequency irregular verb forms should differ significantly because a memorized item that is more frequently heard and used will be retrieved and accessed faster than an infrequent one. If regular verb forms
are handled by the procedural memory system, however, frequency should not play a significant role because the rule of suffix addition should apply at a similar rate for high and low frequency regular verb forms. Regular verb forms do not need to be stored in the declarative memory fully conjugated, as is posited to be the case for irregular verbs, although they can be. Vowel stem change verbs are a special kind of verb in Spanish which take the regular Tense/Aspect/Mood (TAM) suffix but change the vowel of the root when in the preterite tense. This vowel change is predictable and only applies to Spanish verbs from the third conjugation, i.e., verbs which end in –*ir* in their infinitive form. There will be different predictions for this special group of verbs if we think of this vowel change as a new rule to be mastered based on its predictability or if we think of it as a new stem to be memorized because it replaces that of the infinitive form. The literature review presented in Chapter 2 showed no study treating this group of verbs separately. Instead, they are usually included in the group of irregular verbs.

Psycholinguistic Experiment 1 as well as Production Tasks 1 and 2 focused on the production of Spanish preterite forms, while Psycholinguistic Experiment 2 was interested in the speeded recognition of Spanish verb stems by English-speaking participants. In order to uncover the learning mechanisms that L2 learners at varying proficiency levels employ in the production of Spanish preterite forms, their cognitive strategies and the types of mistakes they made when verb forms were used incorrectly were looked at (e.g., overregularizations, no vowel stem change, incorrect TAM suffix, or hypercorrection, among others). The frequency with which they made such errors was also examined and those rates were compared among the proficiency groups to better understand the developmental route for the acquisition of inflectional morphology.
Since Spanish has more inflectional endings than English and different ways to refer to an event in the past, Spanish L2 learners’ ability when producing and accessing Spanish preterite forms was examined as the necessary next step in the ongoing debate about the mental representation and production of inflectional morphology. Languages with a wider range of morphological transformations force the debate to expand beyond the boundaries to which it has traditionally been limited. For this reason vowel stem change verbs are considered in the present study as a separate group of verbs, a group which is at the heart of the regularity spectrum: these verbs certainly apply a regular rule for TAM but they also undergo an additional internal transformation. Our classification of these verbs as regular or irregular depends, therefore, on whether we believe this stem change is a new rule to be applied or a new irregular root to be memorized.

In addition to the new group of verbs included, another contribution of this study design is that it is cross-sectional in nature, providing “snapshots” of morphology acquisition by different groups of learners at a particular point in time. This methodology aims to provide the same kind of findings which may have been obtained by the “moving picture” of a longitudinal study involving a series of observations over a longer period of time using the same group of participants.

The procedure for data collection, the design of all tasks and materials, participants’ information and recruitment, as well as data analysis are discussed in this chapter. Data coding is explained in the next chapter, with the results for the corresponding tasks.

3.2. Research Questions

The specific research questions that guided this study are as follows:

(1) What type of dissociations do English/Spanish bilinguals evidence based on frequency effects, as observed in the RTs, accuracy, and errors when handling complex verb forms?
(2) What type of dissociations do the different groups of late L2 Spanish learners evidence based on frequency effects, as observed in the RTs, accuracy, and errors when handling complex verb forms?

(3) What developmental patterns can we find from the different proficiency groups of late L2 learners when handling complex verb forms of various verb types of high and low frequency?

(4) What significant differences can we find between the group of advanced late learners and the group of English/Spanish bilinguals (taking age of initial exposure to L2 Spanish as the main differing variable) in RTs, accuracy, and errors/behaviors when handling complex verb forms?

Since, according to the dual-mechanism models, NSs generate regular verb forms through rule application, it is hypothesized that there will be no significant differences in RTs between high and low frequency regular verb forms in the group of bilingual speakers. Irregular verb forms, by contrast, are stored in the lexicon in the declarative memory, which is sensitive to input frequency. RTs for high frequency irregular verb forms should be significantly shorter than those for low frequency irregular verb forms. The group of bilinguals in this study is predicted to perform just as NSs would because they are expected to depend more on procedural memory for regular verb forms than late learners.

For late learners, linguistic forms computed by procedural memory in the L1 are expected to be dependent to a greater extent upon declarative memory in L2, which is sensitive to input frequency. RTs for high frequency regular and irregular verb forms should be significantly shorter than those for low frequency verb forms. However, the greater the amount of practice and
experience with the L2 (operationalized by their proficiency level in the L2), the smaller the
dissociation, as a result of a better learning of grammatical rules in procedural memory.

According to the Cognitive Approach and the DP model, the initial stages of SLA are
lexical in nature. It is therefore posited that the pressures for syntactization (or the restructuring
process by which lexical concepts acquire syntactic category and subcategorization features) and
the use of the procedural memory system will be delayed for late L2 learners. This will have
direct consequences on learners’ behavior when handling complex verb forms. Specifically,
more proficient adult late L2 learners will evidence fewer strategies of avoidance, lower
regularization rates, lower regularization rates, as well as fewer error types, a smaller error
frequency, and a greater regular/irregular dissociation than those with lower proficiency levels.

Since English/Spanish bilinguals will make a greater use of the procedural memory from
the very beginning, they should behave more like NSs when handling complex verb forms. They
will show a greater regular/irregular dissociation, less avoidance, fewer errors, and lower
regularization and irregularization rates than the entire group of late L2 learners.

3.3. Participants

3.3.1. Participant Selection

two key variables for the present study were age of initial exposure to Spanish (early vs.
late) and proficiency in Spanish as an L2 (beginning, intermediate, and advanced). All late
Spanish L2 learners reported that they started learning Spanish for the first time at age 14 or
later. On the other hand, most English/Spanish bilinguals started learning Spanish from birth.
The latest a bilingual started learning Spanish for the first time was at age five. Late learners
were recruited and assigned to one of three proficiency levels, based on the Spanish course in
which they were currently enrolled at the university. Their proficiency was then confirmed with
a proficiency exam. The proficiency exam is described further in section 3.4.7. The group of
English/Spanish bilinguals all had an advanced knowledge of Spanish, which allowed for their comparison with the advanced late learners with respect to the role of the age of initial exposure to the L2. By contrast, the different proficiency groups of late learners allowed for an analysis of developmental changes across proficiency levels.

3.3.2. Background Information

Background information for these groups of participants was obtained in a post-test FL background form (Appendix A) at the end of the first session of data collection. This short questionnaire is described in more detail in section 3.4.8.2. Additionally, participants’ age of initial exposure to Spanish and their ethnicity were collected during the first session of data collection.

Of the 15 participants in the beginning proficiency group, 13 were females and two were males. Their ages ranged from 18 to 23 with a mean age of 19.13 years. The L1 for 14 of these participants was English, and one participant had Haitian Creole as the L1. There were three African Americans in this group. All beginning participants started learning Spanish for the first time at about age 14 or later. There were seven freshmen, four sophomores, two juniors, and two seniors in this group. None of them had ever lived in a Spanish-speaking country and only one reported socializing regularly with friends or family members outside the class in Spanish. When asked about their use of English and Spanish in several contexts, all participants mentioned that at their current home they use only English. All but one participant use only English with family and at work (whenever applicable), with the exceptional student using mostly English. With friends, nine participants reported using only English and the remaining six reported using mostly English. Finally, 10 participants use mostly English at school and five of them only

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8 This gender distribution represents the typical one in the Spanish classrooms from which these groups of participants were recruited.
English. In sum, their use of Spanish outside the class was scant and limited to some friends or the school context, where they use mostly English. All participants were asked to rate their proficiency in Spanish on a variety of skills using a 7-point Likert scale on which a “1” represented “very poor” and a “7” represented “highly proficient” (see Appendix A). Most beginning participants rated their Spanish skills from “low” to “average,” as shown by the mean scores from their responses (arranged from highest to lowest): 4.27 for reading, 3.60 for writing and listening, 3.53 for vocabulary knowledge, 3.40 for grammar knowledge, and 3.07 for speaking.

Of the 15 participants in the intermediate group, there were 12 females and three males. The average age of the participants in this group was 19.6 years, ranging from 18 to 22. Except for one native speaker of Mandarin Chinese, the L1 for all participants in this group was English. There were four Asians and one Hispanic in this group and their age of initial exposure to Spanish ranged from 14 to 19. There were two freshmen, four sophomores, six juniors, and three seniors. Only two participants had lived in a Spanish-speaking country (see Appendix B for additional information about the participants’ past travel experiences) and four reported that they socialized regularly with friends or family members in Spanish. When asked about their use of English and Spanish, all participants reported using only English or mostly English with family, with friends, and in their current home; 14 of them said they use only or mostly English at school; and 11 did so at work. Spanish was used most of the time by only one participant at school, and by another participant at work. This group of participants rated most of their skills in Spanish “average,” with the exception being reading, which obtained a “good,” as calculated by the mean scores of their responses: 5.00 for reading, 4.87 for listening, 4.47 for writing, 4.40 for grammar knowledge, 4.13 for vocabulary knowledge, and 3.80 for speaking.
In the advanced proficiency group, there were 13 female and two male participants, with a mean age of 22.67 years, ranging from 21 to 40. All participants in the advanced group spoke English as their L1 and all of them were university seniors, with the exception of an assistant professor and a graduate student. There was one African American participant, as well as one participant of multicultural ethnicity. Their age of initial exposure to Spanish ranged from 14 to 20. Most of them (11 participants) had lived in a Spanish-speaking country (see Appendix B) but only five reported socializing regularly with friends or family members in Spanish. English was exclusively or most often used by most participants in all contexts: with family, at home, and at work by all participants, by 14 participants with friends, and by 13 of them at school. Spanish was used most of the time by only two participants at school, and by another participant with friends. The mean scores for the different skills indicated that most of them rated their Spanish skills from “average” to “good”: 5.80 for listening, 5.73 for reading, 5.07 for writing, 4.93 for vocabulary knowledge, 4.73 for speaking, and 4.60 for grammar knowledge.

In the bilingual group, there were 12 females and three males. Their ages ranged from 18 to 29 with a mean age of 20.60 years. About half of them considered Spanish their L1 and the remaining seven participants reported both English and Spanish as their L1s. All participants were of Hispanic origin and most of them learned Spanish from birth or prior to age five. There were two freshmen, two sophomores, four juniors, five seniors, and two graduate students in this group. All of them socialize regularly with friends or family members outside of class in Spanish but only nine had ever lived in a Spanish-speaking country (Appendix B). When asked about their use of English and Spanish in several contexts, most participants mentioned that they use English only or most of the time in four out of the five contexts: 14 of them with friends, 13 at school, 13 at work, and 11 at home. Only one used mostly English with family. Spanish was
used most of the time by 10 participants with family, by two participants at home and at school, and by one participant with friends. Four participants reported using only Spanish with their family and two participants at home. In sum, it was in the family context where these bilinguals used Spanish only or most of the time. Most bilingual participants rated their Spanish skills from “good” to “advanced,”: 6.40 for listening, 5.93 for reading and speaking, 5.73 for grammar knowledge, 5.60 for writing, and 5.53 for vocabulary knowledge.

3.3.3. Recruitment of Participants

Most L2 Spanish learners were enrolled in a Spanish course at the University of Florida at the time of data collection. In order to recruit them, different Spanish courses were contacted, depending on the proficiency level targeted. In some cases, the information about the study was sent to the instructor to read to the class and collect potential participants’ emails, but for the most part the researcher visited the course at the beginning of a class to introduce the topic of the investigation broadly. For the beginning learners, SPN2200 sections were visited, which is the first semester of second-year Spanish, during the first two weeks of the semester. Beginning learners were recruited at the start of their second-year Spanish to make sure they completed the second semester of first-year Spanish where the preterite tense is introduced. For the intermediate group, the researcher visited SPN3300 sections, a high intermediate Spanish course with emphasis on grammar and composition, required for those learners majoring/minoring in Spanish. For the advanced group, fourth-year courses were visited. The topic was introduced orally and the class was provided with the researcher’s contact information or asked to write their email on a sheet of paper for those who wanted to get additional information about the study. Participation was completely voluntary, although in some classes the instructor offered an additional reward for their participation, usually an extra point in the final grade.
Bilinguals were informed about the study through an advertisement posted in the independent student newspaper *The Alligator*, which is available for free on campus five days a week. Some advertisements were also placed on various campus sites. Once potential bilingual participants sent an email with their willingness to participate in the study, they were contacted back with further details about the study. Some people were disqualified before taking part in the study simply because they did not meet the minimum prerequisites, namely: (a) speaking both English and Spanish, as a native speaker, (b) being 18 years old or older, and (c) having learned Spanish and English from a very early age in the US or another country where Spanish is not the official means of communication.

### 3.4. Design and Materials

Regularity and verb form frequency are the most important linguistic variables in this study because one of the aims of this research is to find dissociations between different types of verb forms based on their morphological structure. Following the predictions of the dual-mechanism models, we need to find significant differences in the way learners represent and access complex verb forms in Spanish as an L2. As a consequence, the corpus of verbs used to address the research questions in this study included 20 regular, 20 irregular, and 20 vowel stem change Spanish verbs in the third-person singular preterite form, subdivided into 10 high and 10 low frequency items, for a total of 60. All 60 test items and 60 fillers were used for the two psycholinguistic experiments (Experiments 1 and 2) but only 24 test items were targeted on each of the elicited narratives (Tasks 1 and 2), as is described later. What follows is an explanation of the test items’ selection as well as information on the different materials used in the study.

#### 3.4.1. Verb Types

Spanish has a rich verbal morphology. Aguirre & Dressler (2006) outlined the schema of any Spanish verb form as follows:
[Root + Thematic Vowel] + Suffix1 (TAM) + Suffix2 (PN)

The first suffix is the tense, aspect, and mood marker. The second suffix is the agreement marker and it refers to person and number (PN). This suffix holds throughout the conjugation except for a few exceptional verbs.

In the present study, each verb form was analyzed independently rather than regarding all verb forms of a single verb as belonging to either one or the other verb type. In fact, if we look at the internal structure of individual verb forms, a verb can take regular suffixes as well as having irregular forms and even stem change ones. For example, the verb *servir* (‘to serve’) is regular in *servimos* (‘we serve’) [serv-i]-Ø-mos but undergoes a vowel stem change in *sirvió* (‘s/he served’) [sirv-i]-ó-Ø. *Poner* (‘to put’) is usually considered an irregular verb in Spanish, but the verb form *ponemos* (‘we put’) [pon-e]-Ø-mos does not exhibit any irregularity.

All test forms were in the 3rd person singular of the preterite tense. Instead of allowing participants to narrate in the past using the person and number of their choice for the test items, their available choices were constrained for several reasons. First, doing so helped in the comparison of participants’ responses but, more importantly, it forced them to use low frequency verb forms, which may have otherwise been completely absent from their production. The behavior they showed when encountering a low frequency test item is of great importance for this investigation because it can inform us about the mental mechanisms at work when coping with different types of verbs in the L2. Additionally, by selecting the 3rd person singular of the preterite the potential role of automaticity for the 1st person singular verb form was avoided, as being the first item when accessing the rules for the preterite paradigm, which they have been undoubtedly exposed to in their Spanish classes. Finally, this verb form only takes the TAM suffix because there is no overt PN suffix.
Three broad categories based on regularity were considered to address the research questions. First, a given verb form was considered regular if it added the regular TAM and PN suffixes\(^9\) to the root, while keeping unchanged the root of the infinitive form:

1. **Regular**: `preguntó` (‘s/he asked’) = `[pregunt-Ø]-ó-Ø`.

Second, irregular verb forms were those which replaced the whole verb stem of the infinitive, or at least its root. These are usually referred to as suppletive forms or strong preterites because, although some of their endings may still be recognized, the root of the infinitive form and the root in the preterite tense “are so different from each other that they cannot be derived by general rules at all” as Bauer (2003, p. 48) pointed out.

2. **Irregular**: In `tuvo` (‘s/he had’), the stem `[ten-e]-` was replaced by `[tuv-Ø]-`.

Finally, vowel stem change irregular verb forms were those which suffered a vowel change in the root while adding the regular TAM suffix. As mentioned before, this group of verbs is halfway between the purely irregular and the purely regular verb forms and different predictions can be proposed depending on whether the internal vowel change is thought of as another rule or as an irregular root.

3. **Stem change**: `sintió` (‘s/he felt’) instead of the predicted regular form `*[sent-i]-ó-Ø`.

### 3.4.2. Verb Frequencies

The 60 verb forms chosen as test items for this study were selected based on the averaged frequencies from three corpora: two online databases and a printed frequency dictionary. What follows is a brief description of each corpus including their total number of words and representativeness in modern Spanish, followed by the procedure used to collect and average the frequencies for every verb form, as well as some challenges faced during the process.

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\(^9\) For a detailed list of the regular suffixes, see Aguirre & Dressler (2006, p. 92-93).
One resource was the online corpus *Corpus de Referencia del Español Actual* (‘Reference Corpus of Modern Spanish’ or CREA), from the Royal Academy of the Spanish Language, which includes an impressive database of more than 150 million words from the 1970s to the current time. It can be accessed for free at the following web address: [http://corpus.rae.es/creanet.html](http://corpus.rae.es/creanet.html). The corpus had a total of 150,778,934 words when frequencies for potential test items were collected; 83,939,527 words (55.67%) were from Spain while 66,759,968 words (44.28%) were from Latin American countries; 79,558,459 of these words (52.67%) came from books, 68,387,717 words (45.37%) from printed media, and 2,832,758 words (1.88%) from other resources including oral data.

The second online corpus was *Corpus del Español* (‘Spanish Corpus’ or CDE) (2002-present), created by Mark Davies and funded by the National Endowment for the Humanities. It can be accessed for free at this web address: [www.corpusdelespanol.org](http://www.corpusdelespanol.org). Although the complete corpus includes 100 million words from texts from the 1200s to the 1900s, verb form counts for the present study were obtained from the 20-million-words portion of the corpus for the late 1900s. This portion of the corpus contained a total of 20,350,000 words in January 2008. Virtually all texts were from 1970-2000; a quarter of the words came from the academic register, another quarter from newspapers, another quarter from literature, and the final quarter of the words from oral texts. Approximately 43% of the texts came from Spain while the remaining 57% came from Latin American texts.

Finally, the third resource consulted was the dictionary *Frecuencias del Español* (‘Spanish frequencies’) published by Almela et al. (2005). This dictionary was based on the linguistic corpus CUMBRE, which contains more than 15,000 texts for a total of 20,662,306 words. Approximately 65% of the texts came from Spain while the other 35% came from Latin.
American texts. Two thirds of the texts are written (70% of the Spanish texts and 60% of the Latin American texts) and about one third of the texts are oral (30% and 40% of the texts for Spain and Latin America, respectively).

The procedure for obtaining the frequencies for each verb form was the following: Every specific verb form, such as *abrió* (‘s/he opened’), was searched in the three corpora during the month of January 2008. The number of tokens of every verb form in each corpus was recorded. These raw counts were then transformed into frequencies of occurrence per million words, in order to allow comparability among the different corpora, following this formula:

\[
\text{Frequency in Corpus } X = \left\{ \frac{\text{N tokens in Corpus } X \times 1,000,000}{\text{Total N words in Corpus } X} \right\}
\]

For example, this is how the frequency of the verb form *abrió* (‘s/he opened’) was obtained for the CREA corpus from the raw counts:

<table>
<thead>
<tr>
<th>Corpus and total N words</th>
<th>CREA 150,778,934</th>
<th>CDE (1900s) 20,350,000</th>
<th>CUMBRE 20,662,306</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info recorded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N cases</td>
<td>7,380</td>
<td>1,177</td>
<td>982</td>
</tr>
<tr>
<td>Freq./m.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{Frequency on CREA} = \frac{7,380 \times 1,000,000}{150,778,934} = 48.95
\]

Finally, the frequencies from the three corpora were averaged in order to obtain the frequency which, in this study, is used to determine whether a verb form can be considered as either of high or low frequency. Tables 3-1, 3-2, and 3-3 display the token counts, frequencies per million words from the three corpora, and averaged frequencies for the regular, irregular, and vowel stem change verbs.
Table 3-1. Token count, frequencies per million words from the three corpora, and averaged frequency for regular test items

| High frequency regular verb forms | CREA | | | CDE | | | CUMBRE | | | Averaged | 
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *Empezó* ('s/he started') | 11,129 | 73.81 | 2,020 | 99.26 | 1,893 | 91.62 |       | 88.23 |
| *Preguntó* ('s/he asked') | 12,799 | 84.89 | 1,578 | 77.54 | 1,897 | 91.81 |       | 84.75 |
| *Salió* ('s/he went out') | 11,651 | 77.27 | 1,661 | 81.62 | 1,616 | 78.21 |       | 79.03 |
| *Llevó* ('s/he carried') | 11,479 | 76.13 | 1,872 | 91.99 | 1,359 | 65.77 |       | 77.96 |
| *Miró* ('s/he looked') | 6,168 | 40.91 | 1,691 | 83.10 | 1,336 | 64.66 |       | 62.89 |
| *Tomó* ('s/he took') | 8,501 | 56.38 | 1,477 | 72.58 | 962 | 46.56 |       | 58.51 |
| *Llamó* ('s/he phoned') | 7,445 | 49.38 | 1,119 | 54.99 | 1,067 | 51.64 |       | 52.00 |
| *Entró* ('s/he entered') | 6,993 | 46.38 | 1,180 | 57.99 | 1,037 | 50.19 |       | 51.52 |
| *Abrió* ('s/he opened') | 7,380 | 48.95 | 1,177 | 57.84 | 982 | 47.53 |       | 51.44 |
| *Nació* ('s/he was born') | 5,871 | 38.94 | 1,125 | 55.28 | 1,014 | 49.07 |       | 47.76 |

| Low frequency regular verb forms | CREA | | | CDE | | | CUMBRE | | | Averaged | 
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *Viajó* ('s/he travelled') | 1,706 | 11.31 | 292 | 14.35 | 158 | 7.65 |       | 11.10 |
| *Pagó* ('s/he paid') | 1,810 | 12.00 | 161 | 7.91 | 144 | 6.97 |       | 8.96 |
| *Vendió* ('s/he sold') | 1,294 | 8.58 | 210 | 10.32 | 154 | 7.45 |       | 8.78 |
| *Esperó* ('s/he waited') | 1,114 | 7.39 | 222 | 10.91 | 161 | 7.79 |       | 8.70 |
| *Olvidó* ('s/he forgot') | 1,235 | 8.19 | 198 | 9.73 | 159 | 7.70 |       | 8.54 |
| *Regaló* ('s/he gave away') | 1,281 | 8.50 | 183 | 8.99 | 150 | 7.26 |       | 8.25 |
| *Inventó* ('s/he invented') | 1,021 | 6.77 | 185 | 9.09 | 143 | 6.92 |       | 7.59 |
| *Escapó* ('s/he escaped') | 1,117 | 7.41 | 165 | 8.11 | 147 | 7.11 |       | 7.54 |
| *Besó* ('s/he kissed') | 1,041 | 6.90 | 141 | 6.93 | 155 | 7.50 |       | 7.11 |
| *Cantó* ('s/he sang') | 729 | 4.83 | 128 | 6.29 | 146 | 7.07 |       | 6.06 |
### Table 3-2. Token count, frequencies per million words from the three corpora, and averaged frequency for irregular test items

<table>
<thead>
<tr>
<th>High frequency irregular verb forms</th>
<th>CREA</th>
<th>CDE</th>
<th>CUMBRE</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cases</strong></td>
<td><strong>Freq.</strong></td>
<td><strong>Cases</strong></td>
<td><strong>Freq.</strong></td>
<td><strong>Cases</strong></td>
</tr>
<tr>
<td><strong>Dijo</strong> ('s/he said')</td>
<td>106,172</td>
<td>704.16</td>
<td>14,308</td>
<td>703.10</td>
</tr>
<tr>
<td><strong>Hizo</strong> ('s/he did')</td>
<td>49,738</td>
<td>329.87</td>
<td>6,635</td>
<td>326.04</td>
</tr>
<tr>
<td><strong>Tuvo</strong> ('s/he had')</td>
<td>34,749</td>
<td>230.46</td>
<td>5,122</td>
<td>251.70</td>
</tr>
<tr>
<td><strong>Hubo</strong> ('there was')</td>
<td>18,493</td>
<td>122.65</td>
<td>2,949</td>
<td>144.91</td>
</tr>
<tr>
<td><strong>Pudo</strong> ('s/he could')</td>
<td>20,157</td>
<td>133.69</td>
<td>2,477</td>
<td>121.72</td>
</tr>
<tr>
<td><strong>Estuvo</strong> ('s/he was')</td>
<td>17,155</td>
<td>113.78</td>
<td>2,576</td>
<td>126.58</td>
</tr>
<tr>
<td><strong>Puso</strong> ('s/he put')</td>
<td>15,675</td>
<td>103.96</td>
<td>2,254</td>
<td>110.76</td>
</tr>
<tr>
<td><strong>Fue</strong> ('s/he went')</td>
<td>N/A</td>
<td>N/A</td>
<td>1,872</td>
<td>91.99</td>
</tr>
<tr>
<td><strong>Vino</strong> ('s/he came')</td>
<td>N/A</td>
<td>N/A</td>
<td>1,229</td>
<td>60.39</td>
</tr>
<tr>
<td><strong>Produjo</strong> ('s/he produced')</td>
<td>9,432</td>
<td>62.56</td>
<td>1,292</td>
<td>63.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low frequency irregular verb forms</th>
<th>CREA</th>
<th>CDE</th>
<th>CUMBRE</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cases</strong></td>
<td><strong>Freq.</strong></td>
<td><strong>Cases</strong></td>
<td><strong>Freq.</strong></td>
<td><strong>Cases</strong></td>
</tr>
<tr>
<td><strong>Trajo</strong> ('s/he brought')</td>
<td>2,855</td>
<td>18.94</td>
<td>507</td>
<td>24.91</td>
</tr>
<tr>
<td><strong>Introdujo</strong> ('s/he introduced')</td>
<td>1,653</td>
<td>10.96</td>
<td>448</td>
<td>22.01</td>
</tr>
<tr>
<td><strong>Condujo</strong> ('s/he drove')</td>
<td>1,733</td>
<td>11.49</td>
<td>273</td>
<td>13.42</td>
</tr>
<tr>
<td><strong>Redujo</strong> ('s/he reduced')</td>
<td>1,419</td>
<td>9.41</td>
<td>224</td>
<td>11.01</td>
</tr>
<tr>
<td><strong>Atrajo</strong> ('s/he attracted')</td>
<td>594</td>
<td>3.94</td>
<td>129</td>
<td>6.34</td>
</tr>
<tr>
<td><strong>Anduvo</strong> ('s/he walked')</td>
<td>773</td>
<td>5.13</td>
<td>88</td>
<td>4.32</td>
</tr>
<tr>
<td><strong>Tradujo</strong> ('s/he translated')</td>
<td>614</td>
<td>4.07</td>
<td>101</td>
<td>4.96</td>
</tr>
<tr>
<td><strong>Extrajo</strong> ('s/he extracted')</td>
<td>549</td>
<td>3.64</td>
<td>83</td>
<td>4.08</td>
</tr>
<tr>
<td><strong>Contrajo</strong> ('s/he contracted')</td>
<td>419</td>
<td>2.78</td>
<td>95</td>
<td>4.67</td>
</tr>
<tr>
<td><strong>Cupo</strong> ('s/he fit')</td>
<td>N/A</td>
<td>N/A</td>
<td>44</td>
<td>2.16</td>
</tr>
</tbody>
</table>
### Table 3-3. Token count, frequencies per million words from the three corpora, and averaged frequency for vowel stem change test items

<table>
<thead>
<tr>
<th>High frequency stem change forms</th>
<th>CREA</th>
<th>CDE</th>
<th>CUMBRE</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conviértio</strong> ('s/he converted')</td>
<td>6,224</td>
<td>41.28</td>
<td>2,136</td>
<td>104.96</td>
</tr>
<tr>
<td><strong>Murió</strong> ('s/he died')</td>
<td>8,084</td>
<td>53.61</td>
<td>1,404</td>
<td>68.99</td>
</tr>
<tr>
<td><strong>Pidió</strong> ('s/he asked')</td>
<td>10,404</td>
<td>69.00</td>
<td>1,142</td>
<td>56.12</td>
</tr>
<tr>
<td><strong>Siguíó</strong> ('s/he continued')</td>
<td>7,934</td>
<td>52.62</td>
<td>1,228</td>
<td>60.34</td>
</tr>
<tr>
<td><strong>Sintió</strong> ('s/he felt')</td>
<td>6,222</td>
<td>41.27</td>
<td>1,284</td>
<td>63.10</td>
</tr>
<tr>
<td><strong>Consiguió</strong> ('s/he obtained')</td>
<td>6,003</td>
<td>39.81</td>
<td>1,087</td>
<td>53.42</td>
</tr>
<tr>
<td><strong>Advirtió</strong> ('s/he warned')</td>
<td>4,867</td>
<td>32.28</td>
<td>485</td>
<td>23.83</td>
</tr>
<tr>
<td><strong>Sirvió</strong> ('s/he served')</td>
<td>3,762</td>
<td>24.95</td>
<td>493</td>
<td>24.23</td>
</tr>
<tr>
<td><strong>Sonrió</strong> ('s/he smiled')</td>
<td>2,531</td>
<td>16.79</td>
<td>379</td>
<td>18.62</td>
</tr>
<tr>
<td><strong>Repitió</strong> ('s/he repeated')</td>
<td>2,432</td>
<td>16.13</td>
<td>261</td>
<td>12.83</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low frequency stem change forms</th>
<th>CREA</th>
<th>CDE</th>
<th>CUMBRE</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Se despidió</strong> ('s/he said bye')</td>
<td>796</td>
<td>5.28</td>
<td>103</td>
<td>5.06</td>
</tr>
<tr>
<td><strong>Durmió</strong> ('s/he slept')</td>
<td>630</td>
<td>4.18</td>
<td>108</td>
<td>5.31</td>
</tr>
<tr>
<td><strong>Se rió</strong> ('s/he laughed')</td>
<td>566</td>
<td>3.75</td>
<td>109</td>
<td>5.36</td>
</tr>
<tr>
<td><strong>Hirió</strong> ('s/he hurt')</td>
<td>406</td>
<td>2.69</td>
<td>32</td>
<td>1.57</td>
</tr>
<tr>
<td><strong>Mintió</strong> ('s/he lied')</td>
<td>331</td>
<td>2.20</td>
<td>62</td>
<td>3.05</td>
</tr>
<tr>
<td><strong>Se vistió</strong> ('s/he dressed')</td>
<td>271</td>
<td>1.80</td>
<td>51</td>
<td>2.51</td>
</tr>
<tr>
<td><strong>Corrigió</strong> ('s/he corrected')</td>
<td>327</td>
<td>2.17</td>
<td>38</td>
<td>1.87</td>
</tr>
<tr>
<td><strong>Midió</strong> ('s/he measured')</td>
<td>197</td>
<td>1.31</td>
<td>35</td>
<td>1.72</td>
</tr>
<tr>
<td><strong>Se divirtió</strong> ('s/he enjoyed')</td>
<td>66</td>
<td>0.44</td>
<td>9</td>
<td>0.44</td>
</tr>
<tr>
<td><strong>Virtió</strong> ('s/he poured')</td>
<td>10</td>
<td>0.07</td>
<td>4</td>
<td>0.20</td>
</tr>
</tbody>
</table>
While gathering the information on the frequencies for the test items, there were some challenges which could only be addressed by the *Corpus del Español* because this corpus is lemmatized and also tagged for part of speech. The lemmatization feature was helpful in distinguishing those cases where a verb form shared its spelling with another verb form with a different meaning, as in *fue* (‘s/he went’ or ‘s/he was’) which can be the preterite form for the verb *ser* (‘to be’) or for the verb *ir* (‘to go’). The part of speech feature was useful to distinguish cases where a token could either be a verb form or a noun, as in the case of *vino* (‘s/he came’ or ‘wine’) and *cupo* (‘s/he fit in a place’ or ‘occupancy’). Distinctive token counts taking lemmas or parts of speech into account could not be retrieved from either CREA or CUMBRE. The primary difficulty with CUMBRE was that some verb forms were so infrequent that they were not even part of the 10,000 most frequent words and there was no way to find out their exact number of cases, except for the fact that they would appear less than 142 times. For those cases, the generic frequency (< 6.87), the frequency for the 10,000th most frequent word in this corpus, was indicated on Tables 3-1 to 3-3, but was not considered towards the averaged frequency for this study. For these verbs, only data from CREA and CDE were averaged.

### 3.4.3. Fillers and their Frequencies

In addition to the 60 test items, the study included the same number of fillers or distractors. They belonged to a different grammatical category, to be precise, nouns, and the inflectional suffixes they took were those for plural formation. Half of the fillers were masculine nouns and the other half were feminine nouns, of high and low frequency. The procedure and the databases used to obtain their frequencies were the same as those used for the 60 stimulus verb forms. The frequencies in the three corpora and the averaged frequency for the high and low frequency fillers for masculine and feminine fillers can be found in Appendix C.
3.4.4. Audio Recordings

The 60 stimulus verb forms in the preterite tense and the 60 singular noun fillers were digitally recorded by a native speaker of Spanish for use in the design of Experiment 2. The researcher wrote a set of instructions for the native speaker to: (1) read loud, clear and at a normal speed; (2) leave a small pause between words; (3) not to emphasize any syllable of any word in an unnatural way as well as to keep the same intonation throughout the whole recording; and (4) read the whole list of 120 items from start to finish.

The audio recording took place in Spain and the native speaker of Spanish was a young female. She followed the instructions closely and the digital recording with the 120 test items was 3:58 minutes long. Ten additional items were recorded on a different audio file and at a later time for the practice session (last column on Table 3-4). These two audio files were edited using the computer program Audacity; each individual word was cut and saved as a different audio file. That way the audio recordings for each single item could be used in the design of Experiment 2.

In order to assess the overall quality of the audio recordings, two native speakers of Spanish volunteered to listen to them under experimental conditions. They visited the Language and Cognition Lab at the University of Florida. Each native speaker listened to different sets of verb stimuli presented over the headphones. They were instructed to listen to the individual words and write them down on a piece of paper. There was 100% accuracy on their responses and they did not provide any additional comments as to the quality of the audio. The audio recordings were deemed appropriate to be included in the design of the second psycholinguistic experiment, to which we turn now.
3.4.5. Design of the Psycholinguistic Experiments

Before designing the experiments, the test items as well as the fillers were randomized for each experiment separately. The automated formula “=rand()” was used in Microsoft Excel software and the first randomized order of items which fulfilled the following criterion was kept: there could not be more than three items of the same type together, i.e., there could not be four low frequency regular verbs one after the other. This pseudo-randomization technique using the same list of randomized items for all participants provided me with better comparability of results.

The psycholinguistic experiments were designed using PsyScope X\(^{10}\). Dr. Wind Cowles helped me to write the scripts, i.e., once she was provided with the randomized list of items for each experiment and the individual audio files, she wrote the scripts of the experiments in PsyScope X based on the needs for the present study.

For Experiment 1, participants saw either Spanish verbs in their infinitive form or nouns in the center of a computer screen, which remained there indefinitely. Words were color-coded: verbs were displayed in a blue font and nouns in a black font, both in a big font size. Participants were instructed to provide the 3\(^{rd}\) person singular preterite form of verbs or the gender of nouns orally as fast as possible. The list of practice items were included first (second column in Table 3–4), followed by a screen to allow participants to ask questions before starting the experiment, and then the pseudorandomized list of test items and fillers. Instructions were not presented over the computer screen. Instead, they were written on a printed laminated page for the participants (Appendix D), which gave the researcher time to set up the experiment while participants read

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\(^{10}\) PsyScope X is a program used to design and conduct psychological experiments that runs on Apple Macintosh computers. It was developed at Carnegie Mellon University by Jonathan Cohen, Matthew Flatt, Brian MacWhinney, and Jefferson Provost for Mac OS 9 in the 1990s. PsyScope X is a recent universal version which runs on Intel processors.
them. The pseudo-randomization of test items and fillers appears in the protocol checklist (Appendix E).

Table 3-4. Practice items for the psycholinguistic experiments

<table>
<thead>
<tr>
<th>Items on instructions for Experiment 1</th>
<th>Practice items for Experiment 1</th>
<th>Items on instructions for Experiment 2</th>
<th>Practice items for Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beber (‘to drink’)</td>
<td>Comer (‘to eat’)</td>
<td>Comprar (‘to buy’)</td>
<td>Hablar (‘to speak’)</td>
</tr>
<tr>
<td>Flor (‘flower’)</td>
<td>Cocinar (‘to cook’)</td>
<td>Escuchar (‘to listen’)</td>
<td>Estudiar (‘to study’)</td>
</tr>
<tr>
<td></td>
<td>Querer (‘to like’)</td>
<td>Saber (‘to know’)</td>
<td>Elegir (‘to choose’)</td>
</tr>
<tr>
<td></td>
<td>Caer (‘to fall’)</td>
<td>Ver (‘to see’)</td>
<td>Sugerir (‘to suggest’)</td>
</tr>
<tr>
<td></td>
<td>Impedir (‘to impede’)</td>
<td>Computadora (‘computer’)</td>
<td>Acción (‘action’)</td>
</tr>
<tr>
<td></td>
<td>Invertir (‘to invest’)</td>
<td>Cuaderno (‘notebook’)</td>
<td>Zapato (‘shoe’)</td>
</tr>
<tr>
<td></td>
<td>Mesa (‘table’)</td>
<td></td>
<td>Pan (‘bread’)</td>
</tr>
<tr>
<td></td>
<td>Canción (‘song’)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carro (‘car’)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profesor (‘teacher’)</td>
<td></td>
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</tr>
</tbody>
</table>

Experiment 1 was designed so that test items would disappear from the computer screen at the precise moment the microphone detected any sound. Then, PsyScope X waited for 1,500 milliseconds (ms.) before displaying a green circle at the center of the screen, representing the button-box participants had to press to move on to the next item. It was a self-paced experiment and participants had the control to decide when to move on to the next item. This action was assigned to the green button at the center of the button-box. PsyScope X was set up to record the RT or elapsed time from the precise moment each item appeared on the computer screen until the beginning of the participant’s response, i.e., the software detecting any oral waveform. PsyScope X was used simultaneously with the recording feature of Audacity to collect not only their RTs but also their oral responses for later analyses of the accuracy of the response and the types of errors made. As for the noun distractors, they appeared in the singular and participants had to say into the microphone their gender, whether by saying “masculine” or “feminine,” or by using only the definite article which would precede them, i.e., “el” vs. “la.”
For Experiment 2, participants listened to either a Spanish verb in the preterite form or a Spanish singular noun over the headphones while the computer screen displayed a red cross at the center of the screen to direct participants’ attention there. Then, either the corresponding verb in the infinitive form or the plural noun was displayed on the screen and remained there indefinitely. Participants were instructed to listen closely to the words and then read the written words and to decide as fast as possible if the two words had the same stem or a different stem. Their responses were identified by pressing one of two buttons at each extreme of the button-box: the red button for the “different stem” option and the purple button for the “same stem” option. The list of practice items were included first (last column in Table 3-4), followed by a screen to allow participants to ask questions before starting the experiment, and then the pseudorandomized list of test items and fillers. Instructions were also written on a printed laminated page for the participants (Appendix D). Experiment 2 was designed so that the written words would disappear from the computer screen at the precise moment the participant pressed one of the two buttons mentioned. Then, PsyScope X waited for 1,500 ms. before displaying a text that said “Ready?” at the center of the screen, representing the moment at which participants decided when to move to the next item by pressing any button from the button-box. PsyScope X was set up to record the RT or elapsed time from the precise moment the written words appeared on the screen until the participants pressed one of the two buttons. No other type of data was collected during this experiment.

3.4.6. Design of the Elicited Narratives

In addition to the psycholinguistic experiments just described, the study also incorporated two elicited narratives (Tasks 1 and 2). Both required the use of a visual prompt to elicit participants’ responses on the different types of Spanish preterite verb forms presented in a picture-story sequence. Due to the limited space of a page, each picture-story sequence contained
24 drawings (about six per row, four rows per page) for a total of 48 picture stimuli, out of the 60 test items. Each sequence elicited an even number of verb types, i.e., eight regular, eight irregular and eight vowel stem change verbs, of high and low frequency.

For each visual prompt, first the actions were drawn on a white page by hand before scanning them. Then they were edited, colored, and shaded using the Adobe Photoshop CS computer software. Finally, the 24 drawings were arranged on a page trying to display a logical sequence of events, with the help of some brief text dialogues in Spanish. For the first elicited narrative, participants were told to use the verbs provided on the page (see Appendix F). Therefore, below each drawing participants had the verb for that action in its infinitive form. For the second elicited narrative, participants were free to use the Spanish verb of their choice for the actions depicted (see Appendix G). The hope, however, was that they would use the verbs targeted in the study and depicted in the drawings. For each elicited narrative the participant was asked to select among four choices. The task of the researcher during the data collection was to pretend to guess which picture-story sequence the participant selected once s/he finished the narrative.

A pilot test for the second picture-story sequence, the one without the verbs written on the page, was conducted to evaluate the clarity of the drawings and to check if they elicited the intended verb forms. Four college students of Spanish at the intermediate level who were not participants in the study were instructed to write a preterite verb form for each drawing. At least one student used the verb form being elicited for every drawing except one, which showed a plane with one engine on fire. None of the students used the target verb form tuvo (‘had’) in the expression tuvo un accidente (‘had an accident’). Instead, they tried to use an equivalent Spanish verb for the English verb to crash. As suggested by these students, when asked about the
difficulty of that item, that drawing was changed for a different one showing a woman having an
accident with her car.

3.4.7. Proficiency Exams

Besides carefully selecting late learners from specific Spanish courses at the University of Florida, it was necessary to confirm that they had been assigned to the appropriate proficiency level. It is not surprising to find advanced learners with less-advanced knowledge and skills than expected at their proficiency level or beginning learners who could easily be taking an intermediate level course instead. Therefore, a proficiency exam was included in this study to ensure that all participants were assigned to the proper group.

After considering the different tests available, a Spanish exam created by native speakers of Spanish in a country where Spanish is the official language was selected. The same exam for all learners was not selected; instead, an exam which was nuanced to the specific skills and abilities of different groups of participants was preferred. A variety of skills through an objective scoring system was also preferred rather than conducting an oral proficiency interview to be rated by others. Finally, the exam had to be easy to conduct in any location and it also had to be easy to grade. The exams used to obtain the different Diplomas de Español como Lengua Extranjera (DELE) from the Instituto Cervantes were the ones selected for this study. These exams are conducted on a regular basis in more than 100 countries to measure the Spanish knowledge of international students and they are accredited by the Ministry of Education, Social Politics, and Sports of Spain.

The DELE exams from the examination session of the month of November 2007 were used, which are available online for free. All sections from the beginning, intermediate, and advanced exams were used except for the writing and oral tasks. The DELE score used for this study was the aggregate from the scores on the grammar, vocabulary, listening, and reading
sections. Every exam was edited in Microsoft Word so that it fit on fewer pages than the
originals, but they included all relevant sections, including instructions and pictures. The audio
clips were edited to delete long empty spaces in the original waveform. The exams were
conducted following the guidelines from the exam creators very closely, except for providing
long pauses between the different sections. All sections are multiple-choice activities, which
facilitated grading. (For further information about the specific types of activities, the format of
the readings, or the characteristics of the audio recordings, see sample activities in Appendix H
or the whole exam at: http://diplomas.cervantes.es/index.jsp. At this web address, there is also
access to the complete exams and guidelines on how to deliver them.) The DELE proficiency
exam results corresponded well with the proficiency groups of the present investigation, namely:
beginning, intermediate, and advanced. As a consequence, no adjustments in placement were
made based on these findings, and no participants were eliminated from the study.

3.4.8. Other Materials

Besides the materials described in the previous sections, the present study also involved
the creation of additional materials, whether to fulfill ethics requirements or to ensure
comparability among participants’ responses during data collection. This section briefly
describes the following additional materials: the informed consent form, the FL background
form, the instructions for the participants, tags for the color-coded button box, and the protocol
checklist.

3.4.8.1. The informed consent form

This document is required before conducting research with human participants at the
University of Florida. It guarantees participants that their identity will be kept safe, informs them
of their rights, and ensures them of their right to withdraw from the study at any moment. As
shown in Appendix I, the informed consent form included the following sections: title of the
project, purpose of the study, the research methodology, the time required, the anticipated risks, the potential benefits and compensation for taking part in the study, a statement on confidentiality of the data collected, contact information for the principal investigator, the supervisor, and the institutional review office, and statements about the rights of the participants. Participants received a printed copy of the document during the first session of data collection, before taking part in the study.

3.4.8.2. Foreign language background form

The foreign language background form (see Appendix A) was used at the end of the first data collection session. It was used to collect a wide array of personal information from the participants, such as their age, their self-rated proficiency on different skills in the L2, their study abroad experiences (see Appendix B), and the like. It was also used to check if they were familiar with the 60 test items in the study through a translation activity.

3.4.8.3. Instructions for experiments

As mentioned in section 3.4.5., the instructions for the psycholinguistic experiments were not included in the design of the experiments in PsyScope X. Instead, they were written in English and printed on a laminated page for the participants to read (see Appendix D). These pages gave the researcher time to set up the experiments, save previous data when necessary, check the protocol checklist as well as the volume level and the microphone’s sensitivity. All participants received the same instructions and they could read them as many times as they wanted, which could have been difficult to implement if delivered through a series of computer screens.

3.4.8.4. Tags for the button box

For Experiment 1, participants decided when to move to the next item by pressing the green button on the button box (see Figure 3-1).
A laminated tag containing the word “next” was placed on top of the green button during the data collection. In Experiment 2, participants had to press either the red or the purple button located at each side of the button-box. The following tags were placed over the corresponding buttons to make very clear the choice they were selecting:

![Tags: SAME stem and DIFFERENT stem]

**3.4.8.5. Protocol checklist**

The procedure for the first session of data collection was pilot-tested before officially starting with the data collection. A Spanish student was asked to visit the Language and Cognition Lab and complete all tasks. The procedure outlined in section 3.5. was followed, and some changes were made to the protocol, most notably the inclusion of a protocol checklist, in order to avoid some mistakes in the future.

During the pilot test session it became evident that it was very easy to forget any given step because the study involved several tasks and different methods of data collection. For
example, I completely forgot to open Audacity and record the participant’s voice during
Experiment 1 because I was paying more attention to setting up the experiment and making sure
that the microphone was placed correctly. At a different moment, her cell phone rang during the
data collection. This was considered something that may interrupt the data collection, even if
experiments are self-paced and participants had the choice of deciding when to move to the
following item.

Therefore, the protocol checklist form was created (see Appendix E) with several
objectives in mind: (1) to prevent forgetting a necessary step in the data collection, (2) to remind
participants about turning off their phones and making sure that the microphone is placed
correctly over their mouths, (3) to have a form on which to mark items during Experiment 1 that
would need a RT adjustment due to potential false starts, hesitations, coughs, or the like, and (4)
to have a place to write participants’ responses during Tasks 1 and 2 to pretend that I was really
trying to guess the picture-story sequence they selected. In the end, this form facilitated the data
collection and there were virtually no events which disrupted the data collection for the 60
participants included in the study.

3.5. Data Collection

Data were collected on two different occasions for each participant. The first data
collection session was conducted in the Language and Cognition Lab at the University of
Florida, while the second session took place in a seminar room on campus. Data collection
started on the 29th of May, 2008 and was completed on the 21st of October, 2008. This section
describes the procedure followed during each data collection session, outlined in Figure 3-2.

3.5.1. First Session: Main Data and Background Information

The first data collection session lasted for about an hour on average and was conducted
on an individual basis. My main objective was to collect data on participants’ behavior in
relation to Spanish inflectional morphology through a series of controlled tasks under laboratory conditions. The researcher was present at all times and the procedure for each data collection session was as follows.

**PROCEDURE**

(A) First Session (one-on-one, about 1 hour total):
1. Sign-in page
2. Informed consent form
3. The two Psycholinguistic experiments (one of two orders)

![Diagram of experimental procedures]

- Experiment 1: Oral elicitation task
- Experiment 2: Oral and visual lexical decision task

4. Elicited narrative 1 (drawings with written test items)
5. Elicited narrative 2 (only drawings)
6. Foreign language background form
7. $10 compensation in cash

(B) Second Session (mostly in small groups, from less than 1 hour to 2 hours):
1. Proficiency exam
2. $10 compensation in cash

Figure 3-2. Outline of the two data collection sessions

Once the participant arrived at the Language and Cognition Lab at the time and date previously arranged by email, s/he signed her/his name on a sign-in page. Then participants received two copies of the informed consent form that assured their confidentiality. They signed one copy for me and received the other for their own files. Most participants had already received a digital copy of this document via an email attachment before deciding whether to participate in the study or not; as a result, most of them were familiar with the information contained in this document. Their names were not used in any part of the study; instead, they were assigned a number which was used for all data files and data recordings. These files were
always stored on password-protected computers. Before signing the informed consent form and starting the tasks, they had the opportunity to ask questions.

While the participant was reading the informed consent form, the researcher completed an experiment log sheet for the lab and decided on the order of presentation of the psycholinguistic experiments. The two experiments had the same stimuli and fillers but the role of potential priming effects was minimized by reversing the order of their presentation to the participants within the proficiency groups. Priming effects occur when there is an increase in retrieval speed and accuracy due to prior exposure. Seven participants per proficiency group completed Experiment 1 before moving on to the second one, and eight participants per proficiency group completed these experiments in the reverse order.¹¹

In order to provide the greatest consistency among the participants, the protocol checklist was closely followed (Appendix E) during each individual session of data collection. The same eMac personal computer was used to collect the data from all participants. It was located in one of three areas in the Language and Cognition Lab, a small sound-proof room in which participants were seated at a comfortable distance from the computer screen. For Experiments 1 and 2, participants had to wear a headset with microphones and use a color-coded button box from ioLab Systems (see Figure 3-3).

Prior to data being collected, participants were instructed to turn off their cellular phones to prevent possible interference with the voice detection system. They were informed that the session would consist of two experiments with the computer, the headset with microphones, and the button-box, as well as two picture-story descriptions in Spanish. Then the following

¹¹ Some priming effects were found in Experiment 1: faster RTs to high frequency irregulars and higher accuracy scores to irregular and stem change verb forms of high and low frequency in the intermediate group as well as faster RTs to regular and irregular verbs of low frequency in the advanced group. However, the frequency effect results without those participants in the condition Experiment 2 before Experiment 1 were no different than with the entire sample. Therefore, the results of the entire sample are included in the results and discussion chapters.
introductory text was read to them before making sure that the microphone was at an adequate distance from their mouths:

“Today you will be asked to complete two activities on this computer. But, first of all, relax and sit at a comfortable distance from the computer screen. You need to wear a set of headphones with a microphone attached to it. Make sure that it is placed correctly over your head and that the microphone is in front of your mouth.”

Then the data collection started for either Experiment 1 or Experiment 2, as predetermined.

Figure 3-3. Language and Cognition Lab at the University of Florida
3.5.1.1. Experiment 1

Irrespective of the order of presentation of the two psycholinguistic tasks, the procedure for Experiment 1 was as follows. Each participant received a single laminated page (see Appendix D) with written instructions for this task. These were written in English and the main steps were highlighted. Participants had ample time to read the instructions while the experiment was set up. Participants had time to ask questions before starting the experiment. After making sure that they were wearing the headphones with the microphone placed correctly over their mouths, the “Start Recording” button was pressed in Audacity and the program was minimized. Then the button “Run” was pressed in Psycscope X and the participant’s code number was typed in the participant number window, as shown in Figure 3-4.

Figure 3-4. Screenshot of PsyScope X initial windows
The experiment started with a set of 10 practice items (second column in Table 3-4). At the end of the set, participants had time to ask questions. When deemed necessary, participants were instructed to speak louder into the microphone for the rest of the experiment. And for nouns only, they were told they could simply say el or la (‘the,’ masculine and feminine, respectively) because it is a shorter word than “masculine” or “feminine,” which conveys the same information. Then they started the experiment.

For each of the 120 experiment items, PsyScope X recorded the time from the onset of the written stimulus onscreen to the onset of participant’s oral response. However, the program took into account any waveform via the voice detection software, whether it was a cough or the participant’s final response. In order to correct these artifacts or inaccurate calculations, for each test item the researcher observed very closely whether or not the written stimulus disappeared from the screen at the precise moment the participant produced her/his oral response. That information was written on the protocol checklist (Appendix E) as either correct (✓) or incorrect (✗). Test items were highlighted on the protocol checklist, while this information was not recorded for the filler items. In the data coding stage of this study, the protocol checklist was used to correct the RTs computed by PsyScope X for the false starts, i.e., the items for which participants provided multiple answers, those cases of verb forms produced with long initial syllables while buying extra processing time or similar behavior that could bias the results.

Once the participant provided an answer for the last experiment item, PsyScope X was closed. Then the voice recording was stopped, the project was saved with the file name “XXaudiolab” and as an .aiff audio file. Finally, Audacity was closed before moving on to the next task.
3.5.1.2. Experiment 2

Again, irrespective of the order of presentation of the two psycholinguistic tasks, the procedure for Experiment 2 was as follows. Each participant received a single laminated page (see Appendix D) with written instructions for this task. These were written in English and the main steps were highlighted. Participants had ample time to read the instructions while the experiment was set up. Participants had time to ask questions before starting the experiment. They were also informed that in the instructions there was a mistake and that the tags were placed correctly on the button-box (see Figure 3-5), which was the reverse assignment from the instructions. After making sure that they were wearing the headphones, the button “Run” was pressed in Psyscope X and the participant’s code number was typed in the participant number window.

![Figure 3-5. “Same Stem” and “Different Stem” tags on top of the purple and red buttons, respectively, in the ioLab Systems button box](image)

The experiment started with a set of 10 practice items, after which participants had time to ask questions. They were asked if the volume level was appropriate and adjusted it for the rest of the experiment when necessary. They were also instructed to inform me about any errors that
they were conscious of during the experiment. Finally, it was recommended that they place both hands on the button-box close to each button for faster responses. Then they started the experiment.

Participants completed this task at their own pace. On the protocol checklist, any conscious error they informed me of during the task was noted. Once they pressed a button for the last experiment item, PsyScope X was closed.

3.5.1.3. Task 1

For each elicited narrative, four laminated color copies of the corresponding picture-story sequence were made. The participants were asked to pick one as if there were different picture-story sequences. This deception technique was employed to ensure communicative relevance for the task, i.e., to promote the need to provide a complete description of all the actions depicted in the drawings, as well as to allow comparability among all participants. The following introductory text was read to them from the protocol checklist:

“Please, pick one of these pages but do not show it to me. It will contain a picture-story sequence of a character that you need to narrate to me. Please, tell me in Spanish what this person did in the past. You have to use the verbs provided for each drawing in the preterite tense. My task will be to guess which picture story you have just selected once your narration is complete. You need to provide as much information as possible because all the picture-story sequences are very similar and they only differ in a couple of drawings. Do not disclose the name of the character to me, which is at the right bottom of the page, until your narration is complete. Instead, refer to the character as ÉL or ELLA.”

The participant had time to ask questions while Audacity was being set up. Once it was checked that they were wearing the headphones with the microphone placed correctly over their mouths, the “Start Recording” button in Audacity was pressed and the program was minimized for the remainder of the data collection, including the second elicited narrative (Task 2).

Since the researcher already knew the verbs the participants were required to use, the verb forms the participants produced for each test item were written in the protocol checklist. A
table was created with big cells, each containing the Spanish verb participants had to use (see Appendix E). Their responses were written on this chart while the participants were talking to the researcher, as if the researcher were truly trying his best to guess the character’s name. Their talking was not interrupted if they skipped any given item but it was interrupted if they started to use a different tense than the preterite for several consecutive items. At the end of the narration the researcher pretended to guess the character’s name. The voice recording on Audacity was not stopped. Instead, the researcher moved on to the second elicited narrative without a break.

3.5.1.4. Task 2

Again, for the second narrative the participants were asked to pick one of the four picture-story sequences provided. Even though another introductory text was created to read to them, participants were usually told that the instructions remained the same as in the previous task except that they could use the verb of their choice that best described the action depicted in each drawing. This time, the verbs they chose for each drawing were also written down by the researcher. Once the participant finished her/his oral narration, they were asked if the name of the character was Luisa and after they confirmed that, the voice recording was stopped, the project was saved with the file name “XXaudiodescr” as an .aiff audio file. Then Audacity was closed.

Once the second elicited narrative was completed, participants were asked to fill out a foreign language background form (Appendix A). While they were completing this questionnaire, a receipt was written out in the participant’s name and the $10 bill was prepared. This time was also used to get a copy of the data files just collected (two audio files and two Excel files) and to write a brief entry about the participant in an Excel file at the lab’s main PC.

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12 These corrections were made in English and participants were not asked to go back and redo the previous test items. They simply were asked to go on from that point in the preterite.
This file was used to record the participants’ ID and to report any problem observed during the data collection overall. When the student gave me the form, they were handed the cash reward and thanked for participating in my study and completing the first session of data collection successfully.

As mentioned in section 3.4.6., the hope with Task 2 was that participants would use the verbs targeted in the second picture-story sequence. However, that was not always the case, which hindered the comparison of results among participants and groups. Of the 1,909 tokens coded for this task, only 1,348 tokens (or 70.61%) were verb forms used for the drawings of the second picture-story sequence; the remaining tokens were new verbs added to make a more descriptive narrative. And from those 1,348 tokens, only 763 tokens (56.60%, or 39.97% of the total) were verb forms with the elicited verbs under investigation. Therefore, less than half of the data coded were the verb forms being elicited. There were many cases in which a given participant provided two or more options for the same test item. For example, participant 5 used *se puso enfermo* (‘she got sick’) and *tuvo fiebre* (‘she had temperature’) for drawing 17 (see Appendix G) instead of the elicited verb form *estuvo enferma* (‘she was sick’). Her/his responses are correct but they are not the ones I was looking for. Furthermore, claims cannot be made that s/he was trying to avoid the targeted verb form by using her/his choices because her/his responses and the elicited verb forms are all irregular verb forms of high frequency. As a consequence, when a participant failed to use an elicited verb in this task, one cannot claim that the participant did it as a strategy of avoidance for that given test item. It is exactly the nature of this task that made it difficult to compare it to the other three. By itself, Task 2 is a very informative task on verbal morphology production by L2 learners, but it allowed too much freedom to the participants, which arguably, impeded the comparison of results with the other
data collection tasks in this study. Consequently, it was decided not to include the results from this task in the rest of the study in order to allow a more consistent comparison of results and triangulation of data from Experiments 1 and 2 as well as Task 1.

3.5.2. Second Session: Proficiency Exams

The main goal for the second session was to have an objective score on participants’ competence in Spanish as an L2, separate from the proficiency group they were assigned to based on the Spanish course they were currently taking at the university. For this session, participants were generally assigned to groups in order to be as expedient as possible. Some students were met individually; the biggest the group surveyed was with eight participants simultaneously. The time participants needed to complete the proficiency exam depended on the proficiency exam in question. At the beginning level, participants usually completed the exam in less than an hour to an hour and 15 minutes. Intermediate participants completed their exam in 60-90 minutes. Participants who took the advanced exam needed more than an hour and a half but generally less than two hours. Two participants in the advanced group requested additional time for the completion of the exam. One of them had to return on a later day to complete the readings because she did not have enough time during the two-hour window of data collection. The other advanced participant was allowed to take the last pages of her exam home and complete the reading activities without the help of any external resource. She promised she did it as requested and provided her last responses a couple of days later.

For each participant, once s/he arrived at the office at the time and date previously arranged by email, s/he started the corresponding proficiency exam. Her/his ID was written at the top of the first page. Participants usually started with the grammar and vocabulary sections. After the first 15 minutes, and when most participants for that day had already arrived, they were asked if they wanted to complete the listening activities before continuing with the exam and then the
audio files were played using a portable CD player at a comfortable volume. They then completed the rest of the exam. Once each participant finished all the activities, s/he handed me the exam and received $10 in compensation. Before leaving the office, they were thanked for participating in the study.

3.6. Data Analysis

Statistical analyses were carried out with SPSS version 13.0. for Windows. The alpha level for significance in all statistical tests was preset at $p < .05$, although any statistical result at $p < .01$ is also reported. The following chapter provides the results of these analyses.

First, descriptive statistics and frequencies were used to report the participants’ production accuracy on the test items for all tasks. These data also helped in evaluating participants’ errors by providing information about the cognitive strategies that most learners per proficiency group used when coping with the harder test items.

Secondly, and only for the two psycholinguistic experiments, a series of independent-samples $t$ tests were performed to evaluate the comparisons between verb types of high and low proficiency and to determine the statistical significance of the comparisons. Independent-samples $t$ tests were also used for all tasks to examine potential differences in the accuracy and mean RTs to test items between the advanced and bilingual groups.

Thirdly, one-way analysis of variance (ANOVA) tests were used to test results for differences among the three proficiency groups of late L2 learners. Additionally, in order to assess which groups obtained significantly different results from which other groups of late L2 learners, the follow-up Tukey post hoc test results were checked.

Finally, Pearson bivariate correlations were run to test the linear relationships between different variables. These correlations were used to test whether there was a relationship between
the frequencies of the test items in the Spanish language (as measured by the three corpora described in section 3.4.2.) and participants’ accuracy, independently of the items’ verb type.
CHAPTER 4
RESULTS

4.1. Introduction

In this chapter the main results from the different tasks are presented, including the RT results, the accuracy scores, and the types of errors and/or cognitive strategies used by Spanish L2 learners. Results are not only descriptive but also include findings from the statistical tests employed. At the end of this chapter, section 4.4, briefly discusses whether the results obtained from the different tasks were similar to one another and how this triangulation of data can inform the present investigation. The significance of these results and the account of how these data can help in providing answers to the research questions are described in detail in the next chapter.

4.2. Psycholinguistic Experiments

First, the results of the two psycholinguistic experiments are discussed. The order of presentation of Experiments 1 and 2 was counterbalanced across proficiency groups, as mentioned in section 3.5.1.

4.2.1. Results from Experiment 1

There were three main goals of Experiment 1: (a) to compare the elapsed time between the visual stimuli onscreen and the participants’ oral response for regular, irregular, and vowel stem change verbs, of high and low frequency; (b) to examine participants’ accuracy in the production of the third person singular preterite tense forms elicited; and (c) to examine participants’ errors and observed behaviors when dealing with complex verb forms for which they did not know the correct answer.

Each participant’s data for Experiment 1 were recorded into a single Excel file which included the following information for each token (N = 60): (a) participant’s code, (b) participant’s proficiency level, (c) item number, (d) verb type of high or low frequency, (e)
participant’s raw RT, (f) participant’s adjusted RTs, when applicable (see below), (g) participant’s final oral response, and (h) participant’s behavior and/or error type, if applicable. There were a total of 3,600 tokens (60 tokens × 60 participants).

Even though participants were instructed to produce only their final responses into the microphone, there were cases in which they monitored their responses, paused after lengthening the first syllable of the test item and before providing their final response, provided multiple answers, and the like. For that reason, some of the initial RTs had to be adjusted before being entered into the appropriate data cells. Audacity software was used to measure the additional amount of time between the start of the first oral soundwave produced by the participants and the start of the soundwave corresponding to their final response, as shown in Figure 4-1.

Figure 4-1. Screenshot of Audacity software

In this way, a more precise elapsed time between the presentation of the visual stimuli and participants’ final response is calculated. For example, in Figure 4-1, if A was the beginning of a false start and B the start of the final response, the amount of time measured in milliseconds from A to B was added to the initial RT given by the computer for that test item. Only 3.97% (143/3,600) of the RTs for the total number of forms elicited from all groups of participants had to be adjusted, distributed as follows: in the beginning group 4% (36/900), in the intermediate
group 4.44% (40/900), in the advanced group 3.44% (31/900), and in the bilingual group 4% (36/900). The main verb types adjusted in the beginning and intermediate groups were the irregular and the stem change verbs, whereas most of the adjusted forms in the advanced and the bilingual groups were the irregular verbs.

Before running the appropriate statistical tests, the mean RTs and accuracy rates for each participant and for each condition were computed. The average RTs in ms. for the correct responses were calculated by verb type and verb type frequency, and the average accuracy in the oral responses to the different verb types was also calculated, by verb frequencies.

4.2.1.1. RT results

First, the statistical results for the RTs for the different verb types across proficiency groups are presented. For the most part, these results did not provide evidence in favor of the expected dissociations and/or frequency effects proposed by dual-mechanism models.

A series of independent-samples $t$ tests were performed to evaluate the comparisons between verb types of high and low frequency per proficiency group and to determine the statistical significance of the comparisons. These results are displayed in Table 4-1.

In the beginning group of late learners, the RTs to low frequency items were greater than to the high frequency items of regular and stem change verb forms: 2732 and 2275 ms. for high frequency regular verbs and stem change verbs, respectively, and 3340 and 2901 ms. for the corresponding group of low frequency items, in the same order. However, the only significant results observed in the group of beginning learners were found in the group of irregular verbs, although in an unexpected direction. Beginning learners took significantly longer ($t = 2.180, df = 22, p = .040$) to produce the correct response to high frequency (M = 3587.59, SD = 1487.74) irregular verbs than to low frequency (M = 2428.24, SD = 913.41) irregular verbs.
### Table 4-1. Independent-samples $t$ test results for the RTs for the correct responses by all groups of learners in Experiment 1: Comparison between test items of high and low frequency. Mean RT (SD)

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Frequency</th>
<th>Beginning (N = 15)</th>
<th>Intermediate (N = 15)</th>
<th>Advanced (N = 15)</th>
<th>Bilingual (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>High</td>
<td>2732.21 (1671.25)</td>
<td>1584.46 (459.32)</td>
<td>1420.08 (667.57)</td>
<td>1531.66 (697.33)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>3340.27 (3357.23)</td>
<td>1688.52 (561.74)</td>
<td>1482.13 (615.39)</td>
<td></td>
</tr>
<tr>
<td>Irregular</td>
<td>High</td>
<td>3587.59* (1487.74)</td>
<td>2819.26 (1336.31)</td>
<td>2935.77 (2183.70)</td>
<td>2058.36 (960.09)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>2428.24* (913.41)</td>
<td>2290.58 (3215.69)</td>
<td>3364.26 (3033.42)</td>
<td></td>
</tr>
<tr>
<td>Stem Change</td>
<td>High</td>
<td>2275.58 (852.46)</td>
<td>1952.38 (1033.09)</td>
<td>2438.34 (2105.27)</td>
<td>1622.06* (702.90)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>2901.20 (1395.22)</td>
<td>2675.67 (1494.70)</td>
<td>2200.78 (934.02)</td>
<td>2251.40* (934.02)</td>
</tr>
</tbody>
</table>

* $p < .05$, two-tailed, equal variances assumed

In the intermediate and advanced groups, the differences in the RTs for the high and low frequency test items of all verb types failed to reach statistical significance, as shown in Table 4-1. It shows that these groups of learners took about the same amount of time to respond to the test items per verb type, irrespective of the elicited test items’ frequency in Spanish. For the most part, the pattern of results from the intermediate group was similar to those observed in the beginning group. They took longer to respond to low frequency than to high frequency regular verbs and stem change verbs but it took them somewhat longer to respond to high frequency than to low frequency irregular verbs, as shown in Table 4-1. The group of advanced learners took longer to respond to low frequency than to high frequency regular verbs and irregular verbs, but they took slightly longer to respond to high frequency than to low frequency stem change verbs.

The group of English/Spanish bilinguals showed a different pattern of results. It took them significantly longer ($t = -2.085$, $df = 28$, $p = .046$) to respond to low frequency (M = 2251.40, SD = 934.02) than to high frequency (M = 1622.06, SD = 702.90) stem change verbs. Further, it took them longer to respond to high frequency than to low frequency regular verbs,
while the opposite was found for irregular verbs; i.e., it took them longer to respond to low frequency than to high frequency irregular verbs, as shown in Table 4-1. However, neither of these last two results reached statistical significance.

In sum, RT results from Experiment 1 did not provide strong evidence of dissociations between the different verb types in line with the predictions of the DP model. For the most part, there were not significant results in the RTs to the test items of high and low frequency on the different verb types in this study. However, beginning learners took significantly longer to respond to high frequency than to low frequency irregular verbs, while bilinguals took significantly longer to respond to low frequency than to high frequency stem change verbs.

![Graph of RTs](image)

* $p < .05$, ** $p < .01$, n.s. = non significant

Figure 4-2. One-way ANOVA with Tukey post hoc test on the RTs for high frequency regular verbs comparing the beginning, intermediate and advanced late learners for Experiment 1

In order to track RT differences across proficiency levels in the groups of late learners, a series of one-way ANOVAs with a Tukey post hoc test were run for the RT results to the different verb types. Results revealed evidence of dissociations between the RTs to regular verb forms on the one hand (Figures 4-2 and 4-3) and the RTs to irregular and stem change verb
forms on the other hand, since there were significant results for regular verb forms which were absent for irregular and stem change verb forms. Figure 4-2 shows that the RTs to the high frequency regular verbs decreased significantly across proficiency levels (N = 45, F = 6.666, \( p = .003 \)). Beginning learners took 2732 ms. to respond correctly to high frequency regular verbs while intermediate and advanced learners took a significantly shorter amount of time (1584 ms. and 1420 ms., respectively). Intermediate learners took significantly less time (MD = 1147.75, SEM = 391.56, \( p = .015 \)) to respond to high frequency regular verbs than the beginning learners, while the RT differences between the advanced and the beginning learners were even more robust (MD = 1312.13, SEM = 391.56, \( p = .005 \)) than those between the beginning and the intermediate.

\[\text{Reaction Times (milliseconds)}\]

\(3340.27 \quad 1688.52 \quad 1637.33\)

\(\text{Beginning} \quad \text{Intermediate} \quad \text{Advanced}\)

\((*) \ p < .1, \text{ n.s. = non significant}\)

Figure 4-3. One-way ANOVA with Tukey post hoc test on the RTs for low frequency regular verbs comparing the beginning, intermediate and advanced late learners for Experiment 1
In addition, Figure 4-3 shows that the RTs to the low frequency regular verbs also
decreased significantly across proficiency levels (N = 45, F = 3.470, p = .040). However, this
time the Tukey post hoc results were not as strong as for high frequency verbs. Beginning
learners took 3340 ms. to provide the elicited low frequency regular forms while the intermediate
(1688 ms.) and advanced (1637 ms.) learners took a significantly shorter amount of time (MD =
1651.75, SEM = 735.50, p = .075 and MD = 1702.94, SEM = 735.50, p = .065, respectively).

As mentioned before, none of the patterns of results between the three groups of late
learners reached statistical significance for irregular and stem change verb forms. These patterns
indicated that the intermediate learners took a shorter amount of time to respond to irregular
verbs and stem change verbs of high and low frequency than the beginning learners, as shown in
Table 4-1. However, the advanced learners took longer than the intermediate group to respond
correctly to irregular verbs of high and low frequency and to high frequency stem change verbs,
but they took less time to respond to low frequency stem change verbs, thus providing no
evidence of a discernable pattern of change among proficiency groups.

Finally, the RT results between the two groups of advanced speakers were compared, i.e.,
between the advanced late learners and the English/Spanish bilinguals. The latter usually took
less time to respond correctly to any verb type under investigation except for high frequency
regular and low frequency stem change verb forms. The t test results indicated that the RT
differences between these two groups of highly proficient learners in L2 Spanish failed to reach
statistical significance.

In sum, when tracking significant differences between the groups of participants in their
RT results to the different verb types, there were only significant differences in the RTs for
regular verbs, of high and low frequency, between the beginning groups of learners on the one
hand and the intermediate and advanced groups on the other hand. There were no significant
differences in RT results for any verb type between the groups of advanced speakers.

4.2.1.2. Accuracy results

In this section, the percentages of correct responses for each verb type of high and low
frequency across the proficiency groups are reported. First, I explore possible frequency effects
among the verb types for each group of participants individually, and then I examine which
groups of participants increased their accuracy on the different verb types in relation to the other
groups. This analysis allows us to track developmental changes across proficiency levels and to
check if there are differences in the production of advanced speakers with different learning
experiences. Table 4-2 displays the percentage of correct responses for each verb type, of high
and low frequency, in the oral production of the different groups of participants.

Table 4-2. Accuracy rates on the different verb types of high and low frequency for Experiment
1 for all groups of participants (3,600 tokens). Percentage (correct responses/test
items per group of participants and verb type)

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th>Irregular</th>
<th>Stem Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Beginning</td>
<td>84.67%</td>
<td>83.33%</td>
<td>60%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(127/150)</td>
<td>(125/150)</td>
<td>(90/150)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>98%</td>
<td>91.33%</td>
<td>77.33%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(147/150)</td>
<td>(137/150)</td>
<td>(116/150)</td>
</tr>
<tr>
<td>Advanced</td>
<td>98%</td>
<td>96.67%</td>
<td>86.67%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(147/150)</td>
<td>(145/150)</td>
<td>(130/150)</td>
</tr>
<tr>
<td>Bilingual</td>
<td>99.33%</td>
<td>98%</td>
<td>92.67%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(149/150)</td>
<td>(147/150)</td>
<td>(139/150)</td>
</tr>
</tbody>
</table>

There are three different patterns we can pinpoint from Table 4-2. In the production of
late learners, the accuracy rates for regular verbs were generally higher than those for irregular
verbs and stem change verbs. Only the advanced learners obtained a similar accuracy rate for
high frequency irregular verbs (86.67%) compared to the accuracy results for regular verbs by
any proficiency group. Besides this difference in the accuracy scores between regular verbs on
the one hand and irregular verbs and stem change verbs on the other hand, late learners always showed higher levels of accuracy on all verb forms, irrespective of their verb type and frequency, if we look at the accuracy rates from one proficiency level to the next one. The only exception to this trend was the low frequency irregular verbs, for which the group of advanced learners obtained slightly lower scores than the group of intermediate learners (from 45.33% to 44.67%). However, this difference in accuracy scores was minimal, less than 1%. The last pattern of results we can observe in Table 4-2 is the accuracy scores for any verb type by the English/Spanish bilinguals, which were usually higher, in some cases reaching almost perfect accuracy (99.33% of correct responses for high frequency regular verbs). These speakers produced the elicited verb forms of two thirds of all verb types with more than 85% accuracy, the exceptions being low frequency irregular verbs and stem change verbs (67.33% and 78.67%, respectively).

In order to check if there were frequency effects in the three types of verbs, a series of independent-samples t tests were run taking frequency as the grouping variable. There were clear dissociations for the most part between irregular verbs on the one hand and the other two verb types on the other hand. An unexpected result was the frequency effects for regular verbs in the group of intermediate learners only. The statistical results for each proficiency group are described in the following paragraphs.

In the group of beginning learners there were frequency effects in the accuracy rates for irregular verbs only, as shown in Table 4-3. Beginning learners produced irregular verb forms with significantly better accuracy \( t = 3.530, df = 28, p = .001 \) if they were of high frequency \( (M = 60, SD = 31.40) \) than if they were of low frequency \( (M = 22.67, SD = 26.31) \). Conversely, there were no frequency effects in the accuracy scores of regular or stem change verb forms.
In the group of intermediate learners there were frequency effects in the accuracy rates for both regular \((t = 3.035, df = 28, p = .005)\) and irregular \((t = 2.788, df = 28, p = .009)\) verbs, which is evidence against dissociations of frequency effects based on regularity. Table 4-3 shows that intermediate learners obtained greater accuracy results for high frequency regular verbs \((M = 98, SD = 4.14)\) and high frequency irregular verbs \((M = 77.33, SD = 22.19)\) than for low frequency regular verbs \((M = 91.33, SD = 7.43)\) and low frequency irregular verbs \((M = 45.33, SD = 38.52)\), respectively. There were no frequency effects in accuracy rates for stem change verbs.

Table 4-3. Independent-samples \(t\) test results for accuracy rates by all groups of learners in Experiment 1: Comparison between test items of high and low frequency. Mean accuracy rate (SD)

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Frequency</th>
<th>Beginning ((N = 15))</th>
<th>Intermediate ((N = 15))</th>
<th>Advanced ((N = 15))</th>
<th>Bilingual ((N = 15))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>High</td>
<td>84.67 (25.03)</td>
<td>98.00** (4.14)</td>
<td>97.33 (7.04)</td>
<td>99.33 (2.58)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>83.33 (28.45)</td>
<td>91.33** (7.43)</td>
<td>96.67 (7.24)</td>
<td>98.00 (4.14)</td>
</tr>
<tr>
<td>Irregular</td>
<td>High</td>
<td>60.00** (31.40)</td>
<td>77.33** (22.19)</td>
<td>86.67** (13.97)</td>
<td>92.67** (12.23)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>22.67** (26.31)</td>
<td>45.33** (38.52)</td>
<td>44.67** (37.20)</td>
<td>67.33** (22.51)</td>
</tr>
<tr>
<td>Stem Change</td>
<td>High</td>
<td>42.67 (26.58)</td>
<td>57.33 (26.04)</td>
<td>70.67 (25.20)</td>
<td>85.33 (22.00)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>26.00 (23.24)</td>
<td>46.67 (27.17)</td>
<td>56.00 (26.94)</td>
<td>78.67 (19.22)</td>
</tr>
</tbody>
</table>

\*\*\(p < .01\), two-tailed, equal variances assumed

In the group of advanced learners there were frequency effects in the accuracy rates for irregular verbs only \((t = 4.094, df = 28, p = .000)\). This group of participants produced more correct irregular verb forms if they were of high frequency \((M = 86.67, SD = 13.97)\) than if they were of low frequency \((M = 44.67, SD = 37.20)\). There were no frequency effects for regular or stem change verb forms.
Again, in the group of bilinguals there were frequency effects in the accuracy scores for irregular ($t = 3.830, df = 28, p = .001$) verb forms but not for regular or stem change verb forms, as shown in Table 4-3. This group of participants also obtained significantly higher accuracy results for high frequency irregular verbs ($M = 92.67, SD = 12.23$) than for low frequency irregular verbs ($M = 67.33, SD = 22.51$).

In order to look for possible developmental changes and differences in ultimate attainment based on age of initial exposure to Spanish, several statistical tests were run on these results and we found significant differences in the accuracy rates between the various groups of late learners and also between the two groups of advanced speakers. First, the significant results found in the accuracy scores across the proficiency groups of late learners are described, followed by those between the advanced groups of speakers.

A series of one-way ANOVAs were run with a Tukey post hoc test to compare the accuracy rates on all verb types of high and low frequency between the three groups of late learners. The significant results are displayed in Figures 4-5 to 4-8. The first set of significant results was found for stem change verbs, irrespective of their frequencies. There were significant differences between the groups ($N = 45, F = 4.370, p = .019$) in their accuracy rates for high frequency stem change verbs, and the Tukey post hoc test indicated that the significant differences ($MD = -28, SEM = 9.48, p = .014$) were found between the beginning ($M = 42.67, SD = 26.58$) and the advanced groups ($M = 70.67, SD = 25.20$), as shown in Figure 4-4. However, these results were more robust for the low frequency stem change verbs.
*p < .05, n.s. = non significant

Figure 4-4. One-way ANOVA with Tukey post hoc test on the accuracy rates for high frequency stem change verbs comparing the beginning, intermediate and advanced learners for Experiment 1

**p < .01, n.s. = non significant

Figure 4-5. One-way ANOVA with Tukey post hoc test on the accuracy rates for low frequency stem change verbs comparing the beginning, intermediate and advanced learners for Experiment 1
There were also significant differences in the accuracy results for low frequency stem change verbs between the groups of late learners (N = 45, F = 5.293, p = .009). The Tukey post hoc test indicated that the differences (MD = -30.00, SEM = 9.44, p = .008) were found between the beginning (M = 26, SD = 23.24) and the advanced (M = 56, SD = 26.94) proficiency groups only, as shown in Figure 4-5.

There were also significant results between these three groups in the accuracy rates for high frequency regular verbs and for high frequency irregular verbs. First, for both high frequency regular verbs and high frequency irregular verbs, there were significant differences between the groups, as shown by the one-way ANOVA results (N = 45, F = 3.949, p = .027, and N = 45, F = 4.924, p = .012, respectively).

Figure 4-6. One-way ANOVA with Tukey post hoc test on the accuracy rates for high frequency regular verbs comparing the beginning, intermediate and advanced learners for Experiment 1

(* p < .1, n.s. = non significant)
For high frequency regular verbs, the Tukey post hoc results, which reached the significance cutoff point, were found between the beginning and the intermediate groups as well as between the beginning and the advanced groups of late learners (MD = -13.33, SEM = 5.48, \( p = .050 \) for both cases), as shown in Figure 4-6. However, these differences were more robust for high frequency irregular verb forms (\( N = 45, F = 4.924, p = .012 \)) and they were found between the beginning and the advanced groups only: M = 60, SD = 31.40 for the beginning group and M = 86.67, SD = 13.97 for the advanced group (MD = -26.67, SEM = 8.62, \( p = .010 \) Tukey post hoc results), as shown in Figure 4-7.

\[\text{Accuracy Rates (0-100)}\]

\begin{center}
\begin{tabular}{ccc}
& Beginning & Intermediate & Advanced \\
\hline
Accuracy Rates & 60 & 77.33 & 86.67 \\
\hline
\end{tabular}
\end{center}

\*\( p < .05 \), n.s. = non significant

Figure 4-7. One-way ANOVA with Tukey post hoc test on the accuracy rates for high frequency irregular verbs comparing the beginning, intermediate and advanced learners for Experiment 1

The last set of statistical tests run for the accuracy scores in Experiment 1 were a series of independent-samples \( t \) tests to assess if there were significant differences between the advanced groups of speakers. Figure 4-8 shows that the only results that reached statistical significance
between those groups were found for the low frequency stem change verb forms (N = 30, \( df = 28, \ t = -2.653, \ p = .013 \)).

Additionally, the differences in the accuracy for the low frequency irregular verb forms between these groups (N = 30, \( df = 28, \ t = -2.019, \ p = .053 \)) approached statistical significance. Again, these results point to dissociations between regular verb forms on the one hand and irregular verb forms on the other hand. The bilingual group consistently obtained higher accuracy for low frequency irregular verbs (M = 67.33, SD = 22.51) and low frequency stem change verbs (M = 78.67, SD = 19.22) than the group of advanced learners (M = 44.67, SD = 37.20 for irregular verbs and M = 56, SD = 29.94 for stem change verbs).

4.2.1.3. Error types and participants’ behaviors

From the different variables used in the coding stage of this study, the variable with the greatest range of options was the participants’ behavior and/or error type for the test items. A total of 23 options were classified for the present analysis, in order to capture as much
information as possible from the participants’ responses. Table 4-4 presents a brief summary with a specific example to illustrate each behavior/error. This taxonomy was also used in the coding of this type of data for the Production Task considered (section 4.3.2.).

Table 4-4. Summary of behaviors/errors used for the coding of oral data for Experiment 1 and Tasks 1 and 2

<table>
<thead>
<tr>
<th>#</th>
<th>Behavior/error</th>
<th>Example</th>
<th>Correct form with translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>Cantó (s/he sang)</td>
<td>Cantó (‘s/he sang’)</td>
</tr>
<tr>
<td>1</td>
<td>Overregularization</td>
<td>*Redució</td>
<td>Redujo (‘s/he reduced’)</td>
</tr>
<tr>
<td>2</td>
<td>No vowel change</td>
<td>*Sentió</td>
<td>Sintió (‘she/he felt’)</td>
</tr>
<tr>
<td>3</td>
<td>Nonfinite form/Noun</td>
<td>*Para regalar</td>
<td>Regaló (‘in order to give a present’)</td>
</tr>
<tr>
<td>4</td>
<td>Hypercorrection</td>
<td>Puso &gt; *puse</td>
<td>Puso (‘s/he put’)</td>
</tr>
<tr>
<td>5</td>
<td>Buying time</td>
<td>*Puuuuuudo</td>
<td>Pudo (‘s/he could’)</td>
</tr>
<tr>
<td>6</td>
<td>Different PN suffix</td>
<td>*Llamé</td>
<td>Llamó (‘s/he called’)</td>
</tr>
<tr>
<td>7</td>
<td>No response</td>
<td>Ø</td>
<td>Nació (‘s/he was born’)</td>
</tr>
<tr>
<td>8</td>
<td>Wrong stress</td>
<td>*Extrajó</td>
<td>Extrajo (‘s/he extracted’)</td>
</tr>
<tr>
<td>9</td>
<td># 2 + Incorrect suffix</td>
<td>*Vertó</td>
<td>Virtió (‘s/he poured’)</td>
</tr>
<tr>
<td>10</td>
<td>Different tense</td>
<td>*Sigo</td>
<td>Siguió (‘s/he continued’)</td>
</tr>
<tr>
<td>11</td>
<td># 1 + # 5</td>
<td>*Veeeeeentió</td>
<td>Vino (‘s/he came’)</td>
</tr>
<tr>
<td>12</td>
<td>Monitor</td>
<td>*Mentió &gt; mintió</td>
<td>Mintió (‘s/he lied’)</td>
</tr>
<tr>
<td>13</td>
<td>Wrong root</td>
<td>*Esquepó</td>
<td>Escapó (‘s/he escaped’)</td>
</tr>
<tr>
<td>14</td>
<td># 12 + # 6</td>
<td>*Pongo &gt; *puse</td>
<td>Puso (‘s/he put’)</td>
</tr>
<tr>
<td>15</td>
<td># 6 + # 5</td>
<td>*Puuuude</td>
<td>Pudo (‘s/he could’)</td>
</tr>
<tr>
<td>16</td>
<td>TAM of another class</td>
<td>*Vinió</td>
<td>Vino (‘s/he came’)</td>
</tr>
<tr>
<td>17</td>
<td>Nonexistent/Other verb</td>
<td>*Se puso</td>
<td>Pudo (‘s/he was able to’)</td>
</tr>
<tr>
<td>18</td>
<td># 12 + # 1</td>
<td>*Andió &gt; *andó</td>
<td>Anduvo (‘s/he walked’)</td>
</tr>
<tr>
<td>19</td>
<td># 5 + # 8</td>
<td>*Repiiiiitió</td>
<td>Repitió (‘s/he repeated’)</td>
</tr>
<tr>
<td>20</td>
<td># 2 + # 8</td>
<td>*Corregió</td>
<td>Corrijo (‘s/he corrected’)</td>
</tr>
<tr>
<td>21</td>
<td># 1 + # 8</td>
<td>*Redució</td>
<td>Redujo (‘s/he reduced’)</td>
</tr>
<tr>
<td>22</td>
<td># 2 + # 5</td>
<td>*Meeeeeedió</td>
<td>Midió (‘s/he measured’)</td>
</tr>
</tbody>
</table>

This section provides a descriptive account of the most prevalent cognitive strategies and types of errors that the different groups of participants produced in their oral responses to the test items during Experiment 1. First, the most prevalent behavior and/or error for each verb type and group of participants are described, and then the internal structure of the error and/or the relevance of the observed behavior are explained. Table 4-5 summarizes the main observed behavior/error by these groups of participants, arranged by verb type.
Table 4-5. Summary of participants’ main behaviors and errors for all groups of learners (N = 60) and by verb type in Experiment 1. Rate of the main error/behavior (number of errors with the main error type/total number of errors per group of participants and verb type)

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th></th>
<th>Irregular</th>
<th></th>
<th>Stem Change</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Beginning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>34.78%</td>
<td>36%</td>
<td>23.33%</td>
<td>41.38%</td>
<td>46.51%</td>
<td>46.85%</td>
</tr>
<tr>
<td></td>
<td>(8/23)</td>
<td>(9/25)</td>
<td>(14/60)</td>
<td>(48/116)</td>
<td>(40/86)</td>
<td>(52/111)</td>
</tr>
<tr>
<td><strong>Intermediate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>6</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>66.67%</td>
<td>53.85%</td>
<td>23.53%</td>
<td>43.90%</td>
<td>53.13%</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>(2/3)</td>
<td>(7/13)</td>
<td>(8/34)</td>
<td>(36/82)</td>
<td>(34/64)</td>
<td>(36/80)</td>
</tr>
<tr>
<td><strong>Advanced</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>Single</td>
<td>instances</td>
<td>Single</td>
<td>instances</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>60%</td>
<td>(3/5)</td>
<td>68.67%</td>
<td>(7/20)</td>
<td>77.27%</td>
<td>78.79%</td>
</tr>
<tr>
<td>Bilingual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>Single</td>
<td>instances</td>
<td>16</td>
<td>1 &amp; 10\textsuperscript{13}</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>66.67%</td>
<td>(2/3)</td>
<td>27.27%</td>
<td>(3/11)</td>
<td>42.86%</td>
<td>90.91%</td>
</tr>
</tbody>
</table>

When there is only a single instance for an error type, this error type is not reported as it does not represent a trend in the results. In this section, an asterisk represents an incorrect verb form given the instructions of the experiment (provide the third person singular preterite), regardless of the morphological structure of the verb form. For example, *decía (‘s/he used to say’) is considered an incorrect verb form for Experiment 1 although it is a correct verb form for the imperfect tense for the verb decir (‘to say’). For a detailed explanation of the different codes used in the data coding of this experiment, see Appendix J, and for a list of the 60 test items and their corresponding elicited preterite form, see Appendix K; in the interest of brevity, the following sections only report participants’ errors and/or behaviors but the corresponding correct preterite forms are not included.

\textsuperscript{13} If more than one main behavior on a specific verb type, their rates were the same for all behaviors reported in the corresponding cell, e.g., there were five examples of behavior 10 as well as another five examples of behavior 16 for high frequency irregular verbs by the advanced group of late learners.
4.2.1.3.1. Errors associated with regular verb forms

Most beginning learners used present forms instead of the elicited preterite forms for regular verbs, irrespective of their frequency. The greater the proficiency level, the lower the error rate in the production of regular verb forms and the more difficult it becomes to identify behavioral/error patterns. However, most of the occasional mistakes produced by participants in higher proficiency levels (including the bilingual group) had to do with the attachment of a wrong TAM suffix or with confusion in the syllable structure of the verb root.

In the group of beginning learners, the most prevalent behavior for regular verbs was to provide a verb form in another tense (error 10), as shown in Table 4-5. There were eight cases in the group of high frequency regular verbs, half of which were used in the third person singular present tense (*entra ‘s/he enters,’ *llama ‘s/he phones,’ *mira ‘s/he looks,’ *pregunta ‘s/he asks’) instead of their corresponding preterite forms. There were also three examples of *salgo (‘I go out’). The last example was the present subjunctive form *pregunte (‘that s/he asks’). In the group of high frequency regular verbs, there were also six examples of nonexistent forms or verb forms that belonged to other verbs, such as: *empezco (‘s/he started’) or *debia (from the verb deber ‘ought to’) instead of llevó (‘s/he carried’). In the group of low frequency regular verbs, beginning learners produced seven forms in the third person singular present tense (*canta ‘s/he sings,’ *escapa ‘s/he escapes,’ *espera ‘s/he waits,’ *inventa ‘s/he invents,’ *olvida ‘s/he forgets,’ *paga ‘s/he pays,’ *regala ‘s/he gives away’) and another two in the present subjunctive tense (*pague ‘that s/he pays,’ *viaje ‘that s/he travels’). The other main behaviors were four nonexistent forms and four test items used in nonfinite forms. The nonexistent forms were: *basa and *beseo instead of besó (‘s/he kissed’), and *espéro and *espário instead of esperó (‘s/he waited’). The nonfinite forms were all used in the infinitive: *cantar (‘to sing’),
*escapar* (*to escape*), *inventar* (*to invent*), and *viajar* (*to travel*), in place of the preterite verb forms listed in Appendix K.

The group of intermediate learners showed fewer and qualitatively different errors from the ones used by the group of beginning learners. When they had to produce a preterite for high frequency regular verbs, they erred in only three examples. Out of these errors, two were the use of a wrong PN suffix: *llamé* and *tomé* (*I called* and *I took*, respectively). In the group of low frequency regular verbs, out of the 13 errors, there were seven cases of wrong root, i.e., the participant provided the appropriate TAM suffix but made a mistake in the syllable structure of the verb root. For example: *vindió* (*s/he sold*) or *esquepó* (*s/he escaped*). Another error with this group of verbs with more than one example was the use of a different tense, with the verb *vender* (*to sell*): *vendía* (imperfect) or *vendo* (present).

Advanced learners were highly accurate in the production of preterite regular forms. They had only three mistakes in the group of high frequency regular verbs: (1) the use of a different PN suffix, as in *tomé* (*I took*), (2) a verb form in the present tense instead of the preterite, as in *salgo* (*I go out*), and (3) the use of a TAM suffix from another verb class: *abró* (*s/he opened*). This third type of error was the most frequent one with low frequency regular verbs too. Advanced learners made three of these mistakes, out of the five for low frequency regular verbs. There was an example of *vendó* (*s/he sold*) and two examples of *inventió* (*s/he invented*).

Bilingual speakers made virtually no errors with regular verb forms. They had only one example of a wrong TAM suffix in the group of high frequency regular verbs: *mirió* (*s/he looked*). Additionally, in the group of low frequency regular verbs there were two examples of
that error type, out of the three they made: *olvidó (‘s/he forgot’) and *inventió (‘s/he invented’).

4.2.1.3.2. Errors associated with irregular verb forms

When participants did not know the correct preterite form for low frequency irregular verbs, they usually attached a regular ending to the stem of the infinitive, in the hope that their response would be the verb form being elicited. For irregular verbs of high frequency, the use of verb forms in another tense was also one of the most prevalent error types, besides overregularizations. Specific examples are provided in the following paragraphs.

The most prevalent error with high frequency irregular verbs by the beginning learners was to use a verb form in a different tense. Most incorrect forms were verbs used in the present tense and in the first person singular instead of the third person singular. For example, there were three examples of *hago (‘I do’), there were two cases of *producjo (‘I produce’), two examples of *pongo (‘I put’), two *digo (‘I say’) forms, and so on. The next error type, with a total of 13 examples, was to provide a nonexistent form or to use a verb form that belongs to a different verb (error type 17). Some of the nonexistent forms provided were: *vingió (‘s/he came’), *pongió (‘s/he put’), etc. Some examples of verb forms taken from verbs other than the test item were *hecho (‘done’) for the test item haber (‘there is/are’) or the preterite form *puso (‘s/he put’) for the verb poder (‘to be able to’). The last most frequent error type that these learners made with high frequency irregular verbs was overregularization, with a total of 12 examples. However, for the most part this error was limited to the test item producir (‘to produce’), which seven participants overregularized to *produció (‘s/he produced’). Beginning learners had a lot of difficulty producing correct irregular preterite forms for low frequency irregular verbs; they were correct in only about one out of five examples, as shown in Table 4-2. The most frequent error with this type of verbs was overregularization with or without a correct stress assignment to
the verb form produced, i.e., error types 1 and 21, for a total of 48 and 24 examples for each of them. Most overregularization examples were: seven cases of *introdució (‘s/he introduced’), six cases of *atraió (‘s/he attracted’), of *condució (‘s/he drove’), and of *contraió (‘s/he got’), as well as five cases of *cabió (‘s/he fit’) and of *redució (‘s/he reduced’). Most of the overregularization examples with an additional incorrect stress assignment were the following: four cases of *tradució (‘s/he translated’), of *cabío (‘s/he fit’), or *redúcio/*reducio (‘s/he reduced’), and three cases of *ándo (‘s/he walked’) and the different versions of incorrect stress assignment for *éxtraio/*extráio/*extraio (‘s/he extracted’).

Intermediate learners also overregularized most low frequency irregular verbs but they produced most high frequency irregular verbs in incorrect regularized verb forms. In the group of high frequency irregular verbs, overregularization was limited to the verbs producir and venir, where there were four cases of *produción (‘s/he produced’) as well as three examples of *venió (‘s/he came’). The next most frequent error type with high frequency irregular verbs was error 21, or the combination of overregularization and wrong stress assignment, as in *hació (‘s/he did’) or *venió (‘s/he came’). There were a total of six of these errors. And the last most frequent error type with high frequency irregular verbs, with a total of six cases as well, was the use of a different PN suffix in the preterite tense. The error was to provide the first person instead of the third person singular preterite form. There were three cases of *estuve (‘I was’), one *fui (‘I went’), one *dije (‘I said’), and one *puse (‘I put’) instead of the corresponding elicited forms. Most intermediate learners overregularized the low frequency irregular verbs when they did not have a trace memory to any irregular verb form with the feature [+ past]. For example, seven participants said *andó (‘s/he walked’), six participants produced *contraió (‘s/he got’), and there were four cases of *condució (‘s/he drove’) and of *tradució (‘s/he translated’). With this
group of verbs, intermediate participants also produced 18 forms in another tense, mostly in the present tense and with the first person singular PN suffix. They produced four *atraigo (‘I attract’) and four *traigo (‘I bring’) forms as well as two *conduzco (‘I drive’) and two *introduzco (‘I introduce’) forms. Finally, intermediate learners also produced 17 examples of overregularization with wrong stress, these being the three cases of *redúció/*reducio (‘s/he reduced’), the most recurrent example of this error type.

Advanced learners also regularized irregular verbs of high and low frequency as the most prevalent error for this type of verbs. Interestingly, in the group of high frequency irregular verbs, seven participants regularized the verb producir, as in produció (‘s/he produced’). No other high frequency irregular verb was overregularized. The other main error with high frequency irregular verbs was to provide a verb form in another tense. There were a total of six examples: two first person singular present forms (*hago ‘I do’ and *pongo ‘I put’), two third person singular present forms (*hace ‘s/he does’ and *viene ‘s/he comes’), and two singular imperfect forms (*ponía ‘s/he used to put’ and *venía ‘s/he used to come’). With the group of low frequency irregular verbs, the most prevalent error type made by intermediate learners was overregularization, with a rate of 68.67% (57/83) from the total number of errors. All 10 low frequency irregular verbs were overregularized and the advanced learners attached an incorrect regular suffix to the verb stem, which was in agreement with the verb class. Consequently, the advanced learners attached the regular PN marker –ó to the irregular verb andar, as in the five examples of *andó (‘s/he walked’), and they attached the regular suffix –ió to the rest of the low frequency irregular verbs because they belonged to the second and third verb classes, as in the six examples of *extraíó (‘s/he extracted’) or the five examples of *condució (‘s/he drove’).
The group of English/Spanish bilinguals did not have many problems with high frequency irregular verbs. Out of the 11 erroneous forms they produced, they had three cases of verb forms in another tense (*había ‘there used to be,’ *tenía ‘s/he used to have’ and *produzco ‘I produce’) and three cases of overregularized forms (*produció (2) ‘s/he produced’ and *ponió ‘s/he put’). In the case of low frequency irregular verbs, about half of the errors (21/49) were examples of regularized forms. Eight out of the 10 test items were regularized in this group of verbs, and the most frequent errors were five examples of *atraió (‘s/he attracted’) and four examples of *andó (‘s/he walked’). The other most common error with low frequency irregular verbs was error 17, with a total of nine examples. There were two erroneous forms for each of the following test items: andar ‘to walk,’ atraer ‘to attract,’ caber ‘to fit,’ and extraer ‘to extract.’ For example, one participant produced the nonexistent form *extradujo (‘s/he extracted’), and another participant used the preterite form *hubo (‘there was’) as the response to the test item andar (‘to walk’).

4.2.1.3.3. Errors associated with stem change verb forms

A quick look at Table 4-5 is enough to verify that the recurrent error type by all groups of participants with high and low frequency stem change verbs was to keep the root of the infinitive unchanged. Vowel stem change verbs require, besides the attachment of the appropriate TAM suffix, an internal vowel change. The lack of this vowel change was made frequently and at very high rates, especially by the bilingual group, e.g., in more than 90% of the error examples.

In the group of high frequency stem change verbs, beginning learners forgot to change the vowel of the verb root in most test items: *advertió (8), *convertió (7), *sonrió (7), *seguíó (5), and so on. The other main error type in the group of high frequency stem change verbs was number 20, or the combination of no vowel change plus wrong stress assignment. For example, there were five cases of *advertió (‘s/he warned’), four cases of *sentió (‘s/he felt’), four cases
The most prevalent error with low frequency stem change verbs by the beginning group was not to change the vowel of the verb root in the preterite. There were nine cases of *medió, eight cases of *corregió, six cases of *herió and *vertió, five cases of *mentió and *se vestió, four cases of *divertió, and so on. The next most frequent error with low frequency stem change verbs was the combination of no vowel change and wrong stress, with a total of 33 examples such as *se divertió (‘s/he enjoyed’) or *mentió (‘s/he lied’).

The most prevalent errors the group of intermediate participants made with high frequency stem change verbs were to omit the vowel change and also the combination of no vowel change and incorrect stress assignment. Out of the 34 cases of no vowel change there were six examples of *advertió (‘s/he warned’) and of *convertió (‘s/he converted’), as well as four examples of *conseguió (‘s/he obtained’), of *repetió (‘s/he repeated’), of seguíó (‘s/he followed’), and of *servió (‘s/he served’). The main examples with error type 20, i.e., no vowel change and wrong stress, were five cases of *advertió (‘s/he warned’), and four cases each of *convertió (‘s/he converted’), of *sentió (‘s/he felt’), and of *servió (‘s/he served’). Similar error types to those for high frequency verb forms were observed in the group of low frequency stem change verbs. There were 36 cases of no vowel change and 30 cases of no vowel change with wrong stress. The main examples of no vowel change were seven *corregió (‘s/he corrected’) and *vertió (‘s/he poured’) forms each, six *mention (‘s/he lied’), five *se divertió (‘s/he enjoyed’), and four *herió (‘s/he hurt’) forms instead of the elicited preterite forms. The main examples of behavior 20 were four cases of *vertió (‘s/he poured’), as well as three cases of *herió (‘s/he hurt’), *mentió (‘s/he lied’), *se vestió (‘s/he dressed up’), and *corregió (‘s/he corrected’).
Even though the group of advanced learners produced fewer errors when providing stem change preterite forms than the other groups of late learners (44 and 66 errors for high and low frequency items in that order), most incorrect examples were of error type 2, or the omission of the corresponding vowel change. Most vowel change omissions in the group of high frequency stem change verb forms were limited to two test items: *advertió (‘s/he warned’) and *convertió (‘s/he converted’), with eight and nine examples, respectively. And in the group of low frequency stem change forms there were eight examples of *se divertió (‘s/he enjoyed’) and of *medió (‘s/he measured’) each, seven examples of *herió (‘s/he hurt’), and six examples of *corregió (‘s/he corrected’) and of *vertió (‘s/he poured’) each, instead of the appropriate preterite forms.

When bilinguals made an error with stem change verb forms, of high and low frequency, they usually forgot to make the appropriate vowel change in the stem of the verb. In the group of high frequency stem change verbs there were five cases of *convertió ‘s/he converted,’ four cases of *advertió ‘s/he warned,’ and three cases each of *conseguió ‘s/he obtained,’ of *seguió ‘s/he continued,’ and of *servió ‘s/he served.’ And in the group of low frequency stem change verbs, the verbs which were produced without the corresponding vowel change by most participants were *divertió (6) ‘s/he enjoyed,’ *vertió (6) ‘s/he poured,’ *corregió (4) ‘s/he corrected,’ *medió (4) ‘s/he measured,’ and *mentió (4) ‘s/he lied.’

In sum, if we consider the different error types by most groups of participants for the various verb types of high and low frequency, the following patterns can be identified: (1) regular verbs, irrespective of their frequency, were produced in another verb tense by most beginning learners, while the most frequent errors by the rest of the proficiency groups were the use of a different PN suffix or a TAM suffix from other verb classes; (2) all groups of
participants overregularized most low frequency irregular verbs and for high frequency irregular verbs most participants either overregularized or produced those verbs in another tense, usually the present tense; and (3) all groups of participants failed to change the vowel of the verb stem for vowel stem change verbs of both high and low frequency.

4.2.2. Results from Experiment 2

There were two primary goals for Experiment 2: (a) to investigate participants’ accuracy of stem recognition of verbs in their infinitive form after the oral presentation of a preterite form with either the same or a different stem; and (b) to compare the elapsed time between the oral stimuli and the button presses for regular, irregular, and vowel stem change verbs, of high and low frequency across groups.

Each participant’s data for Experiment 2 were recorded in a single Excel file which included the following pieces of information for each token (N = 60): (a) item number, (b) verb type (high or low frequency), (c) written stimuli which were displayed on the screen, (d) event tag or condition in relation to the expected response, (e) button pressed, and (f) participant’s RT.

The percentage of correct responses to the test items was computed by verb type and verb type frequency. Before running the appropriate statistical tests, the average RT in milliseconds for the correct responses was also calculated, again, by verb type and verb type frequency.

4.2.2.1. Accuracy results

The results for the accuracy rates on the test items are presented before presenting the results for the RTs on the same items. Experiment 2 was purely a recognition task and the participants did not have to provide a written or an oral response. They simply had to press one of two buttons to decide as quickly as possible depending on whether the oral stimulus had the same or a different stem from that of the written stimulus which was presented on the computer screen. There were only two options and all groups of learners obtained virtually perfect scores,
as shown in Table 4-6. The only exception to this was in the low frequency stem change verbs, among beginning and intermediate learners, where accuracy was slightly lower (88.67% for both groups).

Table 4-6. Independent-samples t test results for accuracy rates (as measured by the button pressed) by all groups of learners in Experiment 2: Comparison between test items of high and low frequency. Mean accuracy rate (SD)

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Frequency</th>
<th>Beginning (N = 15)</th>
<th>Intermediate (N = 15)</th>
<th>Advanced (N = 15)</th>
<th>Bilingual (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>98</td>
<td>98.67</td>
<td>98.67</td>
<td>98.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.61)</td>
<td>(3.52)</td>
<td>(3.52)</td>
<td>(3.52)</td>
</tr>
<tr>
<td>Regular</td>
<td>High</td>
<td>99.33</td>
<td>100</td>
<td>99.33</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>(2.58)</td>
<td>(.00)</td>
<td>(2.58)</td>
<td>(.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>94</td>
<td>98.67**</td>
<td>97.33</td>
<td>98.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.56)</td>
<td>(3.52)</td>
<td>(5.94)</td>
<td>(3.52)</td>
</tr>
<tr>
<td>Irregular</td>
<td>High</td>
<td>92</td>
<td>92.67**</td>
<td>95.33</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>(11.46)</td>
<td>(7.04)</td>
<td>(5.16)</td>
<td>(4.14)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>98.67**</td>
<td>99.33**</td>
<td>99.33*</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.52)</td>
<td>(2.58)</td>
<td>(2.58)</td>
<td>(.00)</td>
</tr>
<tr>
<td>Stem Change</td>
<td>High</td>
<td>88.67**</td>
<td>88.67**</td>
<td>96*</td>
<td>98.67</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>(11.87)</td>
<td>(11.87)</td>
<td>(5.07)</td>
<td>(3.52)</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, two-tailed, equal variances assumed

A series of independent-samples t tests on the accuracy rates from the different verb types were run, taking frequency as the grouping variable. These tests were run for each proficiency group individually and, as shown in Table 4-6, results indicated that there were significant differences for stem change verb forms in the three groups of late learners and also for irregular verb forms but only for the intermediate group.

Beginning learners obtained very high accuracy results for regular and irregular verb forms, with an accuracy rate in the button presses that ranged from 92% to 99.33%. However, there were frequency effects for stem change verb forms (see Table 4-6). Beginning learners were significantly more accurate ($t = 3.128, df = 28, p = .004$) at identifying the verb stems of high frequency stem change verbs ($M = 98.67, SD = 3.52$) than those of low frequency stem change verbs ($M = 88.67, SD = 11.87$).
In the group of intermediate learners there were frequency effects not only for stem change verb forms ($t = 3.400$, $df = 28$, $p = .002$) but also for irregular verb forms ($t = 2.953$, $df = 28$, $p = .006$), as shown in Table 4-6. Intermediate learners identified the verb stems of irregular verbs and of stem change verbs of high frequency with greater accuracy ($M = 98.67$, $SD = 3.52$ and $M = 99.33$, $SD = 2.58$, respectively) than those of test items of the same verb types but of low frequency ($M = 92.67$, $SD = 7.04$ and $M = 88.67$, $SD = 11.87$, in the same order). These frequency effects were not present in the group of regular verbs.

In the group of advanced learners there were frequency effects for stem change verb forms only ($t = 2.269$, $df = 28$, $p < .031$). They identified the stems of stem change verb forms of high frequency ($M = 99.33$, $SD = 2.58$) at a significantly better rate than those of stem change verb forms of low frequency ($M = 96.00$, $SD = 5.07$), as shown in Table 4-6. There were no frequency effects for regular or irregular verb forms.

Finally, in the group of bilinguals there were no frequency effects in the accuracy rates to any verb type, as shown in Table 4-6. These results may be explained by the high accuracy rates the bilinguals obtained in all verb types, irrespective of their frequency. These accuracy rates ranged from 98% to 100%.

When looking at participants’ percentage of correct responses from one proficiency level to the next one (see Table 4-6), there was a general pattern of greater accuracy for most conditions (high regular, low irregular, high stem change, and low stem change verb forms), as expected. Interestingly, all groups of participants obtained slightly better results at identifying a low regular verb root than a high regular verb root, while the opposite was true for irregular and vowel stem change verb roots: they obtained slightly better results at identifying a high frequency irregular and stem change verb form than a low frequency one. However, after
running one-way ANOVAs and independent-samples \( t \) tests, no significant differences were
found in the accuracy rates on the different conditions, neither between the groups of late
learners on the one hand nor between the two groups of advanced speakers on the other hand.
This indicates that all groups of learners were highly successful at identifying a verb’s stem from
its inflected form. There were no improvements across proficiency groups when comparing the
three groups of late learners, which shows that Spanish L2 learners are proficient at identifying a
verb root from a given conjugated verb form, even if it is a suppletive verb form, such as the
group of irregular verb forms in the present study.

4.2.2.2. RT results

The results for the RTs for the different verb types across proficiency groups are now
presented. Table 4-7 shows a clear dissociation between regular verb forms on the one hand, and
irregular and stem change verb forms on the other hand.

Table 4-7. Independent-samples \( t \) test results for the RTs for the correct responses by all groups
of learners in Experiment 2: Comparison between test items of high and low
frequency. Mean RT (SD)

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Frequency</th>
<th>Beginning (N = 15)</th>
<th>Intermediate (N = 15)</th>
<th>Advanced (N = 15)</th>
<th>Bilingual (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>High</td>
<td>921.18</td>
<td>869.32</td>
<td>943.66</td>
<td>830.02</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>918.68</td>
<td>957.73</td>
<td>1003.47</td>
<td>874.27</td>
</tr>
<tr>
<td>Irregular</td>
<td>High</td>
<td>1154.38*</td>
<td>978.95</td>
<td>1010.88**</td>
<td>945.32</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>1497.75*</td>
<td>1136.55</td>
<td>1496.36**</td>
<td>1097.23</td>
</tr>
<tr>
<td>Stem Change</td>
<td>High</td>
<td>1043.16*</td>
<td>907.13**</td>
<td>934.73**</td>
<td>876.27</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>1424.68*</td>
<td>1207.51**</td>
<td>1382.40**</td>
<td>1103.86</td>
</tr>
</tbody>
</table>

\* \( p < .05 \), \*\* \( p < .01 \), two-tailed, equal variances assumed

The beginning learners identified the root of a regular verb form from its conjugated
preterite form in less than a second, irrespective of the frequency of the conjugated verb form.
There were not significant differences between high (M = 921.18, SD = 229.05) and low frequency regular verb forms (M = 918.68, SD = 201.33). However, the frequency of the test items played a statistically significant role for irregular and stem change verbs, as predicted by the dual-mechanism models. The beginning learners took significantly longer \((t = -2.228, df = 28, p = .034)\) to identify the roots of low frequency irregular (M = 1497.75, SD = 496.87) verb forms than those of high frequency irregular verb forms (M = 1154.38, SD = 330.73). This group of learners also took significantly longer \((t = -2.658, df = 28, p = .013)\) to identify correctly the roots of low frequency stem change verb forms (M = 1424.68, SD = 431.32) than those of high frequency (M = 1043.16, SD = 350.58).

Similar results were found for regular and stem change verb forms by the intermediate group of late learners, but not for the irregular verb forms, as displayed in Table 4-7. Intermediate learners always took longer to respond to low frequency test items, irrespective of the verb type. However, these differences were statistically significant \((t = -2.793, df = 28, p = .009)\) only for stem change verbs: M = 907.13, SD = 252.87 for high frequency items in contrast to the M = 1207.51, SD = 331.07 for low frequency ones. At the intermediate level, no dissociation was found between regular and irregular verb forms, i.e., these participants responded at a similar speed to regular and irregular test items, irrespective of their frequency. These results for the irregular verb forms were not predicted, especially if we consider the results from the group of advanced learners.

The group of advanced learners behaved in a similar way to the beginning group. As shown in Table 4-7, there was a clear dissociation between regular verbs on the one hand and irregular and stem change verbs on the other hand. They reacted to regular verb forms at a very similar speed, whether they were of high (M = 943.66, SD = 262.33) or of low frequency (M =
1003.47, SD = 277.58). However, the advanced learners reacted significantly faster \((t = 2.862, \, df = 28, \, p = .008)\) for irregular verb forms of high frequency (M = 1010.88, SD = 330.74) than for those of low frequency (M = 1496.36, SD = 567.61), and significantly faster \((t = 2.983, \, df = 28, \, p = .006)\) for stem change verb forms of high frequency (M = 934.73, SD = 313.17) than those of low frequency (M = 1382.40, SD = 489.57).

The results for the irregular and stem change forms found for the advanced learners are more robust \((p < .01)\) than those for the beginning learners \((p < .05)\), even though both were statistically significant. An interesting result is that the RTs to irregular and stem change verb forms decreased from the beginning to the intermediate group but increased again from the intermediate to the advanced group. For regular verb forms, the same pattern was found for high frequency items but for low frequency regular forms participants always took longer from one proficiency level to the next one. A series of one-way ANOVAs were run to compare the RTs to the different verb types by frequency between the three groups of late learners but results indicated that these patterns never reached significance \((p > .05)\). There were only near significant results \((N = 45, \, F = 2.801, \, p = .072)\) for the low frequency irregular verbs.

The bilingual group behaved differently compared to the late learners. This group of speakers reacted at a similar speed for all the test items of the different verb types, whether they were of high or low frequency. As shown in Table 4-7, the different RTs for the test items per verb type never reached statistical significance, although participants always took longer to react to low frequency items than to high frequency ones.
Finally, the RTs to the different verb types of high and low frequency between the advanced late learners and the bilingual speakers were compared to check if the differences were statistically significant. A series of independent-samples $t$ tests were run and results indicated that advanced learners took significantly longer ($t = 2.261$, $df = 28$, $p = .032$) to react to low frequency irregular verb forms ($M = 1496.36$, $SD = 567.61$) than the group of bilingual speakers ($M = 1097.23$, $SD = 381.34$), as shown in Figure 4-9. These significant results were not found with any other verb type.

In sum, results from Experiment 2 indicated that all groups of participants were very accurate at deciding whether a conjugated verb form presented orally in the L2 had the same or a different stem from an immediately preceding infinitive verb form presented on a computer screen. Late learners reacted differently to regular verbs on the one hand and to irregular and stem change verbs on the other hand, this becomes apparent when we consider their RTs for items of high or low frequency. There were no differences for regular items; however, there were
significant differences in their RTs for high and low frequency irregular and stem change verb forms, except for irregular items in the intermediate group. There were also frequency effects in the accuracy rates on stem change verbs by all groups of late learners as well as on irregular verbs by the intermediate group. In the group of bilinguals, there were no significant differences in RTs for any type of verb forms. Finally, bilingual speakers reacted significantly faster than advanced learners to low frequency irregular verb forms.

4.3. Results from the Production Task

In this section, the results for the production task\(^1\) are described. A main goal of the production task was to obtain participants’ accuracy levels on the different verb types under investigation by using an oral production task in which verb forms are produced in sentence contexts, in a similar way to habitual Spanish activities used during class time. Another objective was to observe participants’ reaction to specific verb forms of high and low frequency, to check if they treated verb forms differently when they did not know the target verb form. Finally, participants’ errors in specific verb forms for which they did not know the correct answer can be very informative concerning the mental processes at work when handling complex verb forms in the L2.

In this elicited narrative, participants had a picture story sequence of 24 drawings about a male character and they were instructed to narrate in Spanish what that person did in the past (see Appendix F). Each drawing was accompanied by a Spanish verb in its infinitive form and participants were asked to use those verbs in the preterite tense. They were instructed to use all test items and that the researcher would have to guess the character’s name at the end of their

\(^{1}\text{Results for Production Task 2 are not included in this chapter for the reasons described in section 3.5.1.4.}\)
narration. There were an equivalent number of high and low frequency verbs from each of the three verb types.

Again, participants’ oral data were collected with Audacity and the recordings were saved as .aiff files. There were a total of 1,440 tokens (24 tokens per participant \( \times \) 60 participants). All tokens were coded on an SPSS data file. The information included for each token was the following: (a) participant code number, (b) participant’s proficiency level, (c) token number, (d) participant exact oral response, (e) test item, (f) verb type for each test item, (g) accuracy of the response, and (h) participant’s behavior in relation to the test item.

The accuracy of the response variable was coded according to three options: (a) correct, (b) incorrect, or (c) does not apply, used when the participant skipped the test item. The variable with the greatest range of options was the participant’s behavior in relation to the test item, for which the same codes as in Experiment 1 were used (see Table 4-4 and Appendix J for more information).

4.3.1. Accuracy Results

In this section, the accuracy results are reported. Any given verb form was considered correct if it was produced following the grammar rules of Spanish or by using the corresponding memorized item and/or making the appropriate vowel change, even if it was not the first choice of the participant. Table 4-8 displays the accuracy on the different verb types per proficiency group. Participants obtained greater accuracy results for regular verbs than for the rest of the verb types. In general, they also got better results for irregular verbs than for stem change verbs. For example, the highest accuracy rate on the regular verbs by any group of participants was 95% (for high frequency regular verbs by bilinguals), while the greatest accuracy rate for irregular verbs was 85% (for high frequency irregular verbs by bilinguals) and for stem change verbs it was 83.33% (for high frequency stem change verbs by the advanced group).
Table 4-8. Accuracy rates on the different verb types of high and low frequency for the Production Task for all groups of participants (1,440 tokens). Percentage (correct responses/test items per group of participants and verb type)

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th></th>
<th>Irregular</th>
<th></th>
<th>Stem Change</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Beginning</td>
<td>83.33%</td>
<td>68.33%</td>
<td>40%</td>
<td>25%</td>
<td>43.33%</td>
<td>30%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(50/60)</td>
<td>(41/60)</td>
<td>(24/60)</td>
<td>(15/60)</td>
<td>(26/60)</td>
<td>(18/60)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>85%</td>
<td>78.33%</td>
<td>65%</td>
<td>50%</td>
<td>55%</td>
<td>36.67%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(51/60)</td>
<td>(47/60)</td>
<td>(39/60)</td>
<td>(30/60)</td>
<td>(33/60)</td>
<td>(22/60)</td>
</tr>
<tr>
<td>Advanced</td>
<td>90%</td>
<td>81.67%</td>
<td>71.67%</td>
<td>45%</td>
<td>83.33%</td>
<td>40%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(54/60)</td>
<td>(49/60)</td>
<td>(43/60)</td>
<td>(27/60)</td>
<td>(50/60)</td>
<td>(24/60)</td>
</tr>
<tr>
<td>Bilingual</td>
<td>95%</td>
<td>90%</td>
<td>85%</td>
<td>68.33%</td>
<td>81.67%</td>
<td>66.67%</td>
</tr>
<tr>
<td>(N = 15)</td>
<td>(57/60)</td>
<td>(54/60)</td>
<td>(51/60)</td>
<td>(41/60)</td>
<td>(49/60)</td>
<td>(40/60)</td>
</tr>
</tbody>
</table>

An interesting result for the present study is the contrast between the regular verbs on the one hand and the irregular and the stem change verbs on the other hand; i.e., participants from all proficiency groups consistently obtained the highest accuracy results on the regular verbs. This distinction becomes more evident for the low frequency test items on all verb types, e.g., the beginning group got 68.33% (41/60) of the low frequency regular verb forms correct, which, conversely, was in sharp contrast to their accuracy on the low frequency irregular (25%, 15/60) and low frequency stem change verb forms (30%, 18/60). This pattern is also visible for the other groups of participants.

When looking at the results of late L2 learners only, as expected, their accuracy scores on all verb types became progressively higher across the proficiency groups. For example, the beginning learners got 30% of the low frequency stem change verbs correct, while the intermediate learners obtained an accuracy rate of 36.67% and the advanced learners 40%. The only exception were the low frequency irregular verbs, for which the intermediate group obtained slightly better accuracy results (50% or 30/60 verb forms produced correctly) than the advanced group (45% or 27/60 verb forms produced correctly).
In order to check if there were frequency effects in the accuracy rates to the different verb types in this Production Task, a series of independent-samples $t$ tests were run taking frequency as the grouping variable. These tests were run for each proficiency group individually.

Frequency effects were found for some verb types among the advanced and the bilingual groups only (see Table 4-9). By contrast, there were no frequency effects in the accuracy rates for any verb type in the beginning or intermediate groups, as shown in Table 4-9.

Table 4-9. Independent-samples $t$ test results for accuracy rates by all groups of learners in the Production Task: Comparison between test items of high and low frequency. Mean accuracy rate (SD)

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Frequency</th>
<th>Beginning (N = 15)</th>
<th>Intermediate (N = 15)</th>
<th>Advanced (N = 15)</th>
<th>Bilingual (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>High</td>
<td>83.33 (27.82)</td>
<td>85.00 (22.76)</td>
<td>90.00 (12.68)</td>
<td>95.00 (14.02)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>68.33 (38.34)</td>
<td>78.33 (35.19)</td>
<td>81.67 (22.09)</td>
<td>90.00 (18.42)</td>
</tr>
<tr>
<td>Irregular</td>
<td>High</td>
<td>40.00 (35.10)</td>
<td>65.00 (22.76)</td>
<td>71.67* (26.50)</td>
<td>85.00* (22.76)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>25.00 (28.35)</td>
<td>50.00 (29.89)</td>
<td>45.00* (31.62)</td>
<td>68.33* (22.09)</td>
</tr>
<tr>
<td>Stem Change</td>
<td>High</td>
<td>43.33 (33.36)</td>
<td>55.00 (35.61)</td>
<td>83.33** (24.40)</td>
<td>81.67 (19.97)</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>30.00 (27.06)</td>
<td>36.67 (28.14)</td>
<td>40.00** (33.81)</td>
<td>66.67 (33.63)</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, two-tailed, equal variances assumed

In the group of advanced learners, there were frequency effects in the accuracy rates of irregular and stem change verb forms (see Table 4-9). Advanced learners obtained significantly higher accuracy results ($t = 2.503, df = 28, p = .018$) for high frequency irregular (M = 71.67, SD = 26.50) than for low frequency irregular (M = 45, SD = 31.62) verb forms as well as significantly higher accuracy results ($t = 4.026, df = 28, p = .000$) for high frequency stem change (M = 83.33, SD = 24.40) than for low frequency stem change (M = 40, SD = 33.81) verb forms. These frequency effects were not present for the group of regular verbs.
In the group of bilingual speakers, there were frequency effects which were marginally significant ($t = 2.035$, $df = 28$, $p = .051$) in the accuracy results of irregular verbs only, as shown in Table 4-9. They produced all high frequency verb forms with greater accuracy than low frequency verb forms, irrespective of the verb types, but results only neared significance for irregular verbs.

![Accuracy Rates for High Frequency Verbs](image)

*Figure 4-10. One-way ANOVA with Tukey post hoc test on the accuracy rates for high frequency irregular verbs comparing the beginning, intermediate and advanced learners for Production Task*

* *p < .05, (*) p < .1, n.s. = non significant*

In order to track developmental changes on the different verb types by the late L2 learners, one-way ANOVAs were run with the post hoc Tukey test. There were significant results only for high frequency irregular (N = 45, $F = 5.114$, $p = .010$) and high frequency stem change verbs (N = 45, $F = 6.398$, $p = .004$), as displayed in Figures 4-10 and 4-11. No significant differences were found for the regular verb forms, which indicates that late learners start with a
very high accuracy level for those verbs and that this level remains constant across proficiency levels.

* $p < .05$, ** $p < .01$, n.s. = non significant

Figure 4-11. One-way ANOVA with Tukey post hoc test on the accuracy rates for high frequency stem change verbs comparing the beginning, intermediate and advanced learners for Production Task

These results indicate that across proficiency levels, late learners improve more on those items which are sensitive to input frequency. High frequency irregular verb forms benefit mostly at the beginning stages of acquisition (as shown in Figure 4-10), from the beginning to the advanced (MD = -31.667, SEM = 10.440, $p = .011$) proficiency levels but also from the beginning to the intermediate ones (MD = -25.000, SEM = 10.440, $p = .054$), even though the latter difference only nears significance, as indicated by the Tukey post hoc results mentioned. In contrast, high frequency stem change verb forms improved at later stages of acquisition (as shown in Figure 4-11), from the beginning to the advanced (MD = -40.000, SEM = 11.501, $p = \ldots$
.003) as well as from the intermediate to the advanced (MD = -28.333, SEM = 11.501, \( p = .046 \)) proficiency levels.

If we compare the results of the advanced learners and those of the bilingual speakers, their accuracy rates were very similar for most of the verb types, except for the low frequency irregular and stem change verbs. Statistically speaking, similar results were found in terms of a clear dissociation between regular verb forms on the one hand and the irregular and stem change verb forms on the other hand. Independent-samples \( t \) tests were run and the only significant results found are displayed in Figure 4-12.

![Figure 4-12. Independent-samples t test results for accuracy on the different verb types for Production Task: Comparison between the advanced and bilingual groups (N = 30)](image)

*\( p < .05 \), n.s. = non significant, two-tailed, equal variances assumed

No significant differences were found for regular verbs. There were significant differences between these two groups in their accuracy for irregular (\( t = -2.343, df = 28, \ p = .026 \)) and stem change (\( t = -2.166, df = 28, \ p = .039 \)) verb forms, but this time the differences were found only for the low frequency forms. Bilingual speakers obtained significantly better accuracy results for the low frequency irregular (M = 68.33, SD = 22.09) and the low frequency
stem change (\(M = 66.67, SD = 33.63\)) verb forms than the advanced learners (\(M = 45, SD = 31.62\) for irregular and \(M = 40, SD = 33.81\) for stem change verb forms).

If morphological information is handled and encoded by a single system or pattern associator with no intervening rules, then participants’ accuracy rates on any verb form should correlate with the frequency of the Spanish verb form in question, irrespective of its morphological decomposition and internal structure (section 1.1.1.). These results should be more robust for beginning learners because the initial stages of acquisition are more lexical. In order to test these claims statistically, a Pearson bivariate correlation was run between the frequency of these 24 test items as measured by the averaged frequency of the three corpora, and the participants’ accuracy on these items. These correlations were run taking the accuracy rates from the different proficiency groups separately and irrespective of verb types, i.e., all test items at once without further taxonomies. Results indicated that the frequency of the specific verb forms in Spanish never correlated with the accuracy levels of any group: beginning group (\(r = .058, p = .787, n = 24\)), intermediate group (\(r = .308, p = .143, n = 24\)), advanced group (\(r = .214, p = .315, n = 24\)), and bilingual group (\(r = .096, p = .657, n = 24\)). These results are good evidence against the unitary models of morphological representation.

In sum, accuracy results show that all groups of learners obtained high levels of accuracy for regular verb forms and no gains were attained as the proficiency level in the target language increased. Late learners with greater proficiency levels obtained better results for irregular and stem change verb forms of high frequency while the main production differences between the advanced and the bilingual groups in this task was found in the irregular and stem change verb forms of low frequency. No correlations were present between participants’ accuracy and the overall frequency of the verb forms under investigation.
4.3.2. Error Types and Participants’ Behaviors

The second half of the data analysis for the Production Task provides a descriptive report on the most prevalent errors that the different groups of participants exhibited in their oral narratives. First, the most prevalent behavior and/or error for each verb type are described and then the internal structure of the error and/or the relevance of the observed behavior are explained. Table 4-10 summarizes the most prevalent behavior/error by these groups of participants, arranged by verb type. In this section, an asterisk represents an incorrect verb form given the instructions of the task (provide the third person singular preterite) instead of given the morphological structure of the verb form.

Table 4-10. Summary of participants’ main errors for all groups of learners (N = 60) and by verb type in Production Task. Rate of the main error (number of errors with the main error type/total number of errors per group of participants and verb type)

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th></th>
<th>Irregular</th>
<th></th>
<th>Stem Change</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Beginning (N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>3, 6, 10 &amp; 17</td>
<td>3</td>
<td>7 &amp; 10</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>20%</td>
<td>26.32%</td>
<td>22.22%</td>
<td>48.89%</td>
<td>41.18%</td>
<td>52.38%</td>
</tr>
<tr>
<td>Intermediate (N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>10</td>
<td>13</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>44.44%</td>
<td>46.15%</td>
<td>33.33%</td>
<td>60%</td>
<td>66.67%</td>
<td>68.42%</td>
</tr>
<tr>
<td>Advanced (N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>3</td>
<td>3</td>
<td>10 &amp; 16</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>50%</td>
<td>54.55%</td>
<td>29.41%</td>
<td>51.52%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Bilingual (N = 15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error type</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Error rate</td>
<td>100%</td>
<td>100%</td>
<td>55.56%</td>
<td>36.84%</td>
<td>63.64%</td>
<td>60%</td>
</tr>
</tbody>
</table>

4.3.2.1. Errors associated with regular verb forms

It is important to remember that regular verbs were always produced with greater accuracy than irregular verbs and stem change verbs. The lowest accuracy for regular verb forms was observed for low frequency regular verbs by beginning learners, with an accuracy rate of 68.33%. That rate is the same or greater than any accuracy rate for low frequency irregular verbs.
and stem change verbs by any group of participants, including the bilingual speakers, who had
68.33% accuracy for low frequency irregular verbs and 66.67% for low frequency stem change
verb forms. As a consequence, there were few examples per observed behavior/error type.
Table 4-10 displays the main behavior/error for high and low frequency regular verbs by each
group of participants. With the exception of the intermediate learners, the main cognitive
strategy by the participants was to produce a nonfinite form, mostly the infinitive, after another
verb in the preterite: *pudiera regalar (‘s/he could give away’) instead of the preterite form.

Beginning learners showed a variety of errors and behaviors for regular verb forms and
there is a lack of consistency in their use. First, the most prevalent errors with high frequency
regular verbs are described. For the verb llamar (‘to call’) one participant produced *se llamar
(behavior 3), another said *llamé (‘I called’) and another used the present tense *llama (‘s/he
calls’). Two participants produced the nonexistent verb form *merió for the verb mirar (‘to
look’). One participant skipped the verb nacer (‘to be born’), although most of them produced it
morphologically correctly, even if they placed the stress on the wrong vowel (behavior 8) as in
*nacio (‘s/he was born’), by two participants. With the verb tomar (‘to take’), the observed
errors were: *tomar (behavior 3), *tomió (error 16), and *toma (error 10). Similar results were
found in the group of low frequency regular verbs. There were two nonexistent forms for the
verb esperar (‘to wait’): *espreó and *esparió. The verb inventar (‘to invent’) was produced
incorrectly by three participants with a TAM suffix from another verb class, i.e., *inventió (‘s/he
invented’). And regalar (‘to give away’) was either used as a noun or in a nonfinite form: *da un
regale or *para regalar, for example. Finally, the main behaviors with the verb escapar (‘to
escape’) were avoidance (behavior 7), a different tense as in *se escapa (present), and a TAM
suffix from another verb class *escapió.
In the intermediate group there was a greater variety of errors when participants did not provide a correct response. In the group of high frequency regular verbs, llamar (‘to call’) was used in the progressive once *llamando (‘calling’). The verb mirar (‘to watch’) was used once in the present tense *mira (‘s/he watches’) and once with an incorrect PN suffix in the preterite, i.e., *miré (‘I watched’). Although nacer (‘to be born’) was used by one student in a passive construction, the main behavior with this verb was to skip it; two participants did not provide a response for it. And for tomar (‘to take’), two participants used it in the preterite with the incorrect PN suffix: *tomé (‘I took’). In the group of low frequency verbs, escapar (‘to escape’) was used by two participants with a wrong root, changing the root vowel from a to e: *esquepó (‘s/he escaped’). A similar error was observed for the verb inventar (‘to invent’), with four participants producing it with the initial vowel pronounced as an e, not i, as in *enventó (‘s/he invented’). Esperar (‘to wait’) was used once in the progressive and once in the imperfect tense as the most prevalent errors. And for regalar (‘to give away’) there were two present tense forms (*regalo and *regala: ‘I give away’ and ‘s/he gives away,’ respectively), as well as two nonfinite/noun forms (error 3): *dio la regala (‘s/he gave away’) and *para regalar (‘in order to give away’).

In the advanced group there was an increase in behavior 3, or the use of nonfinite verbs for both high and low frequency regular verbs. In the group of high frequency regular verbs, nacer (‘to be born’) was always produced accurately. For the verb llamar (‘to call’) there was an example of the test item used as a noun *hizo una llamada (‘s/he made a phone call’) and one example of wrong root *llomó. The verb mirar (‘to watch’) was skipped once and also used by another participant in a nonfinite form: *quiso mirar (‘s/he wanted to watch’). The verb tomar (‘to take’) was used once in the plural *tomaron (‘they took’) and once in a nonfinite form: *tuve
that que tomar (‘I had to take’). In the group of low frequency regular verbs, both escapar (‘to escape’) and esperar (‘to wait’) were produced in a nonfinite form when used incorrectly, as in *tenía que escapar (‘s/he had to escape’), two examples of *estaba esperando (‘s/he was waiting’), and *tenía que esperar (‘s/he had to wait’). The only error with the verb regalar (‘to give away’) was to provide a wrong root as a result of syllable confusion or metathesis: *relagó instead of regaló. And for the verb inventar (‘to invent’) there were three errors: a nonfinite form in *decidió de inventar (‘s/he decided to invent’), a wrong root in *enventó (‘s/he invented’), and the use of a TAM suffix from another verb class in *inventió.

Bilinguals always produced the regular verbs nacer (‘to be born’), tomar (‘to take’) and escapar (‘to escape’) correctly. The main behavior with the remaining high and low frequency verbs was to use a nonfinite form as in *para llamar (‘in order to call’) or *estaba esperando (‘s/he was waiting’).

4.3.2.2. Errors associated with irregular verb forms

The behaviors and errors observed for the irregular verb forms are different from those for the regular verb forms. Table 4-10 clearly shows that the main error with low frequency irregular verbs was overregularization. This indicates that when L2 learners did not have a memory trace for a given past form related to the infinitive form, they simply attached a regular ending to the stem of the verb, hoping that the final product would be part of the Spanish language. For example, they said *cabió (‘it fit’) instead of cupo, or *reducíó (‘s/he reduced’) instead of redujo. As for high frequency irregular verbs, the most prevalent behaviors/errors were to avoid providing the corresponding irregular verb form (behavior 7) or to substitute a verb form in the preterite with a different PN suffix (error 16) or in another tense (error 10). Although there was some room for variability in the errors made by these groups of participants when handling high frequency irregular verb forms, a form in a different tense was the main
error and the significance of this error is discussed at the end of this section. First, however, the most prevalent behaviors/errors for the specific verb forms elicited by each proficiency group are described.

Beginning learners overregularized the following low frequency irregular verbs: *andar* (‘to walk’), *extraer* (‘to extract’), and *reducir* (‘to reduce’). Their incorrect responses show that they have two different rules at work, whether the verb in its infinitive belongs to the first class or the second/third class: they said *andó* (‘s/he walked’); but in the case of *extraer* and *reducir*, they said *extraió* (‘s/he extracted’) and *redució* (‘s/he reduced’). The verb *caber* (‘to fit’) was the least frequent of all four low frequency irregular verbs and most beginning participants skipped this test item. The main observed behaviors when dealing with high frequency irregular verbs were skipping of the test item and providing a form from a different tense. However, beginning learners treated all four high frequency irregular verbs differently. For the most part, the verb *decir* (‘to say’) was conjugated in the present tense, two *digo* (‘I say’) forms and one *dice* (‘s/he says’) form. The verb *poder* (‘to be able to’) was usually skipped. This test item in particular was difficult to grasp for some participants since it depicted a man on top of a scale with a text bubble which said “83 > 75” and learners should have said something like ‘he was able to lose weight’ (*pudo bajar de peso*). The main error with the verb *poner* (‘to put’) was to provide a nonexistent verb form or a form that belongs to a different verb, in this case the verb *poder* (‘to be able to’) because of obvious similarity. The attested forms were: *pongió, pongos(las), and *pudo*, while the expected preterite verb form was *puso*. For the last high frequency irregular verb, *venir* (‘to come’), beginning participants used the correct irregular stem but attached to it the incorrect TAM suffix –ió: *vinió* (‘s/he came’). This error is interesting in
that it is the opposite case to the observed behavior for most incorrect stem change verbs, where learners used the correct ending but forgot to change the vowel in the stem.

Intermediate learners also overregularized the low frequency irregular verbs, using the two rules described by the beginning group, i.e., –ó and –ió, depending on the verb class: *andó (‘s/he walked’) instead of anduvo or *redució (‘s/he reduced’) instead of redujo. For the verb caber (‘to fit’), in half of their errors intermediate participants produced the nonexistent verb form *cubo, which is very similar to the expected correct form cupo. As with the beginning learners, the intermediate group employed a variety of behaviors and made a range of errors specific to the high frequency irregular verb forms. Of the two errors with the verb decir (‘to say’), one was a different PN suffix: *dije (‘I said’), and the other was a different tense: *dice (‘s/he says’). Most errors with poder (‘to be able to’) were to produce preterite forms of the verb poner (‘to put’): *se puso (‘s/he put’) and *puse (‘I put’). This confusion of poder/poner verb forms was not present with the errors for poner (‘to put’), because the main error with poner was to conjugate it with a different PN suffix, such as *puse (‘I put’). Two imperfect and one present venir (‘to come’) forms were the most prevalent error type with this verb: *venía (2) and *viene. There were also three participants who produced this verb in the preterite with a TAM suffix from another verb class, i.e., the irregular rule was applied but with a wrong ending: *vinió (‘s/he came’). These examples are similar to overregularizations but using the irregular stem [vin-], which was kept.

All advanced learners treated the four low frequency irregular verbs similarly, with the most prevalent error type for each of them being overregularization: *andó (‘s/he walked’), *cabió/*cabó (‘s/he fit’), *extraitó (‘s/he extracted’), and *redució (‘s/he reduced’). The most prevalent behavior/error for the high frequency irregular verbs was specific to the test item in
question. For the verb *decir* (‘to say’), the main error was to provide the imperfect form *decía* (‘s/he used to say’). The verb *poder* (‘to be able to’) was skipped twice and another two advanced participants provided the present tense verb forms *puede* (‘s/he can’) and *puedo* (‘I can’) instead of the corresponding preterite verb form. As for the verb *poner* (‘to put’), there was a range of answers when it was not conjugated correctly, with one example for each: *puse* (‘I put’) whether as the first answer or the final answer after another failed response, *ponía* (‘s/he used to put’) and *pudo* (‘s/he was able to’), examples of behaviors/errors 6, 14, 10, and 17, respectively. Finally, four advanced learners produced the incorrect verb form *vinió* instead of *vino* (‘s/he came’).

Among the bilinguals, there was a variety of errors for high and low frequency irregular verb forms. However, the most prevalent error for low frequency irregular verbs was overregularization and for high frequency irregular verbs it was to provide a verb form in a different tense. The verbs *andar* (‘to walk’) and *extraer* (‘to extract’) were overregularized: *andó* and *extraió*, respectively. For *caber* (‘to fit’), there were two cases of nonfinite forms: *pudo caber* (‘s/he could fit’) as a way to avoid providing the elicited preterite form *cupo* (‘s/he fit’). The remaining low frequency irregular verb *reducir* (‘to reduce’) was either overregularized after providing the correct verb form (“hypercorrection”) as in *redujo* > *redució* (‘s/he reduced’), or it was used in a different tense as in *redujiera* (wrong form for ‘I would reduce’) or *reduzco* (‘I reduce’). The most prevalent behaviors/errors for the high frequency irregular verbs were the following: the verb *poner* (‘to put’) was produced correctly in the preterite (*puso*) by all participants. Two bilingual participants produced the verb form *decidió* (‘s/he decided’) as the preterite verb form for the verb *decir* (‘to say’), which clearly belongs to a different verb (error 17). One verb form in the imperfect *podía* (‘s/he could’) and a form from a different verb
*subió de peso* (‘s/he gained weight’) were the only two errors with the verb *poder* (‘to be able to’). Finally, the main error with the verb *venir* (‘to come’) was to produce it in a different tense, as in *venía* (‘s/he used to come’) or *viniera* (‘s/he would come’).

Since the first stages of acquisition of a foreign language are usually considered lexical in nature, according to the predictions of the Cognitive Approach to language learning by Skehan (1998), the frequency of the different verb forms of every verb in this task may be playing a role in the developing system of these groups of learners. Since irregular verb forms are the ones to be stored and handled by the declarative memory system, the verb forms with the greatest frequency may be the ones accessed the fastest, irrespective of the tense they belong to. As shown in Table 4-10, most learners who erred in the preterite of high frequency irregular verbs did so by using a verb form from another tense. It is relevant for the present study to check if the verb forms supplied incorrectly were more frequent in the Spanish language than the preterite verb form being elicited, i.e., than the third person preterite form. This will indicate if frequency played an interfering role for high frequency irregular verb forms.

For each high frequency irregular verb, the most frequent verb forms for that lemma were checked in the *Corpus del Español*. This corpus proved to be the most resourceful one of the three used in this study, as explained in section 3.4.2., and it was the only one employed for this report. If we do not take into account plural verb forms (in the picture-story sequence there is only one character and the instructions asked participants to report only what he did), nonfinite verb forms (e.g., infinitive, progressive, past participle), and the remainder of the singular preterite forms (better accounted for by behavior/error 6), these participants used singular verb forms in a tense which is among the most frequent one in Spanish for that verb in question. For example, there were three examples of the verb form *dice* (‘s/he says’) instead of the elicited
dijo (‘s/he said’), and the raw token count from the CDE showed that *dice* was the following most frequent singular verb form after *dijo* for that verb in Spanish, following the criteria just described. As shown in Table 4-11, the only exceptions to this pattern were the third person singular conditional tense forms *podría* and *vendría* and the third person singular future form *vendrá*, which were never used in the production of these learners.

Table 4-11. Raw token counts for the most frequent verb forms of the high frequency irregular verbs used in Task 1, ranked according to the data from the *Corpus del Español*.

<table>
<thead>
<tr>
<th></th>
<th>decir (‘to say’)</th>
<th>poder (‘to be able to’)</th>
<th>poner (‘to put’)</th>
<th>venir (‘to come’)</th>
</tr>
</thead>
<tbody>
<tr>
<td>form</td>
<td>#</td>
<td>?</td>
<td>form</td>
<td>#</td>
</tr>
<tr>
<td>dijo</td>
<td>14308 E</td>
<td>puesto 18591 ✓</td>
<td>2550 E viene 2757 ✓</td>
<td></td>
</tr>
<tr>
<td>decir</td>
<td>12599 N</td>
<td>poder 8346 N</td>
<td>puso 2254 E vino 1229 E</td>
<td></td>
</tr>
<tr>
<td>dice</td>
<td>✓ 7794 N</td>
<td>puseden 8114 N</td>
<td>poner 2136 N venir 1195 N</td>
<td></td>
</tr>
<tr>
<td>dicho</td>
<td>4159 N</td>
<td>podía 5287 ✓</td>
<td>pone 1427 ✓ venido 1120 N</td>
<td></td>
</tr>
<tr>
<td>digo</td>
<td>✓ 4029 N</td>
<td>podria 4586 ×</td>
<td>ponía 677 ✓ venia 1090 ✓</td>
<td></td>
</tr>
<tr>
<td>decia</td>
<td>✓ 3730 N</td>
<td>pudo 3319 ✓</td>
<td>poner 664 N vienen 1043 N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓  pudo 2477 E</td>
<td></td>
<td>puesta 623 N venga 827 ×</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pusieron 597 N venian 467 N</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ponerse 545 N vinieron 368 N</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>puse 476 N vengo 272 ✓</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>poniendo 472 N vine 267 N</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>puertos 351 N vengan 237 N</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pongo 343 ✓ vendría 175 ✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>vendrá 166 ×</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>venimos 154 N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>viniera 140 ✓</td>
</tr>
</tbody>
</table>

E = elicited verb form, N = not attested in data and/or not applicable, ✓ = used, × = not used

Arguably, we can conclude that behavior 10, or the use of a different tense, by all groups of participants as the most prevalent behavior for high frequency irregular verb forms is sensitive to the frequency of the different verb forms used incorrectly. To put it differently, when these groups of L2 learners produced an incorrect verb form from a different tense, they always used the verb forms with the highest frequencies in the Spanish language for the test items being elicited, as shown in Table 4-11 with a ✓.

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15 These token counts were obtained during the month of February 2009.
4.3.2.3. Errors associated with stem change verb forms

When looking at the results for stem change verb forms only, it becomes evident that the most prevalent error by all groups of learners was to omit the internal vowel change while adding the appropriate regular ending to the verb forms. For example, they produced *corregió (‘s/he corrected’). The regular TAM suffix –ió was attached correctly to the stem of the verb but most participants failed to change the vowel of the root from e to i (all eight stem change verb forms in the picture-story sequence required this vowel change). When tracking developmental changes across proficiency levels, it also becomes clear that the greater the proficiency level of late learners, the greater the rate of no vowel change with this verb type, irrespective of the frequency of the items. These differences between the proficiency groups indicate that even though late L2 learners improve in their accuracy for stem change verbs, the enduring error, when it occurs, is to forget to make the corresponding vowel change. For most bilingual speakers as well, this error is still the main observed behavior for high and low frequency stem change verb forms when produced incorrectly.

When looking at the results for the different test items individually, a significant percentage of beginning learners neglected to make the vowel change as the most prevalent error for all verb items in the stem change groups except for the verb sentir (‘to feel’). *Repetió (‘s/he repeated’) or *vertió (‘s/he poured’) appeared very frequently in their production when they did not produce those verb forms correctly. For sentir (‘to feel’), most beginning learners placed the stress on the high vowel of the final diphthong, in addition to not making the internal vowel change, e.g., *sentío (‘s/he felt’).

Similar results were observed with the intermediate group. The most frequent error type for all stem change test items was behavior 2, i.e., not changing the vowel but adding the correct TAM suffix. The only verb that was treated differently was repetir (‘to repeat’) in that half of the
errors were behavior 10, or the attachment of a suffix from a different tense, this time the present tense: *repite and *repito.

The main error for the stem change verb forms which were produced incorrectly by the advanced group was again the absence of the vowel change. There was one exception only: the verb seguir (‘to follow’), which all advanced learners produced correctly.

All bilingual speakers always produced the elicited preterite form for the stem change verb conseguir (‘to get’) correctly. Again, the main error for those items produced incorrectly was the absence of the vowel change. For the verb repetir (‘to repeat’), there were a couple of other observed behaviors besides no vowel change: to use an infinitive form as in *volvió a repetirla (‘s/he repeated it again’) and to use a different tense as in *que lo repitiera (‘that s/he repeat it’). However, these instances of the verb repetir (‘to repeat’) while coded as incorrect according to the instructions of the task, are correct in Spanish because they were inserted in a more descriptive narrative in the past with a wider variety of past tenses. Bilinguals used a more developed narrative and they did not pay such close attention to the instructions of the task, which limited their description to the preterite tense.

In sum, if we consider the most prevalent behaviors/errors for the different verb types by all groups of participants, the following patterns were found: (a) all groups forgot to change the vowel of the stem change verbs from e to i in the preterite; (b) they all overregularized the low frequency irregular verbs by applying two different rules: –ó to andar (‘to walk’), and –ió to caber (‘to fit’), extraer (‘to extract’), and reducir (‘to reduce’); (c) most groups of participants provided verb forms in other tenses for high frequency irregular verbs; and (d) the use of a noun from the verb stem or of a nonfinite form was usually provided for high and low frequency regular verbs by most groups of participants, except for the intermediate group.
4.4. Methodological Triangulation of Results

In this last section, the main dissociations or frequency effects found in the different tasks between regular verbs on the one hand, and irregular and stem change verbs on the other hand are outlined. Those developmental changes which were significant across the three proficiency groups of late learners are also mentioned. Finally, the differences which reached statistical significance when comparing the advanced groups of speakers with an early (English/Spanish bilinguals) vs. late (advanced late learners) age of initial exposure to Spanish are discussed. In this section, those results which were only descriptive are not included, i.e., the differences in the error types and observed behaviors when the participants did not provide a correct response.

In the design of this study, the frequency of the test items in the Spanish language was a key variable in determining if L2 learners may be representing and/or accessing fully inflected verbal forms via two different mental systems. If so, frequency should play a role for irregular and, perhaps, stem change verb forms but it should never play a role for regular verb forms. For the most part these predictions were born out in the RT results for the different verb types, as shown in Figure 4-13.

In Experiment 1, there were frequency effects for irregular verbs by the beginning group but in the reversed direction, i.e., it took them longer to produce correct high frequency than to low frequency irregular verbs (see Table 4-1). There were also frequency effects for stem change verbs by the bilingual group only, this time in the expected direction (see Table 4-1). And in Experiment 2, frequency effects in the RTs to stem change verb forms played a role for all groups of learners, except the bilinguals (see Table 4-7). In this experiment, there were also frequency effects in the RTs to irregular verb forms, but only for the beginning and the advanced learners (see Table 4-7). The frequency effects were more robust \( p < .01 \) for the intermediate and advanced groups than for the beginning group \( p < .05 \), indicated by italics in Figure 4-13.
When looking at possible frequency effects in the accuracy rates to the different verb types used in the three tasks, there were interesting results, outlined in Figure 4-14. All groups of learners obtained significantly better accuracy results for high frequency irregular than for low frequency irregular verb forms in Experiment 1 (Table 4-3). In this experiment, there were frequency effects for regular verbs in the intermediate group only, which is the only piece of evidence obtained that does not support regular-irregular dissociations (see Table 4-3). In Experiment 2, the frequency effects were observed for the stem change verb forms among all groups of late learners only, although there were also frequency effects for irregular verbs by the intermediate group (Table 4-6). And in the Production Task, the only frequency effects found

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**Figure 4-13. Outline of statistically significant frequency effects in RTs for all verb types in Experiments 1 and 2**

<table>
<thead>
<tr>
<th>Verb Type</th>
<th>Learning Level</th>
<th>Exp. 1</th>
<th>Exp. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Verbs</td>
<td>Beginning</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Bilingual</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Irregular Verbs</td>
<td>Beginning</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Bilingual</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Stem Change Verbs</td>
<td>Beginning</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Bilingual</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

\(\checkmark\) = results in the expected direction, \(\times\) = results in the opposite direction
were for irregular verbs by the advanced and bilingual groups as well as for stem change verb forms by the advanced learners only (Table 4-9).

Figure 4-14. Outline of statistically significant frequency effects in accuracy rates for all verb types in Experiments 1 and 2 as well as in the Production Task

In order to track developmental changes across proficiency levels in this cross-sectional study, a series of one-way ANOVAs were run on the accuracy rate and RT results between the three groups of late learners. There were significant results for Experiment 1 and the Production Task only, as shown in Figure 4-15. In general, intermediate and advanced learners were faster than the beginning learners at providing a correct preterite form for regular verbs of high and low

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frequency (see Figures 4-2 and 4-3). These improvements in RTs were not obtained for irregular or stem change verbs.

<table>
<thead>
<tr>
<th>Changes Over Time</th>
<th>Exp.1</th>
<th>Exp.2</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RT gains</strong></td>
<td>Regulars</td>
<td>High freq.</td>
<td>YES, B-I, B-A</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>YES, (B-I), (B-A)</td>
<td>(Figure 4-3)</td>
</tr>
<tr>
<td></td>
<td>Irregulars</td>
<td>High freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Stem change</strong></td>
<td>Regulars</td>
<td>High freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy gains</strong></td>
<td>Regulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Exp.1</strong></td>
<td>Irregulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Stem change</strong></td>
<td>Regulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy gains</strong></td>
<td>Regulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Exp.2</strong></td>
<td>Irregulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Stem change</strong></td>
<td>Regulars</td>
<td>High &amp; low freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy gains</strong></td>
<td>Regulars</td>
<td>High freq.</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td>Irregulars</td>
<td>High freq.</td>
<td>YES, (B-I), B-A</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td><strong>Stem change</strong></td>
<td>Regulars</td>
<td>High freq.</td>
<td>YES, B-A, I-A</td>
</tr>
<tr>
<td></td>
<td>Low freq.</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

B = beginning, I = intermediate, A = advanced

Figure 4-15. Outline of statistically significant developmental changes in RTs and accuracy scores between the three groups of late learners in Experiments 1 and 2 as well as in the Production Task.

When tracking developmental changes in the accuracy of their responses to the test items, in both Experiment 1 and the Production Task the advanced learners obtained significantly better results than beginning learners when producing correct high frequency irregular forms (see Figures 4-8 and 4-11 for Experiment 1 and Production Task, respectively) and correct high frequency stem change forms (see Figures 4-5 and 4-12, in the same order). In addition, in the Production Task
advanced learners obtained significantly better accuracy results than the intermediate learners for high frequency stem change verbs (see Figure 4-11). The advanced group also obtained significantly better accuracy results than the beginning group in Experiment 1 for low frequency stem change verbs (see Figure 4-5) and for high frequency regular verbs (see Figure 4-6). Finally, the intermediate learners also obtained better accuracy results than the beginning group in Experiment 1 for high frequency regular verbs (see Figure 4-6).

The last set of significant results was found between the advanced group of late learners and the English/Spanish bilinguals (see Figure 4-16).

Figure 4-16. Outline of statistically significant differences in RTs and accuracy scores between the group of advanced late learners and the bilingual group in Experiments 1 and 2 as well as in the Production Task

There was also consistency across the different tasks used in this study because in Experiment 1 as well as in the Production Task, bilingual speakers obtained significantly better results in the accuracy to low frequency irregular verb forms and in the accuracy to low frequency stem change verb forms (see Figures 4-9 and 4-13, respectively). In this case, it did not matter if these
verb forms were elicited in isolation (Experiment 1) or if they were elicited in sentence contexts (Task). These results also provide a new set of evidence of dissociations between regular verbs and the other verb types in this study because the statistical tests performed never showed significantly better results for bilinguals than for the advanced learners in their accuracy to regular verbs. In Experiment 2, the only significant result was that advanced learners took significantly longer to react to low frequency irregular verb forms than the group of bilingual speakers (Figure 4-9).

In sum, statistical results from the different tasks in this study provided evidence of dissociations in the frequency effects to the different verb types. However, some of these results were in the reversed direction and/or were not observed consistently in all groups of learners. The main improvements between the three groups of late learners were faster RTs for regular verbs when they had to produce them in isolation and significant improvements in accuracy rates to high frequency irregular and stem change verb forms, whether in isolation or in sentence contexts. There were also significantly better accuracy results for high frequency regular verbs and low frequency irregular verbs when participants had to provide preterite forms in isolation only. The bilingual speakers had a better knowledge and responded faster than advanced late learners to low frequency irregular verb forms. They also obtained better accuracy results when asked to produce low frequency stem change verb forms.
In this chapter, the results summarized in Chapter 4 are evaluated and discussed based on the research questions and the main goals of my study. The discussion is organized in three main sections. The first section (5.1.) answers the first and second research questions, which examined the regular-irregular\textsuperscript{1} dissociations that may be found in the accuracy scores, RTs, and/or error types for complex verb forms, due to their regularity and the frequency of their occurrence in the target language. Special attention is paid to the presence and significance of frequency effects in the results reported in the previous chapter. The second section (5.2.) addresses the main goal of the study: It provides answers to the third research question by describing the main developmental patterns in the acquisition of inflection morphology by late L2 learners. There is an emphasis on the mental representation and processing among the various groups of L2 learners included in the study and an attempt is made to explain how the L2 proficiency variable can account for differences in the accuracy scores, RTs, and/or error types in the verb types included in my investigation. Finally, section 5.3. describes the main differences between the advanced group of late L2 learners and the bilingual group in how they handle complex verb forms. This section addresses the fourth research question and helps in understanding what the main effects of greater amount of practice in the L2 and the age of initial exposure to the L2 are once a high proficiency level has been reached in the target language.

5.1. Regular-Irregular Dissociations and Frequency Effects

The DP model (Ullman, 2001b) proposes that late L2 learners will depend to a greater extent upon declarative memory (the memory system which handles arbitrary associations) in the

\textsuperscript{1} When there is a mention in this chapter to regular-irregular dissociations, the latter term includes the stem change verbs since stem change verbs are usually considered a subgroup of irregular verbs, based on the vowel change that is absent in the regular paradigm.
L2, as a function of age of initial exposure to the target language. But practice with the L2, besides an earlier initial age of exposure, should affect both grammatical proficiency and the degree of dependence on procedural memory for grammatical computations (e.g., the sequencing of morphemes for regular verbs). As mentioned in section 1.2.5., the later the initial age of exposure to the L2 and the less the practice with it, the weaker the dissociations should be (perhaps even to the point of absence) between the declarative and procedural memory systems because the procedural memory system is not used for regular verb forms yet. Forms which are normally compositionally computed by the procedural memory system in the L1 may simply be stored as memorized forms in the L2 lexicon, i.e., regular verb forms may be stored in the lexicon and accessed from the declarative memory system rather than being computed by the mental grammar. Some rules may be consciously/explicitly learned (especially in a formal instructional context, as was the case for the participants in the current study) and applied in the declarative memory, although they need not be. These learned explicit rules may be used by L2 learners to construct linguistic forms.

Based on these theoretical claims, the DP model suggests that in SLA both regular verbs and irregular verbs may be learned in and computed over associative memory, at least in the initial stages of acquisition, and both may show associative memory effects, e.g., frequency effects. Consequently, L2 speakers should show less separability between regular and irregular verb forms than L1 speakers since only for L1 processing do regular and irregular verb forms distinctively rely on either grammar or lexicon, respectively. The results of the present study are evaluated in light of these predictions in the following sections.

The first research question looked at the types of regular-irregular dissociations and frequency effects among the English/Spanish bilinguals for accuracy scores, RTs, and error types
for complex verb forms. The second research question investigated the same dissociations and frequency effects but among late L2 learners of varying proficiency levels.

5.1.1. Frequency Effects in the Accuracy Scores

On the one hand, if the DP model is accurate, there should be frequency effects by all the groups of participants, especially in the accuracy scores for irregular verbs, as they are supposed to be computed in the declarative memory. For the bilinguals, there should only be frequency effects for irregular verbs, whereas for the late L2 learners, there may be frequency effects for all verb forms. On the other hand, the higher the proficiency of the late L2 learners, the more probable it should be to find regular-irregular dissociations in the frequency effects for the accuracy scores, if they are present at all.

The group of bilinguals produced high frequency irregular verb forms with significantly greater accuracy than those of low frequency for Experiment 1 and for the Production Task. These frequency effects were not observed for the regular or the stem change verbs. These results support the claims of the DP model in that only irregular verbs showed associative memory effects, namely frequency effects. They also indicate that the accuracy scores for stem change verbs did not differ based on the frequency of the test items. This finding is in sharp contrast with the frequency effects found in the RTs to the stem change verbs in Experiment 1, which are discussed in section 5.1.2.

When regular verb forms are produced correctly by the bilingual participants, it is because they are computing them online using the procedural memory. The mental operation of sequencing should apply to all regular verbs irrespective of their frequency and, not surprisingly, no frequency effects were found for these verbs. An account of the absence of frequency effects for the stem change verbs is described in section 5.1.2.
Finally, in Experiment 2 there were no frequency effects among the group of bilinguals for any verb type. This can be explained by the ceiling effect that the task design provoked, i.e., most participants achieved 100% accuracy for all verb types due to the small number of options (only two) and task difficulty (not a production task). This is discussed in greater detail in section 5.2.1. In sum, for this group of participants, frequency effects were only observed in the accuracy scores to irregular verbs, as predicted by the DP model, because those forms are the ones retrieved from the declarative memory and are the only ones showing associative memory effects.

Turning to the various groups of late L2 learners, in Experiment 1, all groups of late L2 learners showed frequency effects in the accuracy scores to irregular verbs. These participants produced with greater accuracy the irregular verbs they encountered more often in the L2 input, so that the arbitrary mental associations between the verb roots and the irregular preterite forms were strengthened and the high frequency irregular forms were retrieved with greater accuracy. Additionally, intermediate learners produced regular verb forms with greater accuracy if they were of high frequency than those of low frequency. The DP model suggested that for late L2 learners there should be less separability between regular-irregular verbs because both could be initially computed in the declarative memory system and both should show frequency effects. The finding that only the intermediate group showed such frequency effects for the regular verbs may be explained in part by the task demands. L2 learners were asked to produce preterite forms in an oral elicitation task where verb forms were elicited individually and without a sentence context. The beginning learners were those who have been introduced to the preterite rules most recently in the classroom for the first time and they may have been the ones using those rules explicitly from the declarative memory. That is why all regular verbs of high and low frequency
were produced with about the same accuracy scores (84.67% for high and 83.33% for low regular verbs). But the learners in the intermediate group were taking grammar and composition courses in which the introduction of the preterite rules was not part of the curriculum, and this tense was not going to be explicitly tested in upcoming exams. The production by this group of learners showed that frequency played a role for regular verbs because they may have been retrieving individual verbs from the declarative memory (before a restructuring process for L2 learners with higher proficiency). The use of the declarative memory leads the L2 learners to greater productivity, which most intermediate Spanish courses emphasize: greater production in the L2. (For a discussion of the shift or “restructuring” from the declarative to the procedural memory systems for the regular verbs in the groups of late L2 learners, see section 5.2. where the main developmental patterns in the acquisition of verbal morphology by late L2 learners are discussed.) The accuracy scores by the advanced learners, similar to those by the bilinguals described before, indicate that regular verb production is very accurate for both high and low frequency items (97.33% and 96.67%, respectively), and this may be the result of the default regular rules being computed online in the procedural memory system, because they have already been internalized and are now being used implicitly.

In Experiment 2, all groups of late L2 learners were more accurate at identifying stem change roots of high frequency verbs than those of low frequency. When these participants did not identify the vowel change in those verbs, they may have thought that it was due to the task design. They had to decide whether the nonfinite and the preterite forms belonged to the same verb or not, and that led them to press the “different stem” button for low frequency stem change verbs incorrectly if they interpreted the change in the vowel of those pairs of words as a trick from the task. The lowest accuracy scores were for the low frequency stem change verbs,
indicating that late L2 learners were exposed to the vowel changes of those verbs less often than to those of high frequency stem change verbs, hindering their recognition by these learners. As for the irregular verbs, frequency effects were only found among the group of intermediate learners, the only group which also showed frequency effects for regular verb forms in Experiment 1. Both results may point to the interpretation that this group of learners is retrieving and accessing most verb forms from the declarative memory, since memorization helps them to produce more forms in the L2 with accuracy, and, as a consequence, there were more frequency effects found in the intermediate group than in the other groups of late L2 learners. None of the groups displayed frequency effects for regular verb forms, probably because of the ease of the task and because the root and the preterite forms for regular verbs are more similar in their morphological structure.

Finally, in the Production Task, there were frequency effects only among the group of advanced learners, for both irregular and stem change verbs. Late L2 learners paid less attention to the verb forms when they had to insert them in a sentence context, as evidenced by the fact that the accuracy scores in this task were usually lower than in Experiment 1, the other production task. The fact that only the group of advanced learners showed frequency effects for the irregular and stem change verbs points towards greater regular-irregular dissociations as the proficiency of the late L2 learners increased, due to the use of two different mental systems in the computation of verb forms at this proficiency level, similar to the native speakers of Spanish and to the bilingual group (which also showed regular-irregular dissociations in the frequency effects).

5.1.2. Frequency Effects in the RTs

When verb forms are stored in the declarative memory, frequency effects should be observed based on the frequency of the test item, because the retrieval of arbitrary root-preterite
form associations of low frequency items should take longer than those of items encountered more often. Irregular, and maybe stem change verb forms too, may show these associative memory effects. The time needed to attach an inflectional suffix to a regular root should not differ based on the frequency of the test item, because the concatenation of pieces of language can be performed quickly via online mechanisms. Therefore, frequency effects are not expected in the RTs for regular verbs. The frequency effects for all groups of participants in the two psycholinguistic experiments are discussed in the next paragraphs, first for the bilingual speakers and then for the late L2 learners.

In the recognition task (Experiment 2), the bilingual participants did not show any frequency effect for any verb type. This finding contrasts with the frequency effects observed in all groups of late L2 learners, which are discussed below. The best explanation for this lies in the role of automaticity (DeKeyser, 1997). In this experiment, participants were asked to press one of two buttons as quickly as possible once they had decided whether or not each pair of oral and visual stimuli belonged to the same verb. Since the bilingual participants had been exposed to L2 Spanish from a very early age, they seemed to be capable of recognizing L2 words at a very fast speed, which may explain why no frequency effects were observed for the irregular and/or the stem change verbs. Since the bilingual participants have somehow automatized the processing of L2 word recognition, their RTs to any verb type did not vary much. In fact, this group of participants showed the fastest RTs to any verb type when comparing the data from all the groups in the present study.

In the production task (Experiment 1), the bilingual participants showed frequency effects in the RTs to the stem change verbs only. They were faster at making a correct decision for those stem change verbs which were of high frequency in Spanish than for those which were of low
frequency. Coupled with the absence of frequency effects in the accuracy scores to stem change verbs in the same experiment, the following explanation is suggested: The bilingual participants, as well as the rest of the groups in the present study, produced the low frequency stem change verb forms with the lowest accuracy scores for the most part. This indicates that they had problems when retrieving them from memory, based on the vowel change in the root, as indicated by the most prevalent error type for these verb forms (see section 5.1.3.). It seems that the bilinguals knew that these verbs need a vowel change in the preterite and they accessed that information from the declarative memory, where different verb stems are stored for every stem change verb. For example, the verb root of dormir ‘to sleep’ has three allomorphs based on the tense and subject in which it appears: dorm–, duerm–, dorm–. Bilingual participants must retrieve the correct stem from the declarative memory and, as a consequence, they need more time to retrieve those for low frequency items. However, once they accessed the correct root, the computation of the correct PN suffix was fast and accurate, as indicated by the absence of frequency effects in the accuracy scores.

As for the absence of frequency effects for the irregular verbs, the bilingual participants may have internalized all the irregular verbs used in the study and when they knew the correct response for them, they retrieved them from the declarative memory quickly. This may be the opposite case to the stem change verb forms in that the difficulty for the bilingual participants was not to retrieve the irregular verbs with ease but to retrieve them with accuracy, as indicated by the statistically significant accuracy differences for the irregular items. In fact, they had the lowest accuracy scores for low frequency irregular verbs in Experiment 1 (67.33%) while in the Production Task their accuracy scores for high frequency stem change verbs were very similar (68.33%) to those for low frequency stem change verbs (66.67%).
The strongest evidence in support of the DP model was found for late L2 learners in the second experiment, i.e., when participants were asked to identify complex verb forms in Spanish. All groups of late L2 learners showed frequency effects for irregular as well as for stem change verb forms in this experiment except for the irregular verbs by the intermediate learners. These results indicate that when late L2 learners listened to a Spanish preterite form and then were presented with an infinitive root of the same or a different verb stem, they searched the mental lexicon in their developing grammars to look for the possible arbitrary connection between those two words before making a decision. When the irregular and stem change preterite forms were of low frequency, it took them longer to search for that possible connection in their mental lexicon than if they were of high frequency. These frequency effects were not found for the regular verbs and the explanation can be found not only in the predictions of the DP model for the processing of complex verb forms in an L2 but also in the design of this experiment.

The frequency effects for stem change verbs in this experiment may indicate that late L2 learners perceived the vowel change in the pair of words from the stimuli and quickly searched their mental lexicon before making a decision in order to make sure that the vowel in the preterite form was actually a possibility in the target language. To put it differently, these learners stopped for a longer moment when faced with the low frequency stem change test items because they noticed a disagreement between the infinitive and the preterite vowels and they quickly checked in their declarative memory that both verb stems belonged to the same verb, following the instructions of the experiment.

The results from the first experiment, on the other hand, do not support the predictions of the DP model. In this experiment there were no frequency effects for any verb type in the groups of late L2 learners. The only exception was the RTs to irregular verbs by the beginning learners.
However, these effects were in the opposite direction of that predicted; i.e., the beginning learners took significantly longer to produce irregular verbs of high frequency than those of low frequency. These results cannot be accounted for by single-mechanism models (e.g., Bybee, 1995; Rumelhart & McClelland, 1986) either, because frequency never played a role for most of the test items irrespective of the verb type. However, the frequency effects in the RTs to some verb types were evidenced in the results from the second experiment, for the irregular and the stem change verbs for most groups of participants, and as mentioned before.

5.1.3. Regular-Irregular Dissociations in the Error Types

The last type of data coded from the participants’ responses was the errors they made for the verb types being elicited. The pattern of results observed in the error types in Experiment 1 and the Production Task also help in providing a different way to capture the participants’ mental representations for the production of complex verb forms.

Irrespective of the participant’s proficiency level or even the task, the same main error types were made for the low frequency irregular verb forms as well as for the groups of stem change verb forms. Error type 1, or the attachment of a regular suffix to a verb which required an irregular root, was the most repeated error type for low frequency irregular verbs. Error type 2, or the lack of the corresponding vowel change, was made by all groups of participants for stem change verb forms of either high or low frequency in Spanish. The number of errors for regular verb forms, and even for high frequency irregular verb forms, was very low (less than 10 errors for the same error type) in all groups of participants. These latter results are only informative rather than displaying trends in the production of L2 learners. Due to the similarities in the errors produced by the groups of participants in the present study, the error types and error rates by all groups of participants are assessed at the same time in this section.
Even if participants obtained high accuracy scores in Experiment 1 and the Production Task for Spanish morphology in general, they always obtained lower accuracy scores for the low frequency irregular and the low frequency stem change verbs. It is posited here that these verb types are being retrieved from the declarative memory (the whole preterite form for irregular verbs vs. the irregular verb root for stem change verbs) and their frequency in the target language affected how well the participants retrieved them. On the other hand, regular verb forms can be computed online and no such frequency effects were found for them in general, as discussed in the previous sections.

The most prevalent error type for stem change verbs of high and low frequency was to omit the corresponding vowel change, in both tasks. These verb forms were produced as if they were considered regular verb forms because the root was kept unchanged while the corresponding regular suffix, necessary for stem change verbs, was added. Among the group of late L2 learners there was a constant increase in the error rate for the absence of the vowel change as the proficiency level increased. This is an indication that the greater the proficiency of the learner in Spanish as an L2, the more evident it becomes that the lack of vowel stem changes are persistent errors for stem change verbs in the production of late L2 learners. Under single-mechanism models, this finding may be a sign that a single associative memory mechanism can account for this error type. However, upon closer examination, the lack of the necessary vowel change may not provide evidence in favor of such associative memory mechanisms. The reasoning is as follows. In the present study there are two regular rules considered, namely:

Rule 1: “Add –ó to –ar verbs when [3rd singular preterite] must be expressed overtly”

Rule 2: “Add –ió to –er/–ir verbs when [3rd singular preterite] must be expressed overtly”
Rule 1 appears very frequently in the input because 88% of all Spanish verbs follow this rule, according to Aguirre & Dressler (2006). Consequently, if the participants were not sure how to construct the preterite form for the stem change verbs, they should have erred by attaching rule 1 to the unmodified verb root by analogy. However, the regular suffix attached to these stem change verbs was not –ó or rule 1, i.e., the ending from the most frequent verbs in Spanish, but –ió or rule 2, following the conditions of this second mental rule, even though it had been encountered less frequently in the L2 input. Under dual-mechanism models, including the DP model, this error type can be accounted for as the incorrect retrieval of the corresponding irregular verb root (which is kept intact instead because it could not be retrieved from the declarative memory or because it has not been noticed yet) and the attachment of the default regular rule in accordance to the verb class. This selection of the appropriate regular rule in accordance to the verb class could not be observed in previous work using languages with poorer inflectional systems such as English and, as just discussed, this error type is better explained under the DP model: mental rule attached in accordance to verb class and retrieval of an irregular root from the declarative memory system.

The other most prevalent error type in the group of high frequency stem change verbs was the combination of no vowel change plus wrong stress assignment, e.g., *advertio ‘s/he warned.’ Verb forms in the imperfect tense (the other simple past tense in Spanish) do not require changing the vowel of the root. The misplacement of stress in stem change preterite forms may be due in part to confusion with the imperfect tense forms, which require the adding of the suffix –ía in the third person singular for –er/–ir verbs, as in pedía ‘s/he used to order.’ If that is the case for these errors, then two options may explain this error type: (a) participants believed the preterite is similar to the imperfect tense but with a different vowel in the TAM
suffix, i.e., the –io (wrong stress in the preterite marker) suffix was believed to be similar to the –ia (correct imperfect tense suffix) one, or (b) participants did not know how to conjugate these verbs in the preterite and they tried to produce the imperfect tense instead because they knew that, even though they would be wrong, at least the imperfect has a past reference. The TAM morpheme they attached to the root was actually a blend between the semantically incorrect imperfect tense suffix and the preterite tense suffix being elicited.

The most prevalent error type for low frequency irregular verbs in both tasks was overregularization, i.e., the attachment of a regular suffix to a form which is expected to take an irregular root. Especially in Experiment 1, there was usually a constant increase in the error rate of overregularizations as the proficiency level of the groups of participants increased, again indicating that this error type lingered in the production of L2 learners. If frequency alone is the only predictor of the observed behaviors in L2 learners, how can single-mechanism models account for this error? First of all, these forms are not grammatical in Spanish and the late L2 learners had not been exposed to these verb forms in the input. Second, the fact that this error rate is the most prevalent behavior in all groups of participants when they did not produce low frequency irregular verbs correctly means that these are not sporadic errors in the production of some L2 learners but strong and consistent patterns of errors by most participants; e.g., the incorrect form *produc–ió ‘s/he produced’ appeared consistently in the production of all groups of participants in the present study. Finally, if the frequency of the suffix attached incorrectly at the end of the verb is what caused this error, then why is it that in most of the cases the regular rule attached (1 or 2) agreed with the verb class (–ar vs. –er/–ir verbs)?

The DP model offers a better explanation for this error type in low frequency irregular verbs than the single-mechanism models. These verbs are computed from the declarative
memory system, which is sensitive to input frequency. The tasks asked the participants to produce a preterite form and when the elicited verb form was of low frequency (and sometimes even if they were of high frequency) the participants occasionally failed to retrieve the corresponding irregular form from the declarative memory. Due to the pressures of the tasks to provide the preterite form as quickly as possible without skipping items, the participants computed the irregular verb via the procedural memory system, attaching the default regular rule (1 or 2) based on the verb class of each test item. That is why even the beginning learners incorrectly attached the suffix –ió (instead of the most frequent one –ó in the Spanish input) to –er/–ir verbs such as caber ‘to fit,’ traducir ‘to translate,’ extraer ‘to extract,’ or conducir ‘to drive.’ However, when dealing with the –ar verb andar ‘to walk,’ they produced *and–ó ‘s/he walked.’ In both cases, the L2 participants closely followed the conditions of the (over)regularization rules 1 and 2 stated before. Additional evidence in favor of this mental process can be found in error 13, or the use of a wrong root. In those cases the participants chose an incorrect root but attached the appropriate suffix, again, based on the verb class, e.g., some intermediate participants produced: *vind–ió ‘s/he sold’ (rule 2 correct but with a wrong root), *esquep–ó ‘s/he escaped’ (rule 1 correct but with a wrong root). Even if it may be argued that those examples could be the result of syllable confusion, why was that confusion present in the production of some L2 learners when in Experiment 1 they had the nonfinite verbs displayed onscreen for as much time as it took them to produce their oral response? The regular rule attached to the verb root of the irregular verbs is better accounted for by dual-mechanism models and in languages with a rich morphological system such as Spanish. This is one of the advances made by considering the stem change verb forms as a separate group of verbs from the irregular ones. It helped to understand the attachment of the default regular rule in the L2 learners’ IL as a
compensatory strategy for low frequency irregular items when the declarative memory failed to retrieve the elicited form.

Overregularizations were also found in the responses to high frequency irregular verbs but only in Experiment 1, and with the exception of the beginning learners. The beginning learners produced most of the incorrect high frequency irregular verbs in a different tense instead. The same occurred in their production of regular verbs, as well. This provides additional evidence that at this proficiency level the procedural memory is not at work because the regular rules have not been extracted and are not being used implicitly yet. Instead, associative memory mechanisms led these learners to the retrieval of the most frequent verb forms they had encountered up to that moment to compensate for the lack of the preterite forms in the declarative memory system. In the case of the Production Task, error type 10, or the use of a different tense, mainly the present indicative, was found in the production of all groups of participants. In this case, this error type can be attributed to the task design as it has been found in previous studies that when L2 learners are asked to recollect what other people have done in the past with the help of some type of visual stimuli, and especially for those L2 learners at high proficiency levels, they tend to use the present tense. For example, the native and the near-native participants in Salaberry’s (1999) study on Spanish past tense verbal morphology narrated the events from the clips of a silent movie using the present tense instead of the past tense. In the present study, and as mentioned in section 4.3.2.2., when these groups of participants produced an incorrect verb form from a different tense, they always used the verb forms with the highest frequencies in the Spanish language for the test items being elicited, which indicates that for irregular verb forms the frequency of the items conditioned not only the production of L2 learners but also their most prevalent error types.
Finally, the number of cases per most prevalent error type for the regular verbs was limited and the results can only be considered informative in nature. There were interesting results though, especially for the main claims of the Cognitive Approach to language learning (Skehan, 1998). The use of verb forms in another tense usually appeared as the most prevalent error for these verbs in the beginning and the intermediate groups of late L2 learners. These results can be explained by the higher frequencies of those forms retrieved from the declarative memory system, based on the claim that the initial stages of SLA are usually lexical, according to the Cognitive Approach. In the Production Task, the use of a nonfinite form, or even a noun, appeared often in the production of most groups of participants as the most prevalent error type. These cases usually indicated that the elicited verb form was used in the infinitive inside a fixed expression or a chunk of language with a previous auxiliary verb in the preterite tense, e.g., \textit{para} + infinitive ‘in order to…’ (used to link two sentences into a single one), \textit{dio un regalo} ‘s/he gave a present’ and \textit{hizo una llamada} ‘s/he made a phone call’ (the use of a noun to skip the computation of a complex verb form), \textit{tenía que} + infinitive ‘s/he had to…,’ \textit{estaba} + present participle ‘s/he was …,’ and so on. These chunks of language are readily available in the declarative memory system of the L2 participants and they could retrieve them very quickly to aid their narration of the events depicted in the picture-story sequence. The Cognitive Approach suggests that most language production relies on them and, as mentioned in the previous chapter, these examples were considered errors based on the instructions of the tasks even though it would be more accurate to refer to them as an avoidance strategy. It may be even possible that the participants did not realize that they did not use the verb provided in the elicited tense. In any case, these examples support the notion from the Cognitive Approach that most language
production relies on chunks of language readily available in the declarative memory that can be retrieved and computed online quickly to increase fluency during language production.

5.2. Developmental Patterns in the Acquisition of Verbal Morphology

This section addresses the third research question of the present study: What are the developmental patterns among the groups of late L2 learners when handling complex verb forms in L2 Spanish? The main significant results in the accuracy scores (section 5.2.1.), the RTs (section 5.2.2.) and the error types (5.2.3.) are addressed separately and evaluated to the extent that they can provide cumulative evidence either in favor of the dual-mechanism models in general and the DP model in particular or in favor of the single-mechanism models.

5.2.1. Improvements in the Accuracy Scores

In successful SLA the expected developmental pattern is to start with an incomplete representation of the L2 showing less than perfect accuracy scores followed by subsequent stages of increased accuracy rates as a result of higher proficiency levels. This developmental route may not necessarily be present in all L2 learners and/or for all grammatical features in the same way. In fact, there are usually instances of backsliding which, interestingly, may indicate an increase in the complexity of the learner’s developing grammar or IL. The learning context for the participants in my study may have conditioned the developmental patterns found in the accuracy scores for specific verb forms as they have been exposed explicitly to some Spanish grammar rules. However, the expected pattern is that high frequency items will be acquired before the low frequency ones because they have also been encountered more frequently in the L2 classroom. Additionally, verb forms handled by the declarative memory system should be acquired first because, as mentioned by the DP model, the learning speed of this memory system is fast, leading to increased/enhanced productivity. In the case of L2 learners, the DP model suggests that all verb forms are initially handled by the declarative memory system and, as a
consequence, all verb types may show the same pattern of acquisition in relation to the accuracy scores. The results from Experiment 2 are evaluated before those from the other two production tasks (Experiment 1 and the Production Task) analyzed in my study.

In Experiment 2 two factors favored a ceiling effect in the average amount of correct responses per group of participants: only two options were available and the task itself was not difficult since participants did not have to produce complex verb forms. Most of the scores from all groups of participants were at or near the maximum possible for the experiment (100% accuracy) and the utility of the data collection measure used was therefore compromised because of the lack of variability. As predicted due to the ceiling effect, the one-way ANOVA results indicated that there were no significant differences among these groups.

In Experiment 1 and the Production Task, the main statistically significant differences were found in the accuracy scores on the high frequency verb forms, mostly between the beginning and the advanced groups and mostly for the irregular and stem change verb forms. However, it is important to remember that the accuracy scores from Experiment 1 and the Production Task show a clear regular-irregular dissociation in that all groups of participants obtained high accuracy scores for the regular verb forms compared to those for the irregular and stem change verb forms. Late L2 learners always obtained better accuracy scores for the regular verbs in Experiment 1 than in the Production Task. On the other hand, the accuracy scores for the irregular and stem change verb forms were lower than for the regular verbs, and sometimes with very low accuracy, such as only producing a quarter of them accurately. If the initial stages of SLA are usually lexical (Housen, 2002) and if learners initially handle all verb forms via the declarative memory system, which is sensitive to factors such as input frequency (Ullman, 2001b), then why is it that regular verbs are produced with better accuracy scores than the other
verb types, especially when they are supposed to be handled with a memory system distinct from
the one that native speakers of the language employ (the procedural memory system)?

There are several factors which can explain the results for regular verbs. Forty-five
participants were learners of Spanish in a US college and their exposure to Spanish was mostly
in the classroom. The textbooks always present the paradigms of regular verbs before covering
the irregularities and learners tend to memorize these paradigms for the exams (it is not that rare
to find them on the back of the exam of some students). The L2 learners can explicitly access the
regular rules in their declarative memory system to produce a given verb form, whereas the
retrieval of some irregular verb forms from the declarative memory system can easily fail due to
their limited number of exposures. Even if the regular rules are not yet used implicitly at the
early stages of SLA, the L2 learners can produce new verb forms by analogy from other verbs.
And since the group of regular verbs is larger than the different groups of irregular verbs, the L2
learners are more successful at retrieving an appropriate verb ending by analogy than whole
word irregular verbs. Additionally, the fact that regular verb forms do not have changes in the
verb root also favors a high accuracy score; i.e., if L2 learners keep intact the internal segment
structure of the verb while attaching a regular suffix to a verb root that they are not completely
sure about how to conjugate in the preterite, they will always be correct for the group of regular
verbs, but not for the groups of irregular verbs. The microclass of –ir stem change verbs in
Spanish with the vowel alternation pattern e/i (e.g., pedir – pidió ‘to ask for,’ elegir – eligió ‘to
choose’…) contains more than 50 verbs, according to Aguirre & Dressler (2006), while 88% of
all Spanish verbs belong to the default microclass of –ar regular verbs (e.g., cantar – cantó ‘to
sing,’ amar – amó ‘to love’…).
This observation leads to two implications for the findings in the present study. First, even though some high frequency irregular verbs appear more often in the target language than most regular verbs, the frequency with which L2 learners are exposed to regular verb forms is higher, and 80% of the regular verb forms used in my study were –ar verbs (see Appendix K). The second implication is that if L2 learners handle all verb forms initially via the declarative memory, which can lead to some degree of productivity by analogy, regular verb forms are also favored in comparison to the irregular ones because the latter contain just some members from which to extract a verb pattern and they also have many different microclasses, whereas the former can only belong to three default macroclasses (–ar, –er, –ir) with many members per macroclass. Finally, Experiment 1 and the Production Task asked the participants to provide a response for each stimulus. If L2 learners were not sure what the expected response was, the task still asked them to produce something, and so if their declarative memory failed to retrieve a preterite form, they could resort to an explicit default rule and attach a regular suffix to the verb root. This is how they could compensate for the lack of knowledge in the declarative memory and this can also explain why their accuracy scores for regular verbs were the highest, because L2 learners can produce correct regular verb forms even when they are not sure what the elicited verb form is.

The advanced learners obtained significantly higher accuracy scores for high frequency irregular and stem change verb forms in both production tasks than the group of beginning learners. The Tukey post hoc results also indicated that the accuracy differences for high frequency stem change verbs in the Production Task between the intermediate and the advanced groups reached statistical significance. These results show that those verb forms which are handled by the declarative memory system are improved in the production of late L2 learners.
When the test items were elicited in a sentence context (the Production Task), there were clear regular-irregular dissociations in the improvements in the accuracy scores, as indicated by the absence of accuracy changes for the regular verbs. But when the test items were elicited in isolation (Experiment 1), there were significant improvements in the accuracy scores to high frequency regular verbs as well, even though the Tukey post hoc test did not reach the significance level between the beginning and the intermediate or the advanced groups.

The results for the accuracy improvements among the late L2 learners just mentioned lend partial support for the DP model. This model predicts that L2 frequency plays a role for those verb forms handled by the declarative memory system and the accuracy scores from these participants showed that high frequency irregular items (including the stem change verbs) are acquired earlier than the low frequency ones because they have been encountered more frequently and they are sensitive to input frequency. Additionally, if the task asked the learners to concentrate on the verb forms and the verb forms only (Experiment 1), not in producing full sentences in order to describe a picture story in which the test items are somehow less attended to; results showed that low frequency stem change verb forms also benefited as well as high frequency regular verbs. These results may be explained by the demands of Experiment 1. If advanced learners pay close attention to the base form of low frequency stem change verb forms, they will be able to retrieve the vowel stem change pattern with greater accuracy than if they are asked to produce those verbs in sentence contexts. This can also indicate that beginning L2 learners have not yet perceived the vowel change in some preterite forms and may still think that those verbs are regular because they attach the corresponding regular suffix. Only the third person subjects require a vowel change in the preterite tense, and if L2 learners do not pay close attention to those forms in the input, they may think the verb is fully regular in the preterite. In
the case of high frequency regular verb forms in Experiment 1, on the other hand, intermediate
and advanced learners reached almost perfect accuracy scores for those when the task was
limited to the verb forms, so that the application of the default regular rule was facilitated via
analogy of other regular verbs encountered frequently.

Even though the DP model implied that L2 learners are initially handling all verb forms
via the declarative memory system (whether for a whole word verb form such as *cántó* ‘s/he
sang’ or via the explicit knowledge of a regular rule like “add –ó”), the results in the Production
Task indicated that the frequency of the Spanish verb forms used in the present study,
irrespective of whether it was high or low, never correlated with the accuracy scores of any
group. This is a good piece of evidence against single-mechanism models and in favor of dual-
mechanism models because it indicates that the accuracy of recognition or production of the verb
forms was not only the result of the frequency with which L2 learners may have encountered
those forms in the input. To put it differently, something else was driving the acquisition of
inflectional morphology besides the frequency of whole words stored in the declarative memory.
I propose that that something else is the application of mental rules for verb roots, whether
explicitly via analogy from the extensive regular verb forms in the input, or procedurally via
online mechanisms for more advanced L2 learners and the native speakers of the language.

The regular-irregular dissociations in the accuracy scores in the Production Task, the
higher accuracy scores for regular verb forms only in the first stages of acquisition, and the
frequency effects that were generally attested in the accuracy improvements to irregular and stem
change verb forms are all better accounted for by the dual-mechanism models and the DP model
than by single-mechanism models of SLA. However, there are data which may be even more
informative concerning the mental mechanisms late L2 learners employ when handling complex
verb forms: the time they need to retrieve complex verb forms based on their frequency and/or their regularity. These results are discussed in the next section.

5.2.2. Improvements in the RTs

A significant decrease in the RTs to a specific group of verb forms from one group of late L2 learners to the next one, e.g., from the beginning to the intermediate group, can be deemed as an index for automatization. In his study of automatization in the acquisition of L2 morphosyntax rules, DeKeyser (1997) used Anderson’s (1983) Adaptive Control of Thought theory when defining automatization:

(...) knowledge typically starts out as explicit (declarative) information, “knowledge that,” which is turned into specialized procedural rules, and “knowledge how,” for very specific behaviors through analogy with a series of examples and with the help of very general behavioral rules. It is then fine-tuned over time as a function of cost-effectiveness (probability of being correct and cost in terms of mental resources). The result of this last process is a gradual drop-off in reaction time and error rate (DeKeyser, 1997, p. 196-197).

Additionally, DeKeyser (1997) stated that the amount of improvement decreases as a function of the amount of practice.

In Experiment 1, RTs were recorded from the visual presentation of an infinitive verb and the participant’s oral production of its preterite form. In Experiment 2, RTs measured the elapsed time it took the participants to decide whether a preterite verb form presented orally and a written infinitive verb presented onscreen immediately afterward belonged to the same stem/verb or not. When the RTs for all verb forms decrease significantly from one proficiency group of late L2 learners to the next one, it can be hypothesized that all verb forms have been automatized over time as a result of the amount of practice in the L2, irrespective of the regularity of the verb forms. But if the statistical analyses reveal that the RTs for regular verb forms are the only ones to decrease significantly, it can be taken as strong support for the DP model (Ullman, 2001b) because this model posits that the main developmental pattern in the acquisition of complex verb
forms should be a shift from reliance on the declarative memory system to the procedural memory system for those verb forms which are handled by the procedural memory system by native speakers of the target language. A drop-off in the RTs for regular verb forms only can be the result of function of cost-effectiveness in the use of mental resources. In other words, what was initially memorized as a whole-word (e.g., cantó ‘s-he sang’) is now handled by the mental rule ‘add –ó to –ar verbs when the grammatical feature [3rd sing. Preterite] must be expressed overtly.’ The greater the amount of exposure or input for this rule, the lower the RT and the greater the accuracy for getting regular verb forms right when little or no attention is being paid to them.

The decision-making task for Experiment 2 only required participants to press one of two buttons and the RTs from the groups of late L2 learners to press the button did not differ significantly. The task was easy to perform and all groups of L2 learners were able to make a decision quickly, irrespective of their proficiency level, probably because of the design of the task, since, for most of the cases, when the two words belonged to the same verb, these forms started with the same syllables (e.g., compró – comprar ‘s/he bought’ – ‘to buy’). This may therefore have contributed to quick RTs even for the beginning participants. Similarly, when the two words belonged to different verbs, they had different initial syllables even if the intonation pattern was the same (i.e., both verb forms had the same number of syllables and the main accent occurred in the same position), and this may have also contributed to quick RTs by all groups of participants.

The only statistically significant differences in the RTs by the three groups of late L2 learners were observed in Experiment 1. More importantly, the drop-off in the RTs was found only for the regular verbs, regardless of their frequency in the target language. A quick look at
the averaged RTs for high and low frequency regular verbs by the intermediate and advanced
groups of learners in comparison to those by the beginning group shows that the former took
about half the time (measured in ms.) to produce those verb forms. For example, while the
beginning learners took 2732.21 ms. on average to produce the correct preterite forms for the
high frequency regular verbs, the advanced group of learners only took 1420.08 ms.

The significant decrease in these RTs can be the result of the shift from reliance on the
declarative memory system to the procedural one in the mental representation of regular verb
forms by late L2 learners. This shift would be taking place to maximize the effectiveness of the
L2 learners’ mental representations of inflectional morphology because they would no longer be
storing each regular verb form as a whole word; instead, they would be computing and retrieving
regular verbs via the online attachment of an inflectional suffix to an appropriate verb root. As
mentioned by the DP model, the processing of sequences is faster than the retrieval of arbitrary
associations, although the learning speed for the processing of sequences is gradual and
incremental rather than fast (hence the intermediate and especially the advanced groups of L2
learners showed significantly decreased RT scores). It is important to remember that if the
significant decrease in the RTs to the regular verb forms simply implied a process of
automaticity of those verb forms as a result of the intermediate and the advanced groups of L2
learners having received more input and having had more opportunities to use them, then there
would be no reason not to find similar results for the other verb types. To put it differently, if the
results simply indicated a faster access of verb forms based on the frequency with which they
had been encountered previously, then irregular and stem change verb forms should have been
accessed significantly faster by the intermediate and advanced groups too. These results were not
found, lending support for the developmental patterns posited by the dual-mechanism models, in
this case the shift of reliance only for the regular verbs from the declarative to the procedural memory system, as posited by the DP model (Ullman, 2001b).

The developmental shift in the acquisition of the English irregular past forms (*went* > *goed* > *went*) is considered a classic example of the developmental transition from exemplar-based representations to more rule-based representations (McLaughlin, 1990, p. 118). The mental mechanisms to modify internalized cognitive representations are usually referred to as restructuring (McLaughlin, 1990). When this concept was applied to SLA, Lightbown (1985) suggested that the L2 learner’s own system of form-function relationships or IL was characterized by backsliding and loss of forms that seemingly were mastered:

> [restructuring] occurs because language is a complex hierarchical system whose components interact in non-linear ways. Seen in these terms, an increase in error rate in one area may reflect an increase in complexity or accuracy in another, followed by overgeneralization of a newly acquired structure, or simply by a sort of overload of complexity which forces a restructuring, or at least a simplification, in another part of the system (p. 177).

Another way of understanding the results presented in Chapter 4 is to look for evidence of restructuring or a transitional shift between two stages in the development of form-function mappings, following Ellis’ (1985) study (see Figure 5-1).

1. Internalization of new linguistic forms >>> assimilation + non-systematic variation
2.a. Progressive organization of form-function relationships >>>> RESTRUCTURING
2.b. Elimination of redundant forms >>>> economy principle + systematic variation

Figure 5-1. Interlanguage processes during SLA. [Adapted from: Ellis, R. (1985). Sources of variability in interlanguage. *Applied Linguistics, 6* (Page 129).]

The first stage is an assimilation stage in which L2 learners are open to new forms and develop hypotheses that may or may not correspond to the target language form-function relationships; e.g., a beginning learner may incorporate the form *puso* ‘s/he put’ as the preterite form for the verb *poder* ‘to be able to.’ The L2 learner’s form-function system has not yet integrated the new forms and, as a consequence, different forms may coexist for a given function and hence the
The number of errors is high due to the nature of the non-systematic variation of L2 verb forms. In the second stage, the L2 learner accommodates her/his whole L2 system by restructuring the existing form-function relationships in order to give the new forms their own meanings to perform. Sometimes this restructuring stage may trigger the elimination of redundant forms, usually referred to as the economy principle, because those verb forms cannot be integrated into the new system by ensuring that they contribute to distinguishing new meanings, e.g., an intermediate L2 learner may decide that *deció ‘s/he said’ does not have any distinguishable meaning and since it cannot be incorporated to any form-function relationship it is eliminated from the current IL, increasing her/his performance in the L2 since now the verb form dijo ‘s/he said’ is the only form stored in the declarative memory system when the L2 learner needs to satisfy the grammar feature [+ preterite] for the verb form decir ‘to say.’ This new systematic variation is what ultimately can lead L2 learners towards a high proficiency level in the target language. L2 learners restructure their knowledge about the L2 until they sort out all the form-function relationships. However, not all learners reach the last stage, which probably leads to fossilization of the current state of their IL system.

The current results point towards some restructuring in the acquisition of verbal morphology by late L2 learners. As mentioned earlier, this process of restructuring occurs for regular verb forms only, which were initially assimilated as whole words and later on retrieved online via the attachment of a regular mental rule. If, as Lightbown (1985) suggested, “an increase in error rate in one area may reflect an increase in complexity or accuracy in another” (p. 177), then this new dual-mechanism mental representation for complex verb forms (declarative memory for irregular verbs and procedural memory for regular verbs) via the restructuring of the regular verb forms should trigger an increase in error rate for irregular verb
forms. Interestingly, that increase was present in the two production tasks, even if it did not reach significance. For low frequency irregular verb forms, the advanced learners obtained lower accuracy scores than the intermediate learners in Experiment 1 (M = 44.67, SD = 37.20 for the former, M = 45.33, SD = 38.52 for the latter), as well as in the Production Task (M = 45, SD = 31.62, and M = 50, SD = 29.89, in the same order). Again, although the differences found in the accuracy scores were small, this result stands out in sharp contrast to the accuracy differences for the same verb type between the beginning (M = 22.67, SD = 26.31 in Experiment 1 and M = 25, SD = 28.35 in the Production Task) and the intermediate learners since in those cases the accuracy scores doubled from one proficiency level to the next. Based on the averaged accuracy scores from these groups of participants, there are reasons to believe that if true developmental changes could be tracked for the same groups of participants over a long period of time, a backsliding in the accuracy scores for irregular verbs would accompany the above-mentioned restructuring process for regular verb forms in a more clear way. The main issue with these results is that they can only be regarded as apparent, since the participants in each proficiency group were different, i.e., my study did not have a group of L2 learners from which data were collected at regular intervals for a long period of time. Interestingly, the developmental patterns found in favor of the DP model can be considered as an indication of what future L2 studies may expect from a true longitudinal investigation.

5.2.3. Changes in the Rates and Types of Errors

The results from the error types and error rates are less informative about the developmental patterns by L2 learners in the acquisition of verbal morphology because there were not many changes and those found in the data were not very strong. This last section addressing the developmental patterns in the acquisition of verbal morphology evaluates the data on the participants’ main behaviors and error types in Experiment 1 and the Production Task.
In Experiment 1, all groups of late L2 learners made overregularizations for low frequency irregular verbs and did not change the vowel in the verb root for stem change verbs as the most prevalent error types for those test items. The only change in the error types among the proficiency groups for the remaining verb types (high frequency irregular verbs and regular verbs) was that the beginning group produced those forms in a different tense, reflecting a selection of a verb form found more often in the L2 input than the elicited preterite form and since the processing of inflectional morphology by beginning learners is still restricted to the declarative memory system. The remaining results are not very informative due to the limited number of errors produced for high frequency irregular and regular verb forms by late L2 learners of intermediate or advanced proficiency levels. Perhaps worth mentioning is the fact that only the intermediate group made error 13, or the selection of a wrong root, for most regular verbs of low frequency and in both tasks. Even though this error could be simply interpreted as syllable confusion or isolated cases in the production of some L2 learners, it could also be indicative of the wrong selection of a verb root to which the corresponding regular suffix (rule 1 or rule 2, mentioned in section 5.1.3.) was attached correctly, indicative of a step forward towards the use of both the declarative and the procedural memory systems, i.e., wrong selection of a verb root from the long-term memory and online attachment of the regular TAM suffix based on the verb class.

Similar results to those in Experiment 1 were found in the Production Task for stem change verbs (no vowel change) and low frequency irregular verbs (overregularization), which indicates that these error types linger in the production of late L2 learners and even in the production of English/Spanish bilinguals. Finally, in this Production Task, most groups of participants used the regular verbs in nonfinite forms or even as nouns, which was previously
explained in section 5.1.3. under some claims of the Cognitive Approach: These examples may reflect the use of memorized chunks of language readily available in the declarative memory system which were retrieved to insert the elicited verb forms with fluency and in easier-to-compute forms (i.e., unchanged as in the case of infinitives or as nouns in available fixed expressions such as: *hice una llamada* ‘I made a phone call’).

5.3. The Role of Age of Initial Exposure and Amount of Practice in the L2

The greater the amount of practice in the L2, the greater the regular-irregular dissociations in terms of accuracy scores, RTs, and frequency effects, as claimed by the DP model (Ullman, 2001b) for highly proficient L2 learners or the final stages of SLA. In section 1.2.5., it was mentioned that, according to this model, practice with the L2 in addition to age of exposure should affect both grammatical proficiency and the degree of dependence on procedural memory for grammatical computations. The later the initial age of exposure to the L2 and the less practice with it, the weaker the dissociations should be between the declarative/procedural memory systems for the computation of verb forms. That is the interest of the fourth research question, the differences between the two groups of advanced speakers (late L2 learners vs. English/Spanish bilinguals).

The present study included a group of English/Spanish bilinguals who performed the same tasks as the groups of late L2 learners. The main differences between the two groups of advanced speakers are their initial age of exposure to L2 Spanish (around puberty for late learners vs. at age 5 or earlier for the bilinguals), as well as their amount of exposure to the L2 (limited to the Spanish classroom for most late learners vs. frequently at home/with friends, etc. for the bilinguals). If the DP model is correct in the claims related to the differences based on the initial age of exposure and the amount of practice, then there should be differences in the grammatical proficiency between the two groups of advanced speakers, but there should not be
in relation to the dependence on procedural memory for grammatical computations if, as suggested in section 5.2.2., the advanced late L2 learners have already shifted reliance to the procedural memory for the computation of the regular verb forms. This latter claim is discussed in section 5.3.2. The significant differences between these two groups and the differences in error types and error rates for specific verb forms are evaluated to the extent that they provide evidence in support of the single-mechanism or the dual-mechanism models.

5.3.1. Differences in the Accuracy Scores

First, no significant results were found between the groups of advanced speakers in Experiment 2 due to the ceiling effect described in section 5.2.1. Second, in Experiment 1 bilinguals obtained statistically significant higher accuracy results for low frequency stem change verbs than the advanced learners and results almost reached significance in the same direction for low frequency irregular verbs. And third, in the Production Task the bilinguals obtained significantly higher accuracy scores than the advanced group for both low frequency irregular and low frequency stem change verbs.

The only verb forms in which the bilingual group showed an advantage in comparison to the advanced group were those claimed to be handled by the declarative memory system, according to the DP model, provided they were of low frequency in the target language. The amount of exposure to Spanish by the bilingual group was greater than the advanced learners, based on their age of initial exposure to Spanish. They had been exposed to Spanish for a greater number of years and more often and, as a result, they were more successful at retrieving low frequency forms from the declarative memory because they had undoubtedly received more input for them. Even though the averaged scores in the proficiency exam for the bilinguals (M = 31, SD = 4.58) and the advanced groups (M = 27.73, SD = 6.27) did not differ significantly (t = -1.632, df = 28, p = .114), the bilinguals showed a better grammatical proficiency for irregular
and stem change verbs. Those are the verb forms handled by the declarative memory and those are the verb forms in which the bilinguals showed an advantage over the advanced L2 learners because irregular and stem change verbs are the verb types which benefit the most from input frequency.

5.3.2. Differences in the RTs

It was in Experiment 1 where the intermediate but especially the advanced groups of late L2 learners showed a significant decrease in the RTs for producing regular verb forms in comparison to the RTs by the beginning group. These results were explained as a possible change in the mental processing by late L2 learners from the declarative to the procedural memory systems, especially when these differences were not present for the other verb types and when the accuracy scores for low frequency irregular verbs decreased from the intermediate to the advanced proficiency groups. Decreases in the accuracy scores are better understood in this type of data as being triggered by a restructuring of the learner’s IL. Since the group of bilinguals started their acquisition of Spanish at a very early age, their processing of the L2 should pattern more with that of native speakers of the target language; i.e., they should show greater dissociations between the declarative and procedural memory systems for the computation of L2 verb forms. The independent-samples t test results for the RTs on all the conditions showed that the advanced L2 learners and the bilingual speakers did not differ in their RTs to any verb type. These results provide additional evidence that the advanced learners are processing the regular verb forms procedurally, as their RTs are similar to those of the bilingual group and are faster among both groups of participants than those for the irregular and stem change verb forms. Faster RTs for the regular verb forms are expected because the computation of those forms is fast and online rather than being retrieved from the declarative memory system.
In Experiment 2 there were significant differences between the advanced learners and the bilingual groups for low frequency irregular verb forms. These verb forms are retrieved from the declarative memory system and since they are of low frequency in the target language, late L2 learners did not have as much exposure to them as the bilinguals and, as a consequence, had to search longer in their mental lexicon for the appropriate verb form before making a decision. If the restructuring for the processing of regular verb forms is complete by this proficiency level (rather than at the intermediate proficiency level), as suggested in the present study based on the observed patterns of results, then when the L2 learners listened to the low frequency irregular preterite forms in Experiment 2 they tried to make a decision based on whether the two forms would really fit under “verb root – regular form” vs. “verb root – irregular form” because both mental systems (declarative and procedural) are now active and work cooperatively in the computation of complex verb forms. To put it differently, they may be processing the low frequency irregular verbs via both the declarative and the procedural memory systems as possible whole-word associations or rule-like products. That processing is different for the advanced learners since they already know when most verb root and irregular forms belong to the same verb but they are not sure about low frequency irregular items since they had been exposed to those verbs less often and they evaluated both possibilities (rule-like products vs. whole-word associations) implicitly before making their final decision. This explains the significant differences in the RTs by the bilingual speakers who, thanks to their greater amount of practice in Spanish, were capable of identifying the verb root – irregular verb form associations of low frequency items quickly through the declarative memory alone.

5.3.3. Differences in Error Types and/or Error Rates

The differences in the error types and/or error rates between the advanced learners and the bilinguals are evaluated qualitatively and quantitatively in the following paragraphs.
For stem change verb forms, regardless of their frequency in Spanish, the main error type in both groups was not to change the vowel in the preterite forms elicited. The bilingual participants had fewer raw numbers of errors than the advanced L2 learners but the error rate of this error type in Experiment 1 was higher in the group of bilinguals than in the group of advanced learners. If the verb root was not identified as an irregular one by these groups of participants, they may have simply attached the default regular suffix for stem change verb forms. The total number of errors for stem change verb forms was the greatest for all the verb types and a possible explanation, besides the lower accuracy scores for stem change verbs in general, is that the vowel change in the root of those verbs only occurs for third person subjects rather than in the whole preterite tense paradigm. Additionally, those verb forms are not encountered very often in Spanish, and frequency may have hindered L2 learners’ noticing of the stem change patterns, which also contributes to the most prevalent error type just mentioned.

Both groups of participants made overregularizations as the most prevalent error type for low frequency irregular verb forms in both tasks. This error type shows that when L2 learners are not able to retrieve the appropriate irregular preterite form, they can attach to the verb root a regular ending by default in order to complete the task, although the accuracy scores do not reach high levels. Again, the bilingual group had fewer errors than the group of advanced learners. These errors fully support the predictions of the DP model in that when an irregular verb form is not retrieved from the declarative memory system, the procedural memory system can compensate for that lack of knowledge by resorting to a default rule. The default rule attached incorrectly to these irregular verbs usually agreed with the verb conjugational class; e.g., –ó was attached to –ar verbs, whereas –ió was attached to –er/–ir verbs. If frequency were the only factor responsible for these overregularizations, as single-mechanism models suggest, then only
the most frequent regular rule should have been used by these participants since it appears in 88% of all the Spanish verbs. Overregularizations are also produced in Experiment 1 by the advanced and the bilingual speakers for high frequency irregular verbs. Additionally, the bilingual group produced some of these verbs in a different tense, although the number of occurrences was small: three cases. Furthermore, in the Production Task, both groups of participants chose a form from a different tense instead of the elicited preterite form. The advanced learners also attached an incorrect TAM suffix to some of the correct irregular roots. These errors suggest that when these groups of participants narrate in the L2, the frequency of specific verb forms for a given irregular verb may affect the selection of an incorrect verb form. Those verb forms chosen incorrectly were usually in the present tense, a tense which is introduced earlier and practiced more frequently in the classroom setting. Additionally, previous research has shown that even when participants are asked to produce a narrative in the past based on a visual prompt, advanced L2 learners and native speakers tend to use the present tense instead of the expected preterite tense, as mentioned in section 5.1.3.

In the case of regular verbs, both groups of participants showed the same pattern of results. In Experiment 1, the number of errors for regular verb forms was very low. The most prevalent error type for the low frequency items was the use of a TAM suffix from another verb class, e.g., attaching the suffix \(-i\)\text{ó} to a verb from the first conjugation instead of to a verb from the second or third conjugations, as in \(*\text{invent-}i\text{ó}\) instead of \(\text{invent-}\text{ó}\) ‘s/he invented.’ However, in the Production Task, the most prevalent error type for regular verbs by both groups was the use of nonfinite forms, usually after a previous verb in the preterite tense. This error type can be explained by the task design in that participants were asked to narrate what a character did in the past based on a picture-story sequence. Sometimes the participants used a chunk of information
stored in their declarative memory and used it online in the ongoing narrative, in addition to avoiding the computation of some verbs. For example, most of the advanced and bilingual participants used the sentence starts: *tuvo que* … ‘s/he had to,’ *decidió* … ‘s/he decided to,’ *estaba* … ‘s/he was,’ followed by the regular verb in the infinitive form for the first two or followed by the present participle for the third one. These results can also be accounted for under the Cognitive Approach and the role of unanalyzed chunks of language, on which ongoing communication usually relies, as mentioned earlier in section 5.1.3.

In sum, results indicated that the bilingual participants produced fewer errors than the advanced L2 learners although, for the most part, when comparing their most prevalent error types for each verb type (regular, irregular and stem change), the groups did not differ qualitatively, which may indicate that the use of the same mental systems in the processing of complex verb forms leads to the same error types, even though the amount of practice helps in making fewer total errors.

5.4. Outline of Main Findings

In the present study, the first and second research questions asked about possible frequency effects in the accuracy scores, RTs, and/or error types for complex verb forms in Spanish by different groups of participants. Results indicated that there were regular-irregular dissociations in the frequency effects in accuracy scores as well as RTs, supporting the main predictions of the DP model. Specifically, irregular and stem change verb forms of high frequency were accessed and/or retrieved with faster RTs and greater accuracy than irregular and stem change verb forms of low frequency in L2 Spanish. These results were not observed in all tasks or for all groups of participants, but frequency effects were generally absent in the results of the regular verbs. Taken together, frequency effects were indicative of associative memory effects for those items being handled by the declarative memory system, whereas the absence of
such frequency effects, especially in the RTs, supported the view that regular verb forms were computed online in the procedural memory system. The most prevalent error types also supported this dual-mechanism processing, especially the overregularizations of low frequency irregular verb forms: The incorrect TAM suffixes attached to the verb root of irregular verb forms agreed with the conjugational class of the verb itself, rather than simply reflecting the attachment of the TAM suffix of the most frequent verbs in the target language (–ar regular verbs).

The third research question investigated the main developmental patterns in the acquisition of Spanish verbal morphology by late L2 learners. There were accuracy improvements for most high frequency items, especially those of irregular and stem change verbs, suggesting that the initial stages of SLA are usually lexical. However, the most interesting finding was the improvements in the RTs for regular verb forms only, pointing to a restructuring processing in the mental mechanisms used to retrieve them, from the use of explicit rules memorized in the declarative memory system to the implicit use of mental rules that the L2 learners used quickly online. This shift from reliance on the declarative to the procedural memory systems for regular verb forms was claimed by the DP model and evidenced for the first time in the results of the present study.

The fourth research question investigated the differences in L2 achievement for complex verb forms between two groups of advanced speakers, namely adult late L2 learners and English/Spanish bilinguals. Since both groups were using the two memory systems implicated in the processing of regular-irregular verb forms, the only differences were observed in those items for which the greater amount of exposure by the bilinguals could have affected their retrieval:
low frequency irregular and low frequency stem change verb forms. The bilinguals had greater memory traces for these items than the group of advanced L2 learners.

Finally, I have argued that most of the data analyzed here can be better accounted for by the DP model than by the single-mechanism models. Most research results stemmed from the predictions posited by the DP model, the dual-mechanism models in broader terms, and even by the Cognitive Approach to language learning.
The present study examined the developmental changes in the acquisition of complex verbal morphology in L2 Spanish and the mental operations L2 participants at varying proficiency levels employed when storing, retrieving and producing these verbs in the target language. Data on the accuracy of and RTs for complex verb forms of different regularity types were collected through a production task as well as through a psycholinguistic experiment using recognition, in addition to an oral elicited narrative. The results from this cross-sectional study showed that, for the most part, all groups of participants displayed frequency effects (i.e., faster RTs and better accuracy scores for high frequency items) for those verb forms claimed by the DP model to be handled by the declarative memory system. No such frequency effects were found in the computation of regular verb forms, as measured by the RTs.

Additionally, the data from the groups of late L2 learners indicated that the RTs for the regular verb forms only were significantly faster in the groups of advanced and even intermediate learners. These results support the claim that in the acquisition of an L2, late learners shift reliance from the declarative memory system to the procedural system for regular verb forms which, for late L2 learners at higher proficiency levels, were processed very quickly, irrespective of their frequency in the target language, a sign that these verb forms were computed online and via the use of implicit mental rules. In previous studies, the use of mental rules for regular verbs as well as arbitrary associations in the computation of irregular verbs and stem change verb roots, i.e., dual-mechanism processing, shows that L2 learners increased the complexity of the mental representations of this grammar feature as their proficiency level increased. No such improvements in the RTs for the retrieval of irregular and stem change verbs were observed among the groups of participants here, even though the accuracy for the high
frequency items was greater for L2 learners at higher proficiency levels. The lack of those RT differences among the groups of late L2 learners suggests that the RT improvements for regular verbs were not the result of automatization in the processing of verb forms in general.

Overregularizations in the production of low and even high frequency verbs as well as the absence of vowel changes for stem change verbs were the main error types found in the data of all groups of participants. These error types, coupled with the main regular-irregular dissociations described in the previous chapter, support the main claims of the DP model for SLA. Frequency and associative memory effects were found in the data, as predicted by single-mechanism models, but not to the extent of fully accounting for all the acquisitional patterns observed in the data. Instead, dual-mechanism models can better explain most of the results presented in the previous chapters. Results support the notion that the regular rules are not simply a descriptor for linguists but also a reality in the mental representations of complex, but structured, verb forms.

In the following section, the main limitations of my study are described, followed by suggestions for future research studies in the acquisition of verbal morphology by L2 learners. The chapter ends with some pedagogical implications and suggested activities to be used in Spanish classrooms of varying levels.

6.1. Limitations and Future Directions

The conclusions of this research investigation, while highly promising, should nonetheless be interpreted cautiously as, with any research study, there are a number of limitations that should be addressed in future work.

One limitation was that the study was cross-sectional and all developmental patterns described in the results chapter can only be considered apparent. The participants in the different proficiency groups were independent samples and data from the L2 learners were not collected
more than once. A replication of the present study, but using one group longitudinally, would provide a better picture of the developmental changes in the learners’ mental representations of complex verb forms. Running a longitudinal study like this would take several years of data collection, however, which is beyond the scope of a dissertation.

Second, the design of the second psycholinguistic experiment favored the observed ceiling effect in the accuracy scores from all the groups of participants. A wider range of options than the two buttons “same stem” and “different stem” should have been considered in the design of the task. For example, pictures could have been provided with five drawings similar to those of the picture-story sequences used in other tasks, and participants could have selected the one that corresponded to the preterite form they had just heard. Or they may have been asked to produce orally the infinitive of the verb as quickly as possible after hearing the preterite form. Otherwise, this type of data collection measure should be used in similar studies only to collect RTs, for which the measure provided very informative results, and not accuracy scores.

Third, the two picture-story sequences had similar objectives and the design of the second (drawings only) made it difficult to compare with the rest of the tasks because the L2 participants could use any verb form they wanted. In that second production task, the absence of low frequency items and the recurrent use of high frequency items were not very informative with respect to the mental mechanisms of L2 learners when handling complex verb forms. That is why, although data were collected via this measure and coded accordingly, the information from this task was not included in the analysis. In the future, researchers may consider providing the verbs for these types of tasks using picture-story sequences.

Finally, the proficiency exams the participants completed were very difficult, as well as long, especially for the advanced groups of learners (late L2 learners and the bilinguals). Even
though it was considered that the tests were useful and informative in assessing some of the language skills from the participants, most participants felt unhappy about the exam and informed the researcher that the exam was the hardest they had ever taken. Future studies might consider using other standardized proficiency exams. However, it should be noted that participants were not discouraged to the extent of dropping out of the study and no data were collected after the proficiency exams. These exams helped to truly distinguish between the proficiency groups and made sure that the participants in each proficiency level had comparable L2 skills.

Even with these limitations, there are many reasons to have confidence in the validity of this study. The materials were carefully designed, from the selection of the test items based on multiple frequency dictionaries to the audio recordings by a native female speaker from Spain. These materials and the whole protocol were pilot tested and additional changes were made, such as the protocol checklist, to prevent data loss or artifacts during the data collection. In the psycholinguistic experiments, the participants decided when to move to the next test item and the RTs were corrected during the coding process as needed. The statistical methods used were selected in order to capture as much information as possible from the students’ responses. Finally, the results from the tasks were combined because each task was measuring different variables. This triangulation of results proved to be an effective way to provide more robust results than if a single production or recognition task was used.

This study provided evidence in favor of the shift of reliance from the declarative memory system to the procedural memory system for regular verb forms for late L2 learners, as suggested by the DP model (Ullman, 2001b). These results in the averaged RTs for and accuracy scores of the test items were observed in the data from different groups of participants at varying
proficiency levels. There is a need for longitudinal studies in this type of research, which is the only way to faithfully track changes in the mental processing of complex verb forms by developing L2 learners. Additionally, there is a need to include some tasks in which little to no conscious attention (on the part of the participants) is paid to the verb forms, based on the results from Experiment 2. In doing so, the RTs in the processing of regular verb forms only should not be affected, especially for L2 learners at the higher proficiency levels. Future studies may consider including a task in which participants are presented drawings on the screen with the verb elicited but with a wider range of subjects (i.e., different PN suffixes elicited) to test the role of automaticity in relation to verb types and their frequencies in the target language. The use of Spanish proved to be a successful choice in the study of complex verb forms as it has a wider range of verb types than English, as well as a wider variety of regular rules. The overapplication of regular rules based on the verb class helped in providing stronger support for the dual-mechanism models, as discussed in the previous chapter. The use of languages other than English may continue to provide better insights about the processing of inflectional morphology.

6.2. Pedagogical Implications and Suggested Classroom Activities

The main goal of this study was to account for the developmental changes in the acquisition of complex verbal morphology in Spanish as well as to investigate the mental mechanisms by L2 learners when processing inflectional morphology. This is a study about the developing grammars of L2 learners and the implications of these developments in the ongoing theoretical debate about the processing and mental representation of language in broad terms. However, the findings of the study also have pedagogical implications because the participants were primarily classroom learners whose knowledge of Spanish came from formal instruction. What follows is an outline of the main implications, with sample activities that can be
incorporated in the L2 classroom to aid learners in the acquisition of inflectional morphology, based on the way they handle it and the recurring errors in their production.

Irregular verb forms as well as the vowel changes in the stem change verbs were posited as being handled by the declarative memory and, as a consequence, there were frequency effects in the accuracy and the RTs. Retrieval of low frequency items was challenging for all groups of L2 learners and the lack of vowel change for stem change verb forms was a recurring error, even for highly proficient learners. The former was the result of limited exposure to those forms, which hindered the arbitrary connections between the verb root and the corresponding irregular form/irregular verb stem; the latter was the result of lack of noticing of the vowel change for some subjects in the preterite paradigm of stem change verbs. Since irregularities are handled in the declarative memory system, L2 learners may benefit from activities that strengthen the verb root-preterite form connections explicitly. Since the vowel change has to be perceived first before it can be stored in the declarative memory system, inductive tasks are proposed to help L2 learners discover the grammar rules by themselves through guided activities. As for regular verbs, consciousness-raising tasks as well as speeded activities may aid L2 learners to detect the regular patterns and apply them more quickly so that the regular rules can be computed procedurally instead of explicitly. The following exercises are proposed, keeping in mind the discussion points just mentioned.

6.2.1. Concentration Game

L2 learners need to memorize the irregular verb forms so that in their production they do not fail to retrieve them. The associative connections between the base form (infinitive) and the irregular forms (in this case, the preterite tense) can be strengthened with the use of a concentration game, as shown in Figure 6-1. The teacher divides the class in small groups of about 4 or 5 students. Each group will need a set of about 30-40 cards. On half of the cards, the
teacher writes the infinitive form of the verb. On the other half of the cards, the teacher writes the irregular preterite forms of those verbs. After shuffling the cards they are placed in a grid facing down. Students will take turns turning over two cards at a time. If the two cards match (i.e., if they belong to the same verb, as shown in Figure 6-1), the student keeps the pair of cards; otherwise, they are replaced face down in their original positions.

Figure 6-1. Concentration game for irregular verb forms

The winner of the game is the student with the most cards at the end of the game. This concentration game can be played from time to time as new irregular verbs, especially those of lower frequency in Spanish, are introduced in the course. A more difficult version of the game for students at the intermediate/advanced proficiency levels can be to include base-irregular form connections with different subjects, i.e., from the whole preterite paradigm. That way, one can ask the students to state the subject of the base form-irregular preterite matching cards before they can keep the pair of cards.

6.2.2. Reading Passages with Input Enhancement

The regular rules as well as the vowel stem changes in the Spanish input can be somehow enhanced (Sharwood Smith, 1993) to make the verb endings and the vowel changes more salient.
In 2008, Lee & Huang conducted a meta-analysis in this research domain with a systematic synthesis of 16 studies and they found that learners exposed to enhanced texts outperformed those who read unenhanced texts. However, the authors indicated that the observed effect was small-sized ($d = 0.22$) and that the comparisons were provided with another experimental groups (input flood) rather than with true control groups (Lee & Huang, 2008, p. 323). One can find a real text in Spanish, or create a short reading passage, with most of the verbs being regular and stem change and enhance them by boldfacing, italicizing or underlining their endings and vowel changes, as shown in Figure 6-2.

| Juan Pablo (1) nació el 15 de mayo de 1979. (2) Durmió casi todo el día después de abrir sus ojitos por primera vez. (3) Sintió hambre y (4) bebió leche materna cada 3 horas. Su mamá lo (5) besó mucho y su hermano mayor le (6) regaló un peluche. |
| Juan Pablo (1) was born on the 15th of May, 1979. He (2) slept most of the day after opening his eyes for the first time. He (3) was hungry and (4) drank milk every 3 hours. His mom (5) kissed him a lot and his older brother (6) gave him a cuddly toy as a gift. |

Figure 6-2. Reading passage with input enhanced

The teacher can ask the students comprehension questions once they have read the passage and then the teacher can draw their attention to the particular base-preterite changes by using guided yes/no questions such as: ¿En qué terminan los verbos 1 y 4? ‘What’s the ending for verbs 1 and 4?, ¿Cuál es su infinitivo? ‘What’s their infinitive form?, ¿Qué podemos concluir sobre las formas de pretérito de los verbos 1 y 4? ‘What can we deduce about the preterite forms of verbs 1 and 4?’
Another activity that can help L2 students to pay attention to the vowel changes for some subjects of stem change verbs in the preterite is a multiple-choice exercise. Teachers can create a reading passage with a variety of stem verbs in the preterite and make sure it includes low frequency stem change preterite forms as well as fully regular verb forms from the preterite paradigm, e.g., *mentí* ‘I lied’ (regular verb form) as well as *mintió* ‘s/he lied’ (stem change verb form) preterite forms, as shown in the following example:

> La semana pasada salí con mi mejor amiga al cine. Ella estuvo muy feliz todo el día y (1) ____________ de cada chiste o historia que le conté. Fuimos al cine pero como la película fue tan aburrida (2) ____________. Para cenar fuimos al nuevo restaurante mexicano del centro comercial. Yo (3) ____________ una quesadilla de pollo y ella (4) ____________ unos tamales. Pero el camarero (5) ____________ la orden de otra mesa.

‘Last week I went out with my best friend to the movies. She was very happy all day long and (1) ____________ every joke or story I told her. We went o the movies but since the movie was so boring we (2) ____________. For dinner we went to the new Mexican restaurant in the mall. I (3) ____________ a chicken quesadilla and she (4) ____________ tamales. But the waiter (5) ____________ the order from another table.’

(1) a. se rió b. se reió c. me reí d. se ríe
(2) a. nos durmimos b. se duerme c. dormirnos d. nos dormimos
(3) a. pido b. pidi c. pedí d. pidió
(4) a. pedí o b. pide c. pidió d. pedí
(5) a. nos sirvió b. nos sirve c. nos servimos d. nos sirvió

The teacher writes the regular and stem change choices for each verb in addition to the incorrect answers so that L2 students are indirectly reminded that those verbs can have a vowel change in their root. At the end of the activity, one can ask the students to report how many verbs from the correct answers changed the vowel of their roots in the preterite forms. The teacher can help them induce that the vowel change only occurs for some subjects and the teacher can ask the students to provide some examples from the text.
6.2.4. Verb Tree Poster for Patterns of Changes

Students can practice all types of morphological changes in different groups of Spanish verbs, whether these patterns are considered regular (for most Spanish verbs of the same class) or irregular (for a limited number of verbs), using a verb tree poster, as shown in Figure 6-3.

Figure 6-3. Verb tree poster and suggested flashcards
Teachers can make a poster with a tree with many branches. Each tree branch must have an infinitive-preterite example for the verb conjugation pattern that the branch represents. Each student is given a flashcard that must be placed into one of the remaining spots in the tree branches, based on the morphological changes in the preterite form. A sample verb tree and complete set of suggested flashcards are included in Figure 6-3. A follow-up activity can be to ask them write a story in pairs or small groups in Spanish using eight preterite forms, each from a different tree branch, and then have them read it to the class or act it out in front of the class.

6.2.5. Quiz Show Game

Regular verb forms can be practiced in speeded tasks with the use of the Powerpoint software program to force the students to retrieve or simply recognize those forms as quickly as possible. Teachers can design a Powerpoint presentation of about 30-40 slides with some drawings for regular verbs. Teachers divide the class into two big groups and have one member from each come to the front of the class to represent her/his group. For half of the slides, one can provide a drawing and four written options with only one correct choice. For the other half of the slides, one can simply provide a drawing and a personal subject pronoun, as shown in Figure 6-4.

Figure 6-4. Samples of Quiz Show Game slides
For the former, the student who chose the correct option the fastest wins a point. For the latter, the student who provides the correct preterite form the fastest using the appropriate verb suggested by the drawing wins a point. Once a student provides an answer, s/he will not be able to provide additional ones and the turn is handed to the other group. If both groups get the answer wrong, the correct answer is provided by the teacher and the game continues, with no points being deducted. The group with the greatest number of points at the end of the quiz wins.

6.2.6. Correct the Errors

The final suggested activity can be used for advanced L2 learners to offer them more input in low frequency items as well as to direct their attention to frequent errors they make when producing some preterite forms. Teachers can find a reading passage such as a piece of news which contains a lot of low frequency irregular and stem change verbs. One can change some of the verbs to erroneous verb forms, mainly regularizing irregular verbs and keeping unchanged the vowel in the root of stem change verb forms. The instructions can tell the students that they have been hired as proofreaders for a newspaper in Spanish. Their task is to read the passage, find the typos and spot errors, and correct them. Follow-up discussion questions can be included so that students practice the verb forms just read in the passage.

Based on the results from this study, beginning learners seem to use explicit grammar rules to compute regular verbs whereas irregular verb forms are stored in and retrieved from long-term memory. Activities that aid in the extraction of the regular patterns of regular verbs (e.g., reading passages with input enhancement) or activities that promote the arbitrary connections between roots and preterite forms of irregular verbs (e.g., concentration games) are best suited for their needs. Intermediate learners use the declarative memory system to a great extent because it helps them in the retrieval of greater numbers of forms. If they are able to identify patterns in the language (whether in the regular, irregular, or vowel stem change verbs),
that may force them to restructure their IL system (e.g., multiple-choice activities and verb tree posters). Additionally, speeded tasks in the computation of regular verbs can help them retrieve those forms with greater automaticity (e.g., quiz show games). Advanced and bilingual learners may not benefit from additional practice of regular rules. Their main problems stem from low frequency irregular and stem change items. They need more input with them as well as explicit awareness of the main error types for those forms to avoid fossilization of erroneous patterns in their developing grammars (e.g., activities to correct errors).

The previous activities are not meant to change the route of acquisition of Spanish verbal morphology by L2 learners. Instead, they are meant to address some of the most challenging areas in which even highly proficient learners fail to achieve native-like competence as well as to provide precise aid in the mental mechanisms L2 learners use in the processing of complex verb forms, based on their proficiency level and the main findings of this study.

6.3. Final Remarks

The present study has contributed to our understanding of the mental representation of verbal morphology in the acquisition of Spanish as an L2. The late L2 learners started their route of acquisition memorizing verb forms and explicit rules taught in the classroom, but the advanced learners were able to extract patterns from the input, deduce the rules for the regular verbs, and compute those forms online by concatenating the correct TAM suffix to the verb root. In doing so, the declarative memory system of these advanced L2 learners was not overloaded with hundreds of redundant regular verb forms, even though that was observed in the beginning group. This restructuring of verb forms indicates that L2 learners have achieved a more complex representational system capable of computing complex verb forms declaratively or procedurally. This is the first time this shift in reliance from the declarative memory system to the procedural memory system for regular verb forms has been tested and evidenced in the production of L2
learners. This is an important contribution to the debate on the processing of verbal morphology because it evidences that not all verb types are processed equally by L2 learners at varying proficiency levels.
APPENDIX A
FOREIGN LANGUAGE BACKGROUND FORM

● Gender:  ☐ Male  ☐ Female

● Age:

● Your current rank at UF is (circle one, if applicable):
  Freshman  Sophomore  Junior  Senior  Graduate

● When writing, I am…  Right-handed  Left-handed

● Do you need some visual aids when reading from a computer screen or a printed material (circle one)?
  No  Yes, I need contact lenses  Yes, I need glasses

● Do you have any known learning disabilities (circle all that apply)?
  ☐ None
  ☐ Dyslexia
  ☐ Dysgraphia
  ☐ Auditory and/or processing disorders
  ☐ ADHD (attention deficit/hyperactivity disorder)
  ☐ Other. Please, specify __________________________________________

● What is your native(s) language(s)?
  __________________________________________

● Have you ever studied Spanish in a formal instruction setting before entering the University of Florida?
  ☐ Yes  ☐ No
  ➢ If yes:  Where? ____________________________________________
  For how many years? _________________________________________

● Do you usually socialize with anyone outside the class (friends or family members) who only speaks Spanish with you?
  ☐ Yes  ☐ No
  ➢ If yes:  How often? _________________________________________
  Where do they live? _________________________________________

● Have you lived in a Spanish-speaking country?
  ☐ Yes  ☐ No
  ➢ If yes:  Where? (country/s) ________________________________
  For how many months/years? ________________________________
After this class, do you have plans to continue studying Spanish (if applicable)?

☐ Yes ☐ No

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

<table>
<thead>
<tr>
<th>Skill</th>
<th>very poor</th>
<th>poor</th>
<th>low</th>
<th>average</th>
<th>good</th>
<th>advanc.</th>
<th>highly proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish listening</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Spanish reading</td>
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</table>

Thinking only about English and Spanish, what language(s) do you use the most in the following contexts (circle one for each context):

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

Please, translate the following list of Spanish verbs into English. If you do NOT know the meaning of a verb but you have an intuition or a vague idea of its possible meaning, write that down too. If you do not have any idea, leave it blank.

For example:        Probar > a movement of some sort

Abrir > ___________________________________________________
Advertir > ___________________________________________________
Andar > ___________________________________________________
Atraer > ___________________________________________________
Besar > ___________________________________________________
Caber > ___________________________________________________
Cantar > ___________________________________________________
Conducir > ___________________________________________________
Conseguir > ___________________________________________________
Contraer > ___________________________________________________
Convertir > ___________________________________________________
Corregir > ___________________________________________________
Decir > ___________________________________________________
Despedirse > ___________________________________________________
Divertirse > ___________________________________________________
Dormir > ___________________________________________________
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<td>Preguntar</td>
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<td>Seguir</td>
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<td>Tomar</td>
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<td>Traducir</td>
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<td>Traer</td>
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<td>Vender</td>
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<tr>
<td>Verter</td>
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<tr>
<td>Viajar</td>
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### APPENDIX B

**PARTICIPANTS’ PAST TRAVEL EXPERIENCES**

Summary of participants’ destinations in the Spanish-speaking country and duration of the stay

<table>
<thead>
<tr>
<th>Group and N</th>
<th>Participant ID</th>
<th>Destination</th>
<th>Duration in months</th>
<th>Averaged travel experiences for the group</th>
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<td>NA</td>
<td>NA</td>
<td>0 months</td>
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<tr>
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<td>Spain</td>
<td>1.0</td>
<td>1.25 months</td>
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<td>Participant 30</td>
<td>Spain</td>
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<tr>
<td></td>
<td>Participant 3</td>
<td>Peru</td>
<td>5.0</td>
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</tr>
<tr>
<td></td>
<td>Participant 7</td>
<td>Honduras</td>
<td>2.0</td>
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<tr>
<td></td>
<td>Participant 8</td>
<td>Mexico</td>
<td>1.5</td>
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<tr>
<td></td>
<td>Participant 37</td>
<td>Peru</td>
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<tr>
<td></td>
<td>Participant 39</td>
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<td>Participant 40</td>
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<td>Participant 41</td>
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<td>Participant 42</td>
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<td></td>
<td>Participant 46</td>
<td>Spain</td>
<td>1.5</td>
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<tr>
<td>Advanced (11/15)</td>
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<td>Spain</td>
<td>3.0 months</td>
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<td></td>
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APPENDIX C
FREQUENCIES FOR THE FILLER ITEMS

Token count, frequencies per million words from the three corpora, and averaged frequency for high frequency masculine fillers

<table>
<thead>
<tr>
<th>Term</th>
<th>CREA Cases</th>
<th>CREA Freq.</th>
<th>CDE Cases</th>
<th>CDE Freq.</th>
<th>CUMBRE Cases</th>
<th>CUMBRE Freq.</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mundo ('world')</td>
<td>94,895</td>
<td>629.37</td>
<td>12,409</td>
<td>609.78</td>
<td>1,374</td>
<td>66.50</td>
<td>435.22</td>
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<tr>
<td>Momento ('moment')</td>
<td>87,145</td>
<td>577.97</td>
<td>10,486</td>
<td>515.28</td>
<td>1,536</td>
<td>74.34</td>
<td>389.20</td>
</tr>
<tr>
<td>Hombre ('man')</td>
<td>79,463</td>
<td>527.02</td>
<td>9,958</td>
<td>489.34</td>
<td>1,802</td>
<td>87.21</td>
<td>367.86</td>
</tr>
<tr>
<td>Lugar ('place')</td>
<td>79,008</td>
<td>524.00</td>
<td>9,885</td>
<td>485.75</td>
<td>971</td>
<td>46.99</td>
<td>352.25</td>
</tr>
<tr>
<td>Estado ('state')</td>
<td>47,009</td>
<td>311.77</td>
<td>11,957</td>
<td>587.57</td>
<td>1,570</td>
<td>75.98</td>
<td>325.11</td>
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<tr>
<td>Fin ('end')</td>
<td>60,671</td>
<td>402.38</td>
<td>7,443</td>
<td>365.75</td>
<td>879</td>
<td>42.54</td>
<td>270.22</td>
</tr>
<tr>
<td>Grupo ('group')</td>
<td>57,289</td>
<td>379.95</td>
<td>6,396</td>
<td>314.30</td>
<td>1,007</td>
<td>48.74</td>
<td>247.66</td>
</tr>
<tr>
<td>Padre ('father')</td>
<td>42,155</td>
<td>279.58</td>
<td>6,536</td>
<td>321.18</td>
<td>1,059</td>
<td>51.25</td>
<td>217.34</td>
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<tr>
<td>Problema ('problem')</td>
<td>43,790</td>
<td>290.43</td>
<td>5,739</td>
<td>282.01</td>
<td>1,273</td>
<td>61.61</td>
<td>211.35</td>
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<tr>
<td>Señor ('man')</td>
<td>44,293</td>
<td>293.76</td>
<td>5,244</td>
<td>257.69</td>
<td>1,338</td>
<td>64.76</td>
<td>205.40</td>
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<td>Pueblo ('village')</td>
<td>39,898</td>
<td>264.61</td>
<td>4,990</td>
<td>245.21</td>
<td>879</td>
<td>42.54</td>
<td>184.12</td>
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<td>Hijo ('son')</td>
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<td>195.98</td>
<td>4,420</td>
<td>217.20</td>
<td>1,186</td>
<td>57.40</td>
<td>156.86</td>
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<td>Proyecto ('project')</td>
<td>39,353</td>
<td>261.00</td>
<td>3,217</td>
<td>158.08</td>
<td>884</td>
<td>42.78</td>
<td>153.95</td>
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<tr>
<td>Programa ('program')</td>
<td>31,450</td>
<td>208.58</td>
<td>3,250</td>
<td>159.71</td>
<td>973</td>
<td>47.09</td>
<td>138.46</td>
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<tr>
<td>Mes ('month')</td>
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<td>184.00</td>
<td>2,867</td>
<td>140.88</td>
<td>992</td>
<td>48.01</td>
<td>124.30</td>
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</table>
Token count, frequencies per million words from the three corpora, and averaged frequency for high frequency feminine fillers

<table>
<thead>
<tr>
<th>Term</th>
<th>CREA Cases</th>
<th>CREA Freq.</th>
<th>CDE Cases</th>
<th>CDE Freq.</th>
<th>CUMBRE Cases</th>
<th>CUMBRE Freq.</th>
<th>Averaged Freq.</th>
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<tbody>
<tr>
<td>Vida ('life')</td>
<td>124,349</td>
<td>824.71</td>
<td>14,957</td>
<td>734.99</td>
<td>1,516</td>
<td>73.37</td>
<td>544.36</td>
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<td>Forma ('shape')</td>
<td>98,006</td>
<td>650.00</td>
<td>13,561</td>
<td>666.39</td>
<td>1,097</td>
<td>53.09</td>
<td>456.49</td>
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<td>Casa ('house')</td>
<td>80,327</td>
<td>532.75</td>
<td>12,433</td>
<td>610.96</td>
<td>1,373</td>
<td>66.45</td>
<td>403.39</td>
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<td>Política ('politics')</td>
<td>73,650</td>
<td>488.46</td>
<td>7,964</td>
<td>391.35</td>
<td>792</td>
<td>38.33</td>
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<td>Gente ('people')</td>
<td>52,769</td>
<td>349.98</td>
<td>8,896</td>
<td>437.15</td>
<td>1,041</td>
<td>50.38</td>
<td>279.17</td>
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<td>Manera ('manner')</td>
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<td>404.86</td>
<td>7,474</td>
<td>367.27</td>
<td>926</td>
<td>44.82</td>
<td>272.32</td>
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<td>Mujer ('woman')</td>
<td>60,221</td>
<td>399.40</td>
<td>6,945</td>
<td>341.28</td>
<td>1,253</td>
<td>60.64</td>
<td>267.11</td>
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<td>Noche ('night')</td>
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<td>7,152</td>
<td>351.45</td>
<td>1,101</td>
<td>53.29</td>
<td>259.12</td>
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<td>Verdad ('truth')</td>
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<td>308.80</td>
<td>7,323</td>
<td>359.85</td>
<td>839</td>
<td>40.61</td>
<td>236.42</td>
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<tr>
<td>Mano ('hand')</td>
<td>46,813</td>
<td>310.47</td>
<td>5,550</td>
<td>272.73</td>
<td>1,310</td>
<td>63.40</td>
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<td>Situación ('situation')</td>
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<td>366.81</td>
<td>4,788</td>
<td>235.28</td>
<td>912</td>
<td>44.14</td>
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<td>Hora ('hour')</td>
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<td>4,410</td>
<td>216.71</td>
<td>1,175</td>
<td>56.87</td>
<td>181.56</td>
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<td>4,745</td>
<td>233.17</td>
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<td>124.52</td>
<td>873</td>
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<td>153.22</td>
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Token count, frequencies per million words from the three corpora, and averaged frequency for low frequency masculine fillers

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<th>CUMBRE</th>
<th></th>
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<tr>
<td>Dictador (‘dictator’)</td>
<td>2,172</td>
<td>14.41</td>
<td>274</td>
<td>13.46</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>13.94</td>
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<td>Fotógrafo (‘photographer’)</td>
<td>2,221</td>
<td>14.73</td>
<td>235</td>
<td>11.55</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>13.14</td>
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<td>Párrafo (‘paragraph’)</td>
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<td>(&lt; 6.87)</td>
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<td>17.13</td>
<td>150</td>
<td>7.37</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>12.25</td>
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<td>Perfume (‘perfume’)</td>
<td>1,655</td>
<td>10.98</td>
<td>259</td>
<td>12.73</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>11.86</td>
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<tr>
<td>Terremoto (‘earthquake’)</td>
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<td>11.14</td>
<td>174</td>
<td>8.55</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>9.85</td>
<td></td>
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<tr>
<td>Lápiz (‘pencil’)</td>
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<td>218</td>
<td>10.71</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>9.41</td>
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<td>Armario (‘closet’)</td>
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<td>112</td>
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<td>(&lt; 6.87)</td>
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<td>Cheque (‘check’)</td>
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<td>6.87</td>
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<tr>
<td>Hebreo (‘Hebrew’)</td>
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<td>3.51</td>
<td>181</td>
<td>8.89</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
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<td>Diamante (‘diamond’)</td>
<td>484</td>
<td>3.21</td>
<td>142</td>
<td>6.98</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>5.10</td>
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<tr>
<td>Insulto (‘insult’)</td>
<td>755</td>
<td>5.01</td>
<td>83</td>
<td>4.08</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>4.55</td>
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<tr>
<td>Notario (‘notary’)</td>
<td>877</td>
<td>5.82</td>
<td>66</td>
<td>3.24</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>4.53</td>
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<tr>
<td>Coloquio (‘colloquium’)</td>
<td>698</td>
<td>4.63</td>
<td>61</td>
<td>3.00</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>3.82</td>
<td></td>
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<tr>
<td>Veterinario (‘veterinarian’)</td>
<td>446</td>
<td>2.96</td>
<td>35</td>
<td>1.72</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>2.34</td>
<td></td>
</tr>
</tbody>
</table>
Token count, frequencies per million words from the three corpora, and averaged frequency for low frequency feminine fillers

<table>
<thead>
<tr>
<th></th>
<th>CREA Cases</th>
<th>CREA Freq.</th>
<th>CDE Cases</th>
<th>CDE Freq.</th>
<th>CUMBRE Cases</th>
<th>CUMBRE Freq.</th>
<th>Averaged Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tolerancia</em> ('tolerance')</td>
<td>2,448</td>
<td>16.24</td>
<td>279</td>
<td>13.71</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>14.98</td>
</tr>
<tr>
<td><em>Nacionalidad</em> ('nationality')</td>
<td>2,677</td>
<td>17.75</td>
<td>191</td>
<td>9.39</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>13.57</td>
</tr>
<tr>
<td><em>Discriminación</em> ('discrimination')</td>
<td>2,372</td>
<td>15.73</td>
<td>185</td>
<td>9.09</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>12.41</td>
</tr>
<tr>
<td><em>Biografía</em> ('biography')</td>
<td>2,125</td>
<td>14.09</td>
<td>211</td>
<td>10.37</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>12.23</td>
</tr>
<tr>
<td><em>Vitamina</em> ('vitamin')</td>
<td>2,487</td>
<td>16.49</td>
<td>129</td>
<td>6.34</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>11.42</td>
</tr>
<tr>
<td><em>Caridad</em> ('charity')</td>
<td>1,513</td>
<td>10.03</td>
<td>252</td>
<td>12.38</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>11.21</td>
</tr>
<tr>
<td><em>Medianoche</em> ('midnight')</td>
<td>1,728</td>
<td>11.46</td>
<td>208</td>
<td>10.22</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>10.84</td>
</tr>
<tr>
<td><em>Calificación</em> ('grade')</td>
<td>1,750</td>
<td>11.61</td>
<td>197</td>
<td>9.68</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>10.65</td>
</tr>
<tr>
<td><em>Cueva</em> ('cave')</td>
<td>1,367</td>
<td>9.07</td>
<td>241</td>
<td>11.84</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>10.46</td>
</tr>
<tr>
<td><em>Chaqueta</em> ('jacket')</td>
<td>1,918</td>
<td>12.72</td>
<td>164</td>
<td>8.06</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>10.39</td>
</tr>
<tr>
<td><em>Motivación</em> ('motivation')</td>
<td>1,648</td>
<td>10.93</td>
<td>157</td>
<td>7.71</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>9.32</td>
</tr>
<tr>
<td><em>Blusa</em> ('blouse')</td>
<td>981</td>
<td>6.51</td>
<td>140</td>
<td>6.88</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>6.70</td>
</tr>
<tr>
<td><em>Partícula</em> ('particle')</td>
<td>558</td>
<td>3.70</td>
<td>150</td>
<td>7.37</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>5.54</td>
</tr>
<tr>
<td><em>Pastilla</em> ('pill')</td>
<td>459</td>
<td>3.04</td>
<td>81</td>
<td>3.98</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>3.51</td>
</tr>
<tr>
<td><em>Motocicleta</em> ('motorcycle')</td>
<td>377</td>
<td>2.50</td>
<td>61</td>
<td>3.00</td>
<td>(&lt; 142)</td>
<td>(&lt; 6.87)</td>
<td>2.75</td>
</tr>
</tbody>
</table>
APPENDIX D
INSTRUCTIONS FOR EXPERIMENTS 1 AND 2

Instructions for Experiment 1

• The screen will display a small green circle (●). **Press the green button** from the color-coded button box to start the activity.

• The computer will display either a verb or a noun in Spanish at the center of the screen. Words are color-coded. **VERBS** will be displayed in a blue font and in their infinitive form. **NOUNS** will be displayed in a black font and in their singular form. There are a total of 120 words.

• **First, read the verb or the noun silently.** Words will remain onscreen indefinitely.

• Second, **if the word is a VERB** you need to say into the microphone its **third person singular PRETERITE** as quickly as possible. For example, if the verb **BEBER** is displayed on the screen, you need to say **BEBIÓ** into the microphone as quickly as possible. Please, say it **clear and loud**.

• **If the word is a NOUN** you need to say into the microphone its **GENDER** as quickly as possible. Only two options are possible: masculine or feminine. For example, if the Spanish noun **FLOR** is displayed on the screen, you need to say **FEMENINE** into the microphone as quickly as possible. Again, please say it **clear and loud**.

• Words will disappear from the screen at the moment you start providing an answer into the microphone. Please, **do not say anything into the microphone but your final response**, that is, the one you want to provide. It is important that you do not cough, sigh, mumble, murmur or alike as this will automatically trigger the disappearance of the word from the screen before you had a chance to think about your answer.

• If you realize you made a mistake right after you provided an answer, **you can say a new answer into the microphone before moving on to the next word.** But if you realize about your mistake later during the experiment, do not worry about it. **Better concentrate on the upcoming words.**

• Finally, after 1.5 seconds from the moment you provided your answer for each word into the microphone, the small green circle (●) will automatically appear at the center of the screen. **When you are ready for the next word, press the green button again.**

• If you need a small pause or break during the experiment, **you can stop at any of the screens with a small green circle** before moving on to the next word.

• If you have any questions, please **ask the experimenter right now.**

• Before starting the activity, let’s make sure you understand the procedure by working with **10 practice words**. So get ready and start these 10 practice words!
Instructions for Experiment 2

- The computer screen will display the question: **Ready? Press any button** from the color-coded button box to start the activity.

- Right after pressing a button, the computer will display a small red cross (+) at the center of the screen while you listen to a word in Spanish via the headphones. It can be either a **verb in the preterite** or a **singular noun**. You will listen to the word only once. There are a total of 120 words.

- Right after the word is pronounced in full, a written word will be displayed on the computer screen. It can be either a verb in the infinitive or a plural noun in Spanish. **You have to decide if the written word shares the same stem as the word you just listened to or if it has a different stem.** The written word will remain onscreen indefinitely until you make a decision by either pressing the **SAME STEM red button** (🔴) or the **DIFFERENT STEM purple button** (🟣) from the color-coded button box.

- For example, if you heard the word CUADERNO and the screen displayed COMPUTADORAS, you need to press the **DIFFERENT STEM purple button**. However, if you heard CUADERNO and then CUADERNOS was displayed on the screen, the words shared the same stem even though the written version was in its plural form and, consequently, you need to **press the SAME STEM red button**.

- Similarly, if you heard COMPRÓ and the screen displayed ESCUCHÓ, press the **DIFFERENT STEM purple button**. But if you heard COMPRÓ and then COMPRAR was displayed on the screen, the words shared the same stem even though the written version was in its infinitive form, so you need to **press the SAME STEM red button**.

- Please, press any of the two buttons as quickly as possible. If you realize you made a mistake right after you pressed a button, inform about it to the experimenter immediately. But if you realize about your mistake later during the experiment, do not worry about it. Better concentrate on the upcoming words.

- Right after pressing one of the two buttons, the screen will display the **Ready?** question again. **When you are ready for the next word, press any button** from the color-coded button box.

- If you need a small pause or break during the experiment, you can stop at any of the **Ready?** screens before moving on to the next word.

- If you have any questions, please **ask the experimenter right now**.

- Before starting the activity, let’s make sure you understand the procedure by working with **10 practice words**. So get ready and start these 10 practice words.
APPENDIX E
PROTOCOL CHECKLIST

Participant ID: _________________   Date: __________   Group: __________

Before the participant arrives…
☐ Check that the headphones work, the volume level, and microphone’s sensitivity.

With the participant…
☐ Make the participant complete the sign in page.
☐ Make the participant to read and sign the consent form. Write his/her ID code on top of the consent form page. Give him/her a copy.
☐ Complete the experiment log sheet.
☐ Instruct the participant to turn off the cell phone during the data collection.
☐ Turn OFF the network on the computer.
☐ Decide the order of the 2 psycholinguistic tasks: __________ Place the tags on the appropriate buttons.
☐ Read this introductory text:

Today you will be asked to complete two activities on this computer. But, first of all, relax and sit at a comfortable distance from the computer screen. You need to wear a set of headphones with a microphone attached to it. Make sure that it is placed correctly over your head and that the microphone is in front of your mouth.

☐ For TASK 1: Read next page.

☐ For TASK 2: Have the participant read the instructions.
   (Change the tags, if applicable)
   Open Psyc scope dragging the Main Script file.
   Run the experiment by typing the participant’s code number: ______

Additional comments here

☐ For task 1: Have the participant read the instructions.
   • (Change the tags, if applicable: NEXT tag)
   • Start Audacity with file > new > ● (start recording).
   • Open Psyc scope dragging the Main Experiment Script file.
   • Run the experiment by typing the participant’s code number: ______
<table>
<thead>
<tr>
<th>Mesa</th>
<th>Caer</th>
<th>Impedir</th>
<th>Profesor</th>
<th>Carro</th>
<th>Invertir</th>
<th>Cocinar</th>
<th>Canción</th>
<th>Querer</th>
<th>Comer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Comments here…</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hijo</th>
<th>Extraer</th>
<th>Calificación</th>
<th>Economía</th>
<th>Tomar</th>
<th>Pedir</th>
<th>Hebree</th>
<th>Traer</th>
<th>Vitamina</th>
<th>Blusa</th>
<th>Regalar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinario</td>
<td>Postre</td>
<td>Insulto</td>
<td>Politica</td>
<td>Situación</td>
<td>Seguir</td>
<td>Proyecto</td>
<td>Escapar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traducir</td>
<td>Poder</td>
<td>Relación</td>
<td>Manera</td>
<td>Inventar</td>
<td>Llevar</td>
<td>Caber</td>
<td>Corregir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noche</td>
<td>Tener</td>
<td>Problema</td>
<td>Hacer</td>
<td>Poner</td>
<td>Salir</td>
<td>Hombre</td>
<td>Venir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introducir</td>
<td>Hora</td>
<td>Pagar</td>
<td>Morir</td>
<td>Andar</td>
<td>Decir</td>
<td>Producir</td>
<td>Conducir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esperar</td>
<td>Vida</td>
<td>Perfume</td>
<td>Mundo</td>
<td>Gente</td>
<td>Mano</td>
<td>Dictador</td>
<td>Sonreir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chaqueta</td>
<td>Advertir</td>
<td>Motocicleta</td>
<td>Besar</td>
<td>Terremoto</td>
<td>Notario</td>
<td>Mirar</td>
<td>Estado</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empezar</td>
<td>Mes</td>
<td>Despedirse</td>
<td>Diamante</td>
<td>Preguntar</td>
<td>Abrir</td>
<td>Mujer</td>
<td>Tolerancia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Momento</td>
<td>Pastilla</td>
<td>Divertirse</td>
<td>Dormir</td>
<td>Discriminación</td>
<td>Haber</td>
<td>Persona</td>
<td>Cantar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estar</td>
<td>Conseguir</td>
<td>Forma</td>
<td>Verter</td>
<td>Caridad</td>
<td>Biografía</td>
<td>Entraar</td>
<td>Señor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ir</td>
<td>Cueva</td>
<td>Padre</td>
<td>Verdad</td>
<td>Coloquio</td>
<td>Vender</td>
<td>Fin</td>
<td>Viajar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armario</td>
<td>Reducir</td>
<td>Lápiz</td>
<td>Contraer</td>
<td>Reírse</td>
<td>Sentir</td>
<td>Fotógrafo</td>
<td>Pueblo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Llamar</td>
<td>Herir</td>
<td>Programa</td>
<td>Servir</td>
<td>Lugar</td>
<td>Cheque</td>
<td>Particula</td>
<td>Repetir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mentir</td>
<td>Vestirse</td>
<td>Olvidar</td>
<td>Medir</td>
<td>Atraer</td>
<td>Motivación</td>
<td>Medianoche</td>
<td>Nacionalidad</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casa</td>
<td>Nacer</td>
<td>Convertir</td>
<td>grupo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Stop ■ the recording and then file > save project as > IDaudiolab.aup
☐ Make the student pick one picture story among the ones for the man.
☐ Read the instructions for Picture description activity 1:

Please, pick one of these pages but do not show it to me. It will contain a picture-story sequence of a character that you need to narrate to me. Please, tell me in Spanish what this person did in the past. You have to use the verbs provided for each drawing in the preterite tense. My task will be to guess which picture story you have just selected once your narration is complete. You need to provide as much information as possible because all the picture-story sequences are very similar and they only differ in a couple of drawings. Do not disclose the name of the character to me, which is at the right bottom of the page, until your narration is complete. Instead, refer to the character as ÉL or ELLA. Again, use the verbs provided in the preterite form and provide as much information as possible. There is no time limit to complete this task.

☐ Start Audacity with file > new > ● (start recording).
☐ Write the responses in the following chart during the data collection:

<table>
<thead>
<tr>
<th>Nacer</th>
<th>Llamar</th>
<th>Esperar</th>
<th>Venir</th>
<th>Regalar</th>
<th>Poner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verter</td>
<td>Tomar</td>
<td>Mirar</td>
<td>Medir</td>
<td>Corregir</td>
<td></td>
</tr>
<tr>
<td>Mentir</td>
<td>Escapar</td>
<td>Caber</td>
<td>Poder</td>
<td>Decir</td>
<td>Repetir</td>
</tr>
<tr>
<td>Inventar</td>
<td>Reducir</td>
<td>Andar</td>
<td>Sentir</td>
<td>Extraer</td>
<td>Seguir</td>
</tr>
</tbody>
</table>

☐ Pretend you guessed the character’s name: Raúl.

☐ Make the student pick one picture story among the ones for the woman.
☐ Read the instructions for Picture description activity 2:

As before, pick one of these pages but do not show it to me. Again, tell me in Spanish what this person did last month. This time there will not be written verbs on the page but you still have to narrate all the events by using the preterite tense. My task will be to guess which picture story you have just selected once your narration is complete. Do not disclose the name of the character to me, which is at the right bottom of the page, until your narration is complete. Instead, refer to the character as ÉL or ELLA. Again, use verbs in the preterite form and provide as much information as possible. There is no time limit to complete this task.

☐ Write the responses in the following chart during the data collection:
Dormir | Vestirse | Entrar | Hacer | Salir | Abrir
---|---|---|---|---|---
Conducir | Introducir | Pedir | Traer | Servir | Pagar | Cantar
Viajar | Traducir | Ir | Estar | Sonreír | Reír
Preguntar | Besar | Despedirse | Tener | Morir

☐ Pretend you guessed the character’s name: Luisa.

☐ Read the instructions for the questions:

In the previous tasks, you had to use some verbs in the preterite. I would like you to tell me what it is you did inside your mind right before you produced different verbs in Spanish in their preterite forms. You can answer to me in English now.

1. When you had a verb like CANTAR or BEBER and you wanted to provide a preterite form, what is it you did mentally before producing the verb forms CANTÓ or BEBIÓ?
2. And when you had a verb like PEDIR or DORMIR and you wanted to provide a preterite form, what is it you did mentally before producing the verb forms PIDIÓ or DURMIÓ?
3. Finally, when you had a verb like HACER or IR and you wanted to provide a preterite form, what is it you did mentally before producing the verb forms HIZO or FUE?

☐ Stop ■ the recording and then file > save project as > IDaudiodescr.aup
☐ Make the participant fill out the Foreign Language Background form.
☐ Write a check and make the participant sign it. Give him/her the money.

**Before leaving the lab…**

☐ Fill out the lab’s excel document. Desktop > Keys > participantkeys.xls. When complete, eject it with the ▲ button on the left.
☐ Copy all 4 data items to the flash drive.
☐ Turn ON the network.
☐ Make sure all PCs are in sleep mode and that I have completed the sign in page, the experiment log sheet and the lab’s excel document.
APPENDIX F
PICTURE-STORY SEQUENCE 1

nacer                      llamar                     esperar                  venir
regalar                   poner

verter                       tomar                    mirar                               medir                                  corregir

tomar                      verter

mentir                 escapar                caber                 poder            decir                repetir        conseguir
inventar

raúl

83 > 75

85 x 75

No tengo celular

inventario                   reducir                 andar                     sentir       extraer                   seguir
APPENDIX G
PICTURE-STORY SEQUENCE 2

264

APPENDIX G
PICTURE-STORY SEQUENCE 2

¿Cuántos años tienes?

¡Adiós!

Una sopa, por favor

LUISA
Interpretación de Textos Orales. Parte 1.
A continuación escuchará 10 diálogos breves entre dos personas. La persona que responde lo hace de tres formas distintas pero solamente una es adecuada. Oirá cada diálogo dos veces. Después de la segunda audición, marque la opción correcta en la hoja.

Diálogo número 1:

**HOMBRE:** .................................................................

**MUJER:**
a) El mes que viene voy.
b) Gire la segunda a la derecha.
c) Pues no lo encuentro.

Interpretación de Textos Orales. Parte 2.
A continuación escuchará 7 diálogos muy breves. Se le hará una pregunta acerca de cada uno de ellos. Escoja una de las tres respuestas que se le proponen. Oirá cada diálogo dos veces. Después de la segunda audición, marque la opción correcta en la hoja.

Texto 1: 11. ¿Qué objeto lleva esta pareja a la playa?

Interpretación de Textos Orales. Parte 3.
A continuación usted va a oír una noticia radiofónica. La oirá dos veces. Después de la segunda audición, marque la opción correcta en la hoja.

18. Según esta noticia, estos consejos del Ministerio de Sanidad son exclusivos para el verano.
   a) Verdadero.
   b) Falso.

A continuación usted va a oír una conversación entre dos personas. La oirá dos veces. Después de la segunda audición, marque la opción correcta en la hoja.

21. Según la grabación, el hombre…
   a) desea bañarse con los delfines.
   b) dispone de una semana de vacaciones.
   c) quiere realizar un viaje cultural y de ocio.
Conciencia Comunicativa. Parte 1.
¿En qué situación diría usted las siguientes expresiones? Marque la opción correcta en la hoja.

1. ¡Que cumdas muchos más!
   Usted __________ a un amigo.
   a) saluda.
   b) llama.
   c) felicita.

Conciencia Comunicativa. Parte 2.
A la izquierda tiene usted 10 frases. En cada frase hay en letra negrita una o dos palabras que no son adecuadas. Sustitúyala por alguna de las palabras de la lista que aparecen en el cuadro de la derecha. Puede utilizar esta hoja como borrador. Marque la opción correcta en las casillas con números al final de la hoja.

<table>
<thead>
<tr>
<th>Núm.</th>
<th>Frase</th>
<th>Opciones</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Todas las noches son conciertos en las calles de la ciudad.</td>
<td>a) muy</td>
</tr>
<tr>
<td>7.</td>
<td>Ustedes decís que este libro es muy interesante.</td>
<td>b) hay</td>
</tr>
<tr>
<td>8.</td>
<td>[…]</td>
<td>c) [...]</td>
</tr>
</tbody>
</table>

Conciencia Comunicativa. Parte 3.
Rellene los huecos del texto siguiente con una de las tres opciones que se le proponen. Marque la opción correcta en la hoja.

UNA CONVERSACIÓN TELEFÓNICA
HOMBRE: Hola, ¿está Idoia?
MUJER: Sí, soy ____16_____. Eres Mikel, ¿no?
HOMBRE: Sí, no te había ____17_____.
MUJER: Es que estoy un poco resfriada. ¿Qué querías? […]

Opciones:

<table>
<thead>
<tr>
<th>Núm.</th>
<th>Opción 1</th>
<th>Opción 2</th>
<th>Opción 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>a) mí</td>
<td>b) me</td>
<td>c) yo</td>
</tr>
<tr>
<td>17.</td>
<td>a) reconocido</td>
<td>b) reconociendo</td>
<td>c) reconocer</td>
</tr>
<tr>
<td>18.</td>
<td>[…]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interpretación de Textos Escritos. Parte 1.
A continuación encontrará usted un texto y tres preguntas sobre él. Marque la opción correcta en la hoja.

EL CEBICHE
Según todos los indicios, fue en Perú donde se empezó a consumir el pescado y el marisco en crudo. Al principio se maceraba con una especie de naranjillas, pero con la llegada de los españoles y de los portugueses se introdujeron los limones y el perejil, que enriquecieron esta...
preparación y dieron lugar al cebiche, que, en la actualidad y gracias en gran medida al éxito que tuvo entre los marineros ingleses, se consume en todo el mundo.

[...](282 words) (Adaptado de I Congreso de Cocina Iberoamericana. España)

Preguntas:
1. Según el texto, el cebiche es un plato de pescado que...
   a) tiene su origen en Perú.
   b) inventaron los españoles.
   c) perfeccionaron los ingleses.

Interpretación de Textos Escritos. Parte 2.
A continuación le presentamos una serie de textos breves. Conteste a las preguntas que se le hacen. Marque la opción correcta en la hoja.

Texto A:

<table>
<thead>
<tr>
<th>CLASES DE GUITARRA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clases de guitarra</strong></td>
</tr>
<tr>
<td><strong>Clases de guitarra</strong></td>
</tr>
<tr>
<td><strong>Clases de guitarra</strong></td>
</tr>
<tr>
<td><strong>Clases de guitarra</strong></td>
</tr>
</tbody>
</table>

Profesor cualificado (seis años en el Conservatorio de Música) imparte clases de guitarra española.

Si te interesa, llámame y nos pondremos de acuerdo en cuanto a precios y horarios.

Clases todos los días de la semana excepto domingos y festivos.

4. Según el texto, puede ir a clase de guitarra cualquier día de la semana.
   a) Verdadero.
   b) Falso.

Interpretación de Textos Escritos. Parte 3.
A continuación encontrará usted un texto y diez preguntas sobre él. Marque la opción correcta en la hoja.

CÍRCULO DE COLECCIONISTAS

INSTRUMENTOS. Tienda especializada vende instrumentos de percusión de los siglos XVIII y XIX. Solo piezas de gran valor. Si usted puede ofrecernos algún instrumento musical, incluido del siglo XX, llámenos al teléfono 953413227 o entre en nuestra página web www.instrumentosmusicales.com.
Preguntas:
11. Hay una tienda de música que vende instrumentos…
   a) de percusión.
   b) para especialistas.
   c) del siglo XX.

**NIVEL INTERMEDIO**

**Comprensión auditiva.**
Usted va a oír cuatro textos. Oirá cada uno de ellos dos veces. Al final de la segunda audición, dispondrá de tiempo para contestar a las preguntas que se le formulan. Hay dos modalidades de pregunta:

Primer tipo:
   a) Verdadero.
   b) Falso.

Segundo tipo: Selección de una respuesta entre tres opciones:
   a) …
   b) …
   c) …

Marque la opción correcta en la hoja.

**Texto 1: EXPOSICIÓN DE CÓMICS**
A continuación escuchará una noticia sobre una exposición de comics.  
(Adaptado de Radio Espectador. Uruguay)

**Preguntas:**
1. Según la audición, los dibujos de Santiago González se vieron en un programa de televisión.
   a) Verdadero.
   b) Falso.

**Texto 2: EL AJEDREZ EN LA ESCUELA**
A continuación una noticia sobre el ajedrez en la escuela.  
(Adaptado de Radio Rebelde. Cuba)

**Preguntas:**
4. Según la audición, la práctica del ajedrez en las escuelas cubanas…
   a) es una novedad en este curso escolar.
   b) se imparte en todos los niveles educativos.
   c) es una asignatura escolar.
GUÍAS DE VIAJES

Pocas personas se aventuran a visitar por primera vez un lugar sin ir acompañadas de una buena guía de viajes. _____1_____ con el pasaporte, la moneda extranjera o el billete de avión, este producto _____2_____ en parte fundamental del equipaje y ha pasado de ser un artículo minoritario a _____3_____ las posiciones más altas en las listas de los libros más _____4_____.

[...]       (Adaptado de Consumer. España)

Opciones:
1.  a) Además  b) Al lado  c) Junto
2.  a) se ha hecho  b) se ha vuelto  c) se ha convertido
3.  a) estar   b) ocupar  c) ser
4.  a) vendidos  b) ventas  c) venden
5.  [...]

Gramática y Vocabulario. Parte 2.
En cada una de las frases siguientes se ha marcado con letra negrita un fragmento. Elija, de entre las tres opciones de respuesta, aquélla que tenga un significado equivalente al del fragmento marcado. Por ejemplo:

- No he hablado todavía con Javier porque el teléfono está comunicando.
  a) está estropeado
  b) no da señal
  c) está ocupado
  La respuesta correcta es la C.

Marque la opción correcta en la hoja.

21. ¿Qué te parece Dolores?
  Es muy graciosa.
  a) amable
  b) agradecida
  c) divertida

Gramática y Vocabulario. Parte 3.
Complete las frases siguientes con el término adecuado de los dos o cuatro que se ofrecen. Marque la opción correcta en la hoja.

31. ¿Dónde _________ la fiesta?
    En casa de Patricia a las once.
    a) es
    b) está
43. ¿Qué piensas __________ Yolanda?
   Que es encantadora.
   a) en
   b) a
   c) de
   d) con

**Comprensión de lectura.**
A continuación encontrará usted cuatro textos y una serie de preguntas relativas a cada uno de ellos. Hay dos modalidades de pregunta:

**Primer tipo:**
   a) Verdadero.
   b) Falso.

**Segundo tipo:** Selección de una respuesta entre tres opciones:
   a) …
   b) …
   c) …

Marque la opción correcta en la hoja.

**TEXTO 1: PROGRAMA APRENDICES**
El Programa Aprendices, administrado por el Servicio de Capacitación de Chile, es un proyecto que tiene el objetivo de fomentar y apoyar la contratación de jóvenes para que aprendan un oficio. En concreto, ofrece una bonificación mensual por cada aprendiz contratado durante los primeros doce meses de vigencia del contrato. Este beneficio tiene como finalidad financiar los costos de formación de los aprendices en la empresa.
   […] (372 words) (Adaptado de El Mercurio.com. Chile)

**Preguntas:**
1. Según el texto, el Programa Aprendices ofrece a los jóvenes empleados una bonificación mensual.
   a) Verdadero.
   b) Falso.

**TEXTO 2: FOTOGRAFÍAS DE ESCRITORES COLOMBIANOS**
Ayer fue inaugurada en Madrid la exposición fotográfica Cuarenta escritores colombianos. En esta exposición, el fotógrafo colombiano Jorge Mario Múnera recoge los rostros de los escritores del momento, ejemplos de la diversidad y el colorido cultural de Colombia.
   El artista reconoce que lleva toda la vida preparándose para fotografiar a escritores como Héctor Abad, Laura Restrepo, Antonio Caballero, Óscar Collazos o Fernando Vallejo, entre otros, puesto que conoce sus obras desde niño, hecho que le ha permitido acercarse a ellos con conocimiento y con el deseo de plasmar la esencia de cada uno en una imagen en blanco y negro.
   […] (391 words) (Adaptado de El Tiempo. Colombia)
Preguntas:
4. Según el texto, los escritores retratados por Múnera…
   a) son contemporáneos.
   b) son famosos.
   c) son conocidos suyos.

NIVEL SUPERIOR

Comprensión Auditiva.
Usted va a oír cuatro textos. Oirá cada uno de ellos dos veces. Al final de la segunda audición de cada uno de los textos, dispondrá de tiempo para contestar a las preguntas que se le formulan. Hay dos modalidades de pregunta:

Primer tipo:
   a) Verdadero.
   b) Falso.

Segundo tipo: Selección de una respuesta entre tres opciones:
   a) …
   b) …
   c) …

Marque la opción correcta en la hoja.

Texto 1: HISTORIA DEL ELEVADOR
A continuación escuchará una noticia sobre los elevadores.
   (Adaptado de Radio Fórmula. Venezuela)

Preguntas:
1. Según la grabación, el señor Graves Otis tuvo un problema con los cables de su elevador en su presentación pública.
   a) Verdadero.
   b) Falso.

Texto 3: TURISMO EN BUENOS AIRES
A continuación escuchará una entrevista a un secretario de Turismo.
   (Adaptado de Radio Continental. Argentina)

Preguntas:
9. Según la grabación, la provincia de Buenos Aires…
   a) ha tenido desde siempre varios destinos turísticos.
   b) prácticamente solo recibe turismo nacional.
   c) cuenta con atractivos diversificados.
DEMASIADOS ENVOLTORIOS

En los últimos diez años he percibido un notorio crecimiento de la producción y el consumo de envases para alimentos y bebidas. No dudo que el unicel está viviendo su época dorada. Todavía _____1_____ unos años un atole lo servían en un jarro y el tamal lo daban en una hoja de papel reciclado (el jarro se lavaba y el papel era consumido presto _____2_____ la tierra). Hoy día prácticamente cualquier bebida la sirven en unicel; y no solo eso, _____3_____ que lo adornan una tapa y un popote agregados, de los que bien se puede prescindir, puesto que si el vaso es nuevo y _____4_____ ha tocado su borde y se va a desechar, seguramente, ¿qué caso _____5_____ usar un popote? Más basura. […]

(Adaptado de www.floresdenieve.cepe.unam.mx. México)

Opciones:
1. a) hay   b) hacen  c) hace
2. a) para   b) por   c) sobre
3. a) pero   b) sino   c) pues
4. a) nadie  b) alguien  c) ningún
5. a) tuviera b) tenga   c) tiene
6. […]

Gramática y Vocabulario. Parte 2.
En cada una de las frases siguientes se ha marcado con letra negrita un fragmento. Elija, de entre las tres opciones de respuesta, aquélla que tenga un significado equivalente al del fragmento marcado. Por ejemplo:

- Marta no ha venido: se encuentra un poco indispuesta, pero se le pasará.
   a) está ocupada
   b) está algo enferma
   c) se ha enfadado
   La respuesta correcta es B.

Marque la opción correcta en la hoja.

21. No gana un gran sueldo pero se las arregla para llegar a fin de mes.
   a) ahorra
   b) hace lo posible
   c) hace chapuzas

Gramática y Vocabulario. Parte 3.
Complete las frases siguientes con el término adecuado de los dos o cuatro que se le ofrecen. Marque la opción correcta en la hoja.
36. Si insistió en que __________ es porque os necesitaba de verdad.
   a) fuisteis
   b) fuerais

45. Te recomiendo que te busques otra forma de divertirte, ya que nada __________ hacemos te gusta.
   a) con lo que
   b) de lo cual
   c) lo que
   d) de lo que

**Gramática y Vocabulario. Parte 4.**
A continuación le presentamos dos textos. En ellos, debe usted detectar un total de cinco errores. Estos errores se han distribuido al azar, de manera que puede haber, por ejemplo, 4 en el primer texto y 1 en el segundo; o 2 en el primero y 3 en el Segundo. Cada error corresponde a uno de los segmentos en los que se han dividido los dos textos. Así, por ejemplo:

**FRASE:** La dije que viniera a verme esta tarde.

<table>
<thead>
<tr>
<th>1</th>
<th>La</th>
<th>dije</th>
<th>que</th>
<th>viniera</th>
<th>a</th>
<th>verme</th>
<th>esta</th>
<th>tarde</th>
</tr>
</thead>
</table>

El error estaba en el primer segmento de la frase, por lo que debe marcar el número 1:

<table>
<thead>
<tr>
<th>2</th>
<th>La</th>
<th>dije</th>
<th>que</th>
<th>viniera</th>
<th>a</th>
<th>verme</th>
<th>esta</th>
<th>tarde</th>
</tr>
</thead>
</table>

Marque los números correspondientes a cada uno de los errores en la hoja.

**Texto 1:**
Si usted desea negociar algún asunto dentro de su empresa es necesario elegir el momento adecuado para hacer la petición. Si una empresa atraviesa por malos momentos, probablemente sus peticiones no lleguen en buen puerto. Otro buen consejo es lo de ser sincero consigo mismo. Si va a solicitar a sus superiores un aumento de sueldo, asegúrese de que ellos saben exactamente cuáles han sido sus logros por la compañía, su implicación hacia el éxito y mejora de la empresa.

**Comprensión de Lectura. Parte 1.**
En la parte 1 encontrará usted tres textos y una serie de preguntas relativas a cada uno de ellos. Seleccione la respuesta correcta entre las tres opciones que se le ofrecen:

a) …
b) …
c) …

En la parte 2 encontrará una entrevista en la que debe relacionar cada pregunta de la columna A con su respuesta de la columna B. Marque la opción correcta en la hoja.
**TEXTO 1: LA REVOLUCIÓN DE LAS FLORES**

Hasta hace menos de 20 años, las rosas colombianas, con sus clásicas variedades rojas, eran la envidia en las ferias internacionales. Y pese a que siguen siendo reconocidas, los floricultores ecuatorianos se están haciendo notar después de desarrollar variedades de rosas que están acaparando todas las miradas.

Una de las principales productoras ecuatorianas de flores logró desarrollar nuevas variedades que le permitieron obtener especies propias de su país y que, a manera de comercialización, resultan atractivas y exclusivas para grandes mercados como el norteamericano y el europeo.

De esta forma, y ya convertida en una propiedad multinacional, le está dando la vuelta al negocio transformándola en una industria en la que floricultores locales compran el derecho a cultivar variedades a hibridadores especializados en países como Holanda, Francia o Alemania, que les cobran regalías que pueden llegar a representar cerca del 10% de los costos operativos de las empresas.

Los cruces de esta empresa han dado resultado y, con alrededor de siete nuevas especies, ha contribuido a que Ecuador se ubique en los primeros lugares entre los productores y exportadores de flores en el mundo. Su estrategia está tan bien aceptada que les está vendiendo algunas variedades a los productores colombianos.

[…](638 words) (Adaptado de *El espectador. Colombia*)

**Preguntas:**

1. Según el texto, los floricultores ecuatorianos…
   a) han conseguido especies de rosas autóctonas.
   b) llevan mucho tiempo siendo el centro de atención de las ferias internacionales.
   c) compran especies en diferentes países de Europa.

**Comprensión de Lectura. Parte 2.**

A continuación encontrará una entrevista realizada a un alpinista ecuatoriano. Aquí se le ofrecen en la COLUMNA A, por orden, las intervenciones del entrevistador, y en la COLUMNA B, las respuestas que dio el enfrentado. Lo que usted debe hacer es relacionar cada pregunta de la COLUMNA A con su respuesta de la COLUMNA B. Así, por ejemplo al número 7 de la COLUMNA A, le corresponde la letra D de la columna B.

Utilice el recuadro al final de la entrevista para escribir sus respuestas.

<table>
<thead>
<tr>
<th>COLUMNA A</th>
<th>COLUMNA B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>[…] A</td>
</tr>
<tr>
<td></td>
<td>Cuando uno recién inicia es la parte más difícil de sortear. En el 2005, la Concentración Deportiva de Pichincha me nombró el mejor andinista del año; eso me abrió muchas puertas con empresas importantes del país que confiaron en mi proyecto. En un inicio tuve que costearme solo, pero luego me dieron la ayuda necesaria.</td>
</tr>
<tr>
<td>7</td>
<td>¿Cómo fue esa ascensión máxima al Everest?</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8-10</td>
<td>[…]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I
INFORMED CONSENT FORM

Protocol Title: The role of age of initial exposure and proficiency in the mental representation, access, and cognitive strategies for Spanish inflectional morphology by foreign language learners.

Please read this consent document carefully before you decide to participate in this study.

Purpose of the research study: This study investigates the mental representation, access, and production of Spanish inflectional morphology by adult beginner, intermediate, and advanced learners of Spanish as a foreign language in a formal instruction context.

What you will be asked to do in the study: If you agree to participate in this research project, you will be asked to attend to two data collection sessions.

The first session will take place at the Language and Cognition Lab located in Turlington Hall B-127. After reading and signing this consent form, you will be asked to sit in front of a PC screen, wearing a set of headphones with a microphone attached to it. First, you will be asked to read some Spanish words presented over the screen and say to the microphone if it was masculine or feminine (for nouns), or produce the past form (for verbs). This activity will last approximately 12-15 minutes. Second, you will be asked to listen to some Spanish words presented over the headphones. Right after the word has been presented, a word will appear on the computer screen and you will be asked to press one of two bottoms as fast as possible to decide if both words were the same or not. This activity will last approximately 12-15 minutes. Third, after sitting on a chair in front of the principal investigator, you will be asked to pick a picture-story sequence from several ones and you will be asked to narrate it to the researcher in Spanish using the verbs below each drawing. Your voice will be recorded with a digital recorder. You will have about 6-8 minutes to complete the narration. Fourth, you will be asked to select a new picture-story sequence from several ones and you will be asked to narrate it to the researcher in Spanish, this time using the verbs of your choice. Again, your voice will be recorded digitally and you will have about 6-8 minutes to complete the narration. At the end of the session you will be asked to fill out a language background information form.

The second data collection session will take place on campus at the University of Florida. You will be asked to complete some exercises in Spanish similar to the ones used at the beginning and intermediate Spanish courses at UF such as: reading comprehension activities, listening comprehension activities, and vocabulary and grammar activities. This data collection session will last about 60 minutes.

Time Required: Two sessions of about 60 minutes will be required to complete the study.

Risks, Benefits, and Compensation: There’s no risk to you. There’s no direct benefit for you for participation. If you agree to participate and complete the sessions according to the instructions given, you will receive a $10 cash bonus per session for a total of $20 in cash.

Confidentiality: Your identity will be kept confidential to the extent provided by law. All materials collected from you will be identified by a code number. All information including results of your performance will be kept in a locked file which only the investigator (Juan P.
Rodríguez) and his dissertation committee members (Dr. Theresa A. Antes, Dr. Joaquim Camps, Dr. Gillian Lord, and Dr. Wind Cowles) will have access to. Your name will not be used on any written or verbal report when presenting the results of the study. The audio recordings will not be attached to your name in any way in order to ensure confidentiality. Your name will not be used in any report.

Voluntary Participation and right to withdraw from the study: Participation in this study is completely voluntary. There is no penalty for not participating. You have the right to withdraw from the study at anytime without consequence.

Whom to contact if you have questions about the study:

Principal Investigator: Juan P. Rodríguez. Graduate Student, Program in Hispanic Linguistics. Department of Romance Languages and Literatures. P.O. Box 117405. 170 Dauer Hall, University of Florida at Gainesville. Gainesville, FL 32611-7405. 392-9222, FAX (352) 392-5679. jpablorodrig@yahoo.com, jprodrig@ufl.edu

Supervisor: Theresa A. Antes, Ph.D., Associate Professor in French and Linguistics. Department of Romance Languages and Literatures. P.O. Box 117405. 170 Dauer Hall. University of Florida at Gainesville. Gainesville, FL 32611-7405. (352) 392-2016 ext. 236, FAX (352) 392-5679. antes@rll.ufl.edu

Whom to contact about your rights as a research participant in the study:

UFIRB office, P.O. Box 112250, University of Florida, Gainesville, FL 32611-2250, Ph. (352) 392-0433. irb2@ufl.edu

Agreement: I have read the entire procedure described above. I voluntarily agree to participate in the study, and I also consent to the audio recordings as outlined above. I have received a copy of this description.

Participant ___________________________________________ Date ________________
Principal Investigator ___________________________________________ Date ________________
APPENDIX J
TAXONOMY USED FOR CODING ERROR TYPES

**Error 0:** None. The participant produced the verb form with accuracy and very fast. For example: *dijo* (*she/he said*) for the test item *decir* (*to say*).

**Error 1:** Overregularization. Participants produced an irregular verb form incorrectly because they treated it as a regular verb form by attaching a regular suffix to the verb root of the infinitive. For example: *redució* (*she/he reduced,* nonexistent verb form) for the test item *reducir* (*to reduce*) instead of the corresponding irregular verb form *redujo*.

**Error 2:** No vowel change but correct suffix. For vowel stem change verbs which required a vowel change but were produced without that change. For example: *sentió* (*she/he felt,* nonexistent verb form) for the test item *sentir* (*to feel*) whose correct preterite form required the vowel stem change from /e/ to /i/, i.e., *sintió*.

**Error 3:** Nonfinite form or a noun. Used when the participant produced a noun with a similar stem to the test item, or when the response was a nonfinite form such as an infinitive or a past participle. For example: *para regalar* (*in order to give a present*) for the test item *regalar* (*to give a present*). Sometimes an infinitive was preceded by another verb in the preterite as a cognitive strategy to avoid the preterite form of the test item while including the past reference required by the demands of the task. For example: *decidió medir* (*she/he decided to measure*) for the test item *medir* (*to measure*) whose preterite form undergoes a vowel stem change: *midió* (*she/he measured*).

**Error 4:** Hypercorrection. Right after the participant provided the correct response, she/he changed it for an incorrect one as her/his final answer. For example: *puse* (*I put*) for the test item *poner* (*to put*), right after saying *puso* (*she/he put*).

**Error 5:** Buying time. Three different observed behaviors were included under this cognitive strategy: (a) lengthened syllable, usually the first one, (b) small pause before suffix addition, and (c) repetition of the response. Participants used these strategies to get extra time before making sure that they accessed the correct form, while making use of their monitor. All strategies led to correct responses with this code. For example: *puuuuuuudo* (*she/he was able to*) for the test item *poder* (*to be able to*).

**Error 6:** Incorrect PN marker. The response was in the preterite but the participant used the incorrect Person/Number suffix, usually the first person singular suffix instead of the third person singular. For example: *llamé* (*I called*) for the test item *llamar* (*to call*), instead of *llamó* (*she/he called*).

**Error 7:** No response. Sometimes participants skipped some test items without even trying. Instead of risking an error, they simply moved on to the next item.

**Error 8:** Incorrect stress. The verb form was the elicited one, but the participant placed the stress on a different syllable and/or segment. The response sounds strange for a native speaker but the verb form is completely correct from a morphological point of view. For example:
*extrajo* is the elicited preterite form for the verb *extraer* (‘to extract’), but some participants placed the stress on the last syllable *extrajó* when it should be on the penultimate.

**Error 9:** There is a combination of no vowel change and a TAM suffix from a different verb class. The elicited verb form for the verb *verter* (‘to pour’) is *virtió* which suffers the internal vowel change *e* > *i* and takes the TAM suffix *–ió*. The form produced by some participants was *vertó* in which the vowel of the root is kept unchanged and the incorrect TAM suffix *–ó* is attached to the stem.

**Error 10:** Different tense. The verb was conjugated into a tense other than the preterite tense. The response is a finite form but not in the tense they were instructed to use. For example, the present tense *sigo* (‘I continue’) was provided instead of the appropriate preterite form *siguíó* (‘s/he continued’).

**Error 11:** A combination of overregularization and buying time. Perhaps the participant was buying time to look for the appropriate link between an infinitive and a memorized past form and, in the absence of correct form retrieval, decided to attach the regular suffix: *veeeenió* instead of *vino* (‘s/he came’).

**Error 12:** Monitor. Right after the participant produced an oral response, and after listening to it, s/he realized the mistake and changed it to the correct response, as in *mentió*, which was followed by *mintió* (‘s/he lied’), the correct answer.

**Error 13:** Wrong root. In this case the correct suffix was attached to the stem of the verb but the root was incorrect. It does not illustrate a failed trial at providing a vowel stem change or anything similar. It is usually confusion in the syllable structure of the root, or even a mispronunciation not monitored by the participant. For example, instead of providing *escapó* (‘s/he escaped’) one participant said *esquepó*.

**Error 14:** A combination of monitor and incorrect PN marker. This error type is very similar to behavior 12, in that the participant realized her/his mistake and tried to fix it with a new verb form. However, this time the new response is still wrong. The root was changed to the appropriate preterite root but the PN suffix is different from the one elicited because an incorrect PN suffix was attached to the root. For example, after saying *pongo* (‘I put’) the participant produced the correct preterite root in *puse* (‘I put’) but with the incorrect PN suffix. The target form was *puso* (‘s/he put’).

**Error 15:** A combination of buying time and incorrect PN marker. The participant provided a verb form close to the elicited one except for the PN suffix. S/he also bought some time before producing her/his response as the final version: *puuuude* (‘I could’) instead of *pudo*.

**Error 16:** TAM suffix of another verb class. The elicited TAM suffix for regular verbs is *–ó* (for verb class I) and *–ió* (for verb classes II and III). Sometimes the participant attached the incorrect TAM suffix, even to irregular roots, as in: *vinió* (‘s/he came’) instead of *vino*. 
The interesting case in this example is that –ió would have been the correct TAM suffix if the elicited form were regular. This example is not considered overregularization because the participant provided the correct irregular root [vin–].

Error 17: Nonexistent form or a verb form from another verb. The verb form provided by the participant does not exist in Spanish and there is no way to analyze its internal structure to reveal any behavior. For example: *huégo (nonexistent word) as the preterite for hacer (‘to do’) instead of the elicited verb form hizo (‘s/he did’). Sometimes the verb form provided is nonexistent for the test item but is a verb form from another verb, like *se puso (‘s/he put on’) as the preterite verb form for poder (‘to be able to’) whose correct preterite form is pudo.

Error 18: Combination of monitor and overregularization. The behavior here is that the first response provided was monitored by the participant and, although the next response was somehow improved, the remaining error is overregularization. For example, after providing the verb form *andió as the preterite for andar (‘to walk’), it was changed so that the TAM suffix matched the verb class of the verb (i.e., from –ió to –ó). However, the new response *andó is still incorrect because the elicited verb form is irregular: anduvo (‘s/he walked’).

Error 19: A combination of buying time and wrong stress. The only difference with error 8 is that this time the participant took some time before producing the response, usually by lengthening a syllable of the verb, as in *repitiitio for the elicited verb form repitió (‘s/he repeated’). Again, the verb form was the elicited one, but the participant placed the stress on a different syllable and/or segment.

Error 20: A combination of no vowel change and wrong stress. For example: *corregio instead of corrigió (‘s/he corrected’).

Error 21: A combination of overregularization and wrong stress. For example: *reducio instead of redujo (‘s/he reduced’).

Error 22: A combination of no vowel change and buying time, as in *meeedió instead of midió (‘s/he measured’).
## APPENDIX K

### LIST OF TEST ITEMS AND THEIR ELICITED PRETERITE FORM

<table>
<thead>
<tr>
<th>Infinitive</th>
<th>High Frequency</th>
<th>Target form</th>
<th>Infinitive</th>
<th>Target form</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regular Verbs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abrir</td>
<td>Abrió (‘s/he opened’)</td>
<td>Besar</td>
<td>Besó (‘s/he kissed’)</td>
<td></td>
</tr>
<tr>
<td>Empezar</td>
<td>Empezó (‘s/he started’)</td>
<td>Cantar</td>
<td>Cantó (‘s/he sang’)</td>
<td></td>
</tr>
<tr>
<td>Entrar</td>
<td>Entró (‘s/he entered’)</td>
<td>Escapar</td>
<td>Escapó (‘s/he escaped’)</td>
<td></td>
</tr>
<tr>
<td>Llamar</td>
<td>Llamó (‘s/he phoned’)</td>
<td>Esperar</td>
<td>Esperó (‘s/he waited’)</td>
<td></td>
</tr>
<tr>
<td>Llevar</td>
<td>Llevó (‘s/he carried’)</td>
<td>Inventar</td>
<td>Inventó (‘s/he invented’)</td>
<td></td>
</tr>
<tr>
<td>Mirar</td>
<td>Miró (‘s/he looked’)</td>
<td>Olvidar</td>
<td>Olvidó (‘s/he forgot’)</td>
<td></td>
</tr>
<tr>
<td>Nacer</td>
<td>Nació (‘s/he was born’)</td>
<td>Pagar</td>
<td>Pagó (‘s/he paid’)</td>
<td></td>
</tr>
<tr>
<td>Preguntar</td>
<td>Preguntó (‘s/he asked’)</td>
<td>Regalar</td>
<td>Regaló (‘s/he gave away’)</td>
<td></td>
</tr>
<tr>
<td>Salir</td>
<td>Salió (‘s/he went out’)</td>
<td>Vender</td>
<td>Vendió (‘s/he sold’)</td>
<td></td>
</tr>
<tr>
<td>Tomar</td>
<td>Tomó (‘s/he took’)</td>
<td>Viajar</td>
<td>Viajó (‘s/he travelled’)</td>
<td></td>
</tr>
<tr>
<td><strong>Irregular Verbs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decir</td>
<td>Dijo (‘s/he said’)</td>
<td>Andar</td>
<td>Anduvo (‘s/he walked’)</td>
<td></td>
</tr>
<tr>
<td>Estar</td>
<td>Estuvo (‘s/he was’)</td>
<td>Atraer</td>
<td>Aattrojo (‘s/he attracted’)</td>
<td></td>
</tr>
<tr>
<td>Haber</td>
<td>Hubo (‘there was’)</td>
<td>Caber</td>
<td>Cebó (‘s/he fit’)</td>
<td></td>
</tr>
<tr>
<td>Hacer</td>
<td>Hizo (‘s/he did’)</td>
<td>Conducir</td>
<td>Condujo (‘s/he drove’)</td>
<td></td>
</tr>
<tr>
<td>Ir</td>
<td>Fue (‘s/he went’)</td>
<td>Contraer</td>
<td>Contraajo (‘s/he contracted’)</td>
<td></td>
</tr>
<tr>
<td>Poder</td>
<td>Pudo (‘s/he could’)</td>
<td>Extraer</td>
<td>Extraño (‘s/he extracted’)</td>
<td></td>
</tr>
<tr>
<td>Poner</td>
<td>Puso (‘s/he put’)</td>
<td>Introducir</td>
<td>Introdujo (‘s/he introduced’)</td>
<td></td>
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<tr>
<td>Producir</td>
<td>Produjo (‘s/he produced’)</td>
<td>Reducir</td>
<td>Redijo (‘s/he reduced’)</td>
<td></td>
</tr>
<tr>
<td>Tener</td>
<td>Tuvo (‘s/he had’)</td>
<td>Traducir</td>
<td>Tradijo (‘s/he translated’)</td>
<td></td>
</tr>
<tr>
<td>Venir</td>
<td>Vino (‘s/he came’)</td>
<td>Traer</td>
<td>Trajo (‘s/he brought’)</td>
<td></td>
</tr>
<tr>
<td><strong>Stem Change Verbs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advertir</td>
<td>Advirtió (‘s/he warned’)</td>
<td>Corregir</td>
<td>Corrigió (‘s/he corrected’)</td>
<td></td>
</tr>
<tr>
<td>Conseguir</td>
<td>Consiguió (‘s/he obtained’)</td>
<td>Despedirse</td>
<td>Se despidió (‘s/he said bye’)</td>
<td></td>
</tr>
<tr>
<td>Convertir</td>
<td>Convertió (‘s/he converted’)</td>
<td>Divertirse</td>
<td>Se divirtió (‘s/he enjoyed’)</td>
<td></td>
</tr>
<tr>
<td>Morir</td>
<td>Murió (‘s/he died’)</td>
<td>Dormir</td>
<td>Dormió (‘s/he slept’)</td>
<td></td>
</tr>
<tr>
<td>Pedir</td>
<td>Pidió (‘s/he asked’)</td>
<td>Herir</td>
<td>Hirió (‘s/he hurt’)</td>
<td></td>
</tr>
<tr>
<td>Repetir</td>
<td>Repitió (‘s/he repeated’)</td>
<td>Medir</td>
<td>Medió (‘s/he measured’)</td>
<td></td>
</tr>
<tr>
<td>Seguir</td>
<td>Siguió (‘s/he continued’)</td>
<td>Mentir</td>
<td>Mintió (‘s/he lied’)</td>
<td></td>
</tr>
<tr>
<td>Sentir</td>
<td>Sintió (‘s/he felt’)</td>
<td>Reírse</td>
<td>Se rió (‘s/he laughed’)</td>
<td></td>
</tr>
<tr>
<td>Servir</td>
<td>Sirvió (‘s/he served’)</td>
<td>Verter</td>
<td>Virtió (‘s/he poured’)</td>
<td></td>
</tr>
<tr>
<td>Sonreír</td>
<td>Sonrió (‘s/he smiled’)</td>
<td>Vestirse</td>
<td>Se vistió (‘s/he dressed’)</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF REFERENCES


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BIOGRAPHICAL SKETCH

Juan Pablo Rodríguez Prieto was born in Palencia, Spain. His passion for the English language was instilled by one of his teachers at the Official School of Languages in Palencia. In 2002, he earned a Bachelor of Arts in English Philology from the University of Valladolid. During his undergraduate studies, he spent one summer in Galway, Ireland. In 2004, he obtained a Master of Arts in Teaching English to Speakers of Other Languages from West Virginia University, where he taught beginning and intermediate Spanish language courses. His teaching experience in Spanish helped him decide to pursue a Doctor of Philosophy (Ph.D.) in Hispanic linguistics at the University of Florida with an emphasis on second language acquisition. He taught a variety of Spanish language courses at the University of Florida, including Introduction to Hispanic Linguistics and the Foreign Language Across the Curriculum course entitled Spain and the European Union, and he also worked for two years as assistant to the coordinators of the beginning Spanish program. The McLaughlin Dissertation Fellowship awarded by the University of Florida helped him for the data collection of the present study.

Juan Pablo has been recognized for his excellence in teaching and for his innovative teaching materials. In 2006, he obtained the Award for Cooperative Leadership in Teaching (first-year Spanish) at the University of Florida. In 2008, he was finalist in the Third Premio Cristóbal de Villalón from the University of Valladolid, and he was also awarded a Graduate Student Teaching Award for the 2008-2009 academic year at the University of Florida. He has published in Revista Española de Lingüística, Revista Española de Lingüística Aplicada, Revista Iberoamericana de Educación and MarcoELE: Revista de Didáctica ELE.

He received his Ph.D. from the University of Florida in the summer of 2009. He will work as assistant professor of Spanish at Ball State University in Muncie, Indiana. His main areas of interest are Spanish second language acquisition, pedagogy and technology education.