2013-03-18

Leaving the Dark to Find the Light: A Study of L1 English Acquisition of L2 Spanish /l/

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Leaving the Dark to Find the Light: A Study of
L1 English Acquisition of L2 Spanish /l/

Ariel R. Bean

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Arts

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March 2013

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ABSTRACT

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L1 English Acquisition of L2 Spanish /l/

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Master of Arts

Second language acquisition (SLA) research is rich in possibilities for examining language-specific phonetics and phonology in the cross-linguistic context of acquisition. However, much of the existing English-Spanish research focuses on the acquisition of voice onset time (VOT) of /p, t, k, b, d, ɡ/ or rhotics, or on acquisition in relation to factors such as task type, time abroad, and motivational intensity (e.g. Alvord & Christiansen, 2012; Díaz-Campos, 2004, 2006; Face, 2006; Martinsen, 2010; Martinsen & Alvord, 2012; Shively, 2008; Shively & Cohen, 2008; Tanner, 2012 a, 2012b; Zampini, 1994). Like these studies, the present study incorporates linguistic and extralinguistic variables, but this time focusing on Spanish /l/ acquisition in native English speakers. Furthermore, the present study investigates L2 lateral liquid /l/ acquisition by comparing L2 results with previously established L1 research of /l/. Reviewing a variety of SLA phonological research in a wide range of contexts, I include in this study nine independent variables based on syllabic context, phonetic context, level of learning, task type, and motivational intensity.

The L2 Spanish /l/ data came from digitally recorded speech samples from 21 L2 Spanish speakers and were compared with a benchmark established by similar recordings from two L1 English and two L1 Spanish speakers. All participated in conversational and reading tasks, and all the L2 participants completed a background questionnaire for demographic and linguistic experience data and the Survey of Motivational Intensity (Gardner, 1985) to measure individual motivational intensities to learn Spanish. From these data, target-like /l/ acquisition was determined by acoustically derived formant measurements and tested for significance in a variety of variables.

Of the independent variables, syllabic context proved to be collinear with vowels preceding and following /l/ and motivational intensity was not statistically significant. Moreover, the results prove that syllabic context, certain preceding and following phonetic segments, level of learning, and task type all have a significant effect on successful L2 Spanish /l/ acquisition.

Keywords: second language acquisition, velarization, phonology, pronunciation, syllabic context, phonetic context, speech style, motivational intensity.
ACKNOWLEDGEMENTS

Conducting this research and writing this thesis were only possible with the support and guidance of mentors, peers, family, and God. Firstly, I never even would have thought to study the intricacies of /l/ without Dr. Scott Alvord’s phonological instruction. He and Dr. Rob Martinsen spearheaded the extensive data collection process with invaluable involvement of Brandon Rogers, Ixchel Zarco, and Josh Tanner. Before I knew it, I was involved as well, and what I began as a project became this thesis. Dr. Willis Fails and Dr. Halvor Clegg offered further instruction and much needed encouragement. Of equal importance was the statistical aid so graciously offered by Dr. Joseph Olsen and his SPSS TA, Nick Jones.

All along the way, I have been blessed with encouragement and support from friends such as Jasmine Talbot, Becky Williams, Lauren Madsen, Roxanne Tibbitts, and my fellow graduate students. Through the entire process, I knew that my parents and siblings were also cheering me on, helping in whatever way possible, just like they always have and always will. Finally, I thank God for blessing me by placing all these wonderful individuals in my path.
# TABLE OF CONTENTS

ABSTRACT ................................................................................................................................. ii

ACKNOWLEDGEMENTS ........................................................................................................... iii

TABLE OF CONTENTS ............................................................................................................... iv

LIST OF TABLES ........................................................................................................................ vi

LIST OF FIGURES ...................................................................................................................... vii

CHAPTER 1: Introduction .............................................................................................................. 1

CHAPTER 2: Review of Literature ................................................................................................ 5

Articulatory and Acoustic Qualities of /l/ ................................................................................... 5

English-specific /l/ Phonology .................................................................................................. 10

Onset versus coda /l/ .............................................................................................................. 10

Word and syllable boundaries and (ambi)syllabicity ............................................................ 11

English [l]-[l] variation .......................................................................................................... 12

Cross-linguistic Allophonic Discrepancies ............................................................................... 12

Theories of Second Language Acquisition of Phonology ......................................................... 14

SLA Research ............................................................................................................................ 16

L2 phonetics and phonology .................................................................................................. 16

L2 level of learning ................................................................................................................ 19

Task type ................................................................................................................................ 20

Motivational intensity ............................................................................................................. 21

CHAPTER 3: Research Design and Methods ............................................................................... 24

Participants: L2 Spanish Learners ............................................................................................. 24

Participants: L1 English and Spanish Benchmarks ................................................................... 29

Instruments and Measures ......................................................................................................... 29

Linguistic Factors ...................................................................................................................... 31

Analysis ..................................................................................................................................... 33

CHAPTER 4: Results .................................................................................................................... 36

Syllabic Context ........................................................................................................................ 38

Preceding Segment .................................................................................................................. 39

Following Segment .................................................................................................................. 42

Level of Learning ...................................................................................................................... 44
**LIST OF TABLES**

Table 1 *Participant Distribution by Sex* ................................................................. 26
Table 2 *Preceding and Following Segment Token Classification* ............................. 32
Table 3 *L2 /l/ Token Distribution by Level of Learning* ........................................ 36
Table 4 *Syllabic Context Fixed Effects Estimates (Compared Against Coda)* ............ 39
Table 5 *Syllabic Context Estimated Marginal Means* ............................................. 39
Table 6 *Preceding Segment Fixed Effects Estimates (Compared Against Pause)* ...... 40
Table 7 *Preceding Segment Estimated Marginal Means* ........................................ 40
Table 8 *Following Segment Fixed Effects Estimates (Compared Against Pause)* ...... 42
Table 9 *Following Segment Estimated Marginal Means* ........................................ 43
Table 10 *Level of Learning Fixed Effects Estimates (Compared Against Span 102 Level)* ...... 44
Table 11 *Level of Learning Estimated Marginal Means* ......................................... 45
Table 12 *Level of Learning Pairwise Comparisons p-values* .................................... 45
Table 13 *Task Fixed Effects Estimates (Compared Against OI)* ............................... 47
Table 14 *Task Bark Estimated Marginal Means* ..................................................... 47
Table 15 *Motivational Intensity Fixed Effects Estimates* ......................................... 48
Table 16 *Preceding Segments Pairwise Comparisons p-values* .............................. 82
Table 17 *Following Segments Pairwise Comparisons p-values* ............................... 83
LIST OF FIGURES

Figure 1 Articulatory Differences in /l/ Velarization (Recasens, 2012, p. 369) ......................... 2
Figure 2 The Gradient Continuum of /l/ Velarization ................................................................... 9
Figure 3 Bark F₂ and Bark F₂–F₁ Data per Level of Learning ...................................................... 37
Figure 4 Waveform and Spectrogram of Nonvelarized /il/ in L1 Spanish ................................. 54
Figure 5 Waveform and Spectrogram of Nonvelarized /il/ in L2 Spanish ................................. 54
Figure 6 Waveform and Spectrogram of Velarized /ul/ in L2 Spanish ................................. 55
CHAPTER 1: Introduction

Today’s global community demands increased cross-cultural interaction and learning a second language is essential to effective intercultural communication, such as between L1 English and L1 Spanish speakers, and the interactions between the two cultures lend themselves well to second language acquisition (SLA) research. As a result of the abundance of the current SLA research, it is commonly known that late learners (i.e. adolescents and adults) commonly have a foreign accent that results from a failure to perfectly acquire L2 phonology and phonetics (e.g. Flege 1981, 1995; Flege & Hillenbrand, 1984; Major, 2001). In a quest to better understand the evolution of an L2 learner’s interlanguage and L2 accent, SLA phonology researchers have examined the interactions of linguistic (e.g. syllabic and phonetic) and extralinguistic (e.g. level of learning, task type, and motivational intensity) factors in association with improved, more L1-like productions in L2 speech patterns.

In the case of L2 phonetics and phonology, Spanish-English SLA research is abundant but incomplete because it is highly concentrated in a few aspects of pronunciation. In general, the focus has been on the L1 transfer and subsequent L2 production of /b, d, g/ as occlusives and spirants, /p, t, k, b, d, g/ in relation to VOT, and /ɾ/ versus /ɾ/ (e.g. Alvord & Christiansen, 2012; Díaz-Campos, 2004, 2006; Face, 2006; Martinsen & Alvord, 2012; Shively, 2008; Shively & Cohen, 2008; Tanner, 2012a, 2012b; Zampini, 1994). Such an abundance of in-depth research certainly is useful and instructive, particularly due to the problematic nature of the observed Spanish phonemes for native English speakers; however, few SLA studies, such as Díaz-Campos (2004), have investigated the transfer of English /l/ velarization. Seeing this need for further /l/ research, I explore here the L1 English learner’s acquisition of the Spanish lateral /l/ in various contexts.
In order to successfully and thoroughly examine L2 /l/ acquisition, it is absolutely necessary to first understand the phonology of /l/ usage typical of both L1 English and L1 Spanish, language acquisition theories, and potential acquisition factors. If /l/ production were common between the two languages, L1 to L2 /l/ transfer would be simple, but they are in fact two distinct languages with a shared phoneme yet differing allophones. Consequently, a direct L1 to L2 /l/ transfer, whether from Spanish to English or vice versa, results in a foreign accent. I am particularly interested in the foreign accent present in L1 American English (AE) learners’ L2 Spanish.

Outside the context of English, Spanish, or any other particular language, a broad definition of a lateral liquid, /l/, is that the tongue obstructs airflow centrally but allows air to continue flowing on either side of the tongue. A rigid tongue body and alveolar contact with the tongue tip are characteristic of a “clear,” nonvelarized alveolar [l], whereas a bunched tongue body approaching the velum with slight or no contact is characteristic of a “dark”, velarized alveolar [ɫ], as shown in Figure 1.

![Figure 1 Articulatory Differences in /l/ Velarization (Recasens, 2012, p. 369)](image)
Within the context of English and Spanish, however, the allophony and distribution of /l/ vary. In English, /l/ can assimilate to a preceding or following segment and it can assimilate in place of articulation or voicing. For example, the /l/ in {play} assimilates in voicing to the preceding voiceless /p/, being produced as partially voiceless. An example of /l/ assimilating in place of articulation occurs in {full}: /l/ becomes a more velarized [ɫ] because the high back vowel /u/ is closer to the velum. In standard AE, [l] occurs after a voiceless consonant in a cluster, a dental [l] occurs before dental consonants, a velarized [l] occurs in syllable codas, and nonvelarized [l] occurs in most other contexts. In Spanish, however, /l/ assimilates only in place of articulation, not voicing. Possible /l/ realizations are a dentalized [l] before dental consonants, an interdental [l] before the interdental /θ/, a palatalized [l] before palatal consonants, and a nonvelarized [l] in all other contexts, including syllable onsets and codas alike. Focusing on velarization, it is clear that [l] and [ɫ] are native possibilities in AE, whereas only the former is acceptable in standard Spanish.

The articulatory proximity to the velum that defines [ɫ] has been the origin of linguistic descriptors such as “velarized” or “dark” and is represented in the left-hand image of Figure 1. In contrast, [l] is farther from the velum often referred to in the literature as “clear” or “light,” as represented in the right-hand image of Figure 1 (e.g. Bowen & Stockwell, 1960; Fry, 1979; Gussenhoven & Jacobs, 2005; Hualde, 2005; Recasens, 1996, 2004, 2012). Consequently, I will treat “velarized” and “dark” synonymously to refer to [ɫ] and “nonvelarized,” “clear,” and “light” synonymously to refer to [l].

Both the dark and light /l/ are acceptable allophones in English, with [l] being more characteristic of syllable onsets and [ɫ] more characteristic of syllable codas. In contrast, [l] is a foreign production to the L1 Spanish ear and [l] is found in standard Spanish onsets and codas.
alike. Often, phonology overviews treat [l] and [ɫ] as being binary, but in-depth phonology research has proven velarization to be a gradient phenomenon. Accordingly, the current study functions on the premise that /l/ velarization is gradient, ranging from frequently velarized in AE to nonvelarized as a rule in standard Spanish. The cross-linguistic /l/ distinction is explained in further detail in Chapter 2.

The present investigation proves pertinent to current L2 acquisition research because much of what has been done investigates /l/ articulatory gestures in depth in L1s such as English, Spanish, and Catalan, but largely neglects the effects those very articulatory gestures have on interlanguage and ultimate SLA. This study is twofold, with an emphasis particularly on the role of phonology and phonetics, but also on the role of other learner factors. Specifically, my research questions are:

- Is there a significant relationship between syllabic and/or phonetic contexts and L1 English speakers’ L2 Spanish acquisition of L1 Spanish /l/?
- Is there a significant relationship between L2 level of learning, task type, and/or motivational intensity and L1 English speakers’ L2 Spanish acquisition of L1 Spanish /l/?
CHAPTER 2: Review of Literature

The present study investigates both linguistic and extralinguistic aspects of SLA. To begin, I explain in further depth /l/ articulatory gestures and acoustics which can be tracked by formant measurements, particularly the height of the second formant and the distance between the first and second formants. Next, I present English phonology and phonetics and then I describe how it differs from that of Spanish. The interlanguage that results from adding the foreign L2 Spanish phonology to the previously established L1 English phonology is then explained with a few L1-L2 acquisition theories. At this point of the literature review, I will be finally able to delve into SLA research related to L2 phonetics and phonology, learner experience, task type, and motivational intensity.

Articulatory and Acoustic Qualities of /l/

Like all liquids, it is commonly known that /l/ simultaneously exhibits consonantal and vocalic features. The rigid tongue body and apical contact with the roof of the mouth causes [l] to be more of a single-gesture consonantal sonorant, but the combined apical movement and dorsal bunching towards the velum of [ɫ] causes it to be considered a dual-gesture, vocalic continuant (e.g. Browman & Goldstein, 1992, 1995; Recasens, 1996; Roussel & Oxley, 2010; Sproat & Fujimura, 1993). Lighter, less velarized [l] produces formants that on a spectrogram appear similar to the high front vowel /i/ but with less vocalic intensity. A classic dark [l] has a bunched tongue body, but as a result of its apical contact with the roof of the mouth, it continues to exhibit consonantal qualities (Oxley, Buckingham, Roussel, & Daniloff, 2006; Oxley, Roussel, & Buckingham, 2007; Roussel & Oxley, 2010). Consequently, as the tongue body approaches the velum and becomes a darker, more velarized [l], the produced phone loses similarity to the high front vowel /i/ and instead becomes more similar to a high back vowel /u/.
As velarization progresses, a common tendency in [l] pronunciation is to relax the articulators, generally resulting in a loss of apical contact. At this point, the utterance has in all actuality ceased to be consonantal and instead becomes a highly velarized high back unrounded vowel [ɯ] (Gussenhoven & Jacobs, 2005; Oxley et al., 2006, 2007; Roussel & Oxley, 2010). As a result of the tongue body movement, the [l]-[l] differentiation based on velarization is actually one of frontness and backness, related to /i/ and /u/. In fact, rather than speaking in terms of velarization or darkness, Stockwell & Bowen (1965) used terms of relative vocalic quality, namely “i-colored” for [l] and “ʌ-colored” for English [l] (p. 57).

Almost a century ago, Navarro Tomás (1917) identified a wide range of /l/ velarization gradience in terms of tongue shape. Using x-rays, he classified Spanish /l/ as having “una articulación distinta de la / plana alemana o francesa, en la cual…la posición del predorso sin duda es semejante a la de la / hueca o cóncava característica del inglés y del catalán” (p. 267). He observed decades ago that, although /l/ may be similar between languages, the Spanish sort is not as “plana,” or clear, as in German or French, but clearer than in English or Catalan. He even recorded that his Spanish /l/ was more like that of English or Catalan in a coda position following the back vowels, /o/ and /u/, but more like that of German or French when he produced an onset /l/ prevocally (Navarro Tomás, 1917).

It is important to note that in the literature, authors have utilized both the second formant height and the distance between the first and second formants to measure /l/ velarization. The higher the F2, the less velarized the /l/. In like manner, the larger the gap between F2 and F1, the less velarized the /l/. This method of determining velarization fits in well with what has been established regarding the acoustic similarity of /l/ to /i/ and /u/: The high front vowel /i/ has a higher F2 and a larger gap between F2 and F1, whereas the high back vowel /u/ has a lower F2 and
smaller gap between F₂ and F₁ (e.g. Yavaş, 2006). Simply put, if /l/ is less velarized, it is more similar to /i/ and if it is more velarized, it is more similar to /u/ and can be measured through formants.

In general, any upward or downward movement in F₂ transitions is effected by an alveolar articulation, such as /l/ realizations. Longer transitions with low Hz values in the F₂ are indicative of velarization (Fry, 1979; Carter, 2003). Expounding upon this, Roussel and Oxley (2010) classified dark /l/ as having F₂ values as low as about 750 Hz and light /l/ as having high F₂ values up to about 1800 Hz. When normalized, these Hertz values are equivalent to ranging from approximately a dark 6.9026 Bark value to a clear 12.1998 Bark value. Roussel and Oxley (2010) also proposed that English-speaking individuals who differ from the English norm of onset [l] and coda [ɫ] by typically using dark /l/ might have perceptual difficulties in identifying light /l/ in onset positions. If so, this could have serious implications for L2 Spanish learners who are dark /l/ speakers in their L1 because if they cannot even distinguish a light /l/ in onsets, it will be particularly difficult for them to first identify and successively produce the light /l/ in other contexts.

Similar to the perceptual difficulties encountered by participants in Roussel and Oxley’s (2010) work when [l] is in the onset position, Recasens (1996) found that the dark [l] exhibits a different F₂ when followed by /i/ and is hardest to perceive in English when followed by /i/, which resulted in causing some listeners to not even produce an /l/, but instead replace it with [w]. No doubt this lateral-vowel confusion is attributable to the F₂ height similarities between [l] and /i/, and [l] and /u/, respectively. Yavaş (2006) also wrote about the relationship between English liquids and glides and differentiated between them via articulatory restriction and
formant values. He described the postvocalic dark [l] as similar to /u/ in that the tongue back approached the velum.

The difference between the ‘clear’ and the ‘dark’ /l/ lies in the timbre of their high front/back vowel. In clear /l/, F1 and F2 are farther apart, as we would expect in a high front vowel, and closer and lower in dark /l/ like a high back vowel.

Postvocalic final /l/ may be like a vowel, making no contact, which results in a /l/-like formant structure. (p.111-112)

Yavaş’s (2006) observation coincides neatly with the F2-F1 results Sproat & Fujimura (1993) cited. The proximity of F1 and F2 can be indicative of [l] or /u/, whereas an increased distance between them is expected of [l] or /i/.

Continuing to expound on the phonetic similarities of /i/, /u/, and /l/, Fry (1979) grouped them together when he commented, “Laterals and semi-vowels are marked by vowel-like formants” (p. 137). Also, in support of the concept of /l/ gradience, he noted that differentiating clear versus dark /l/ is largely determined by F1 and F2 formant differences, “clear [l] having formant frequencies appropriate to a front vowel and dark [l] to a back vowel. Clear [l] in most English pronunciations is somewhat influenced by the vowel it precedes” (p. 121). For evidence, he included spectrograms of the words leal and lull—the former being preceded by a front vowel and the latter by a back vowel. As implicated, the former was produced with a higher F2 and larger F2-F1 distance while the latter had a lower F2 and smaller F2-F1 distance due to the influence of their respective preceding segments, which coincides with Simonet’s (2010) findings that proximity to the velum is exhibited by a relatively higher F1 and lower F2. Furthermore, Van Hofwegen (2009), curious about cross-generational Chicano English, considered F2 and found F2-F1 significant between second and third-generation English speakers,
those who were raised as bilinguals and those who grew up English-dominant. Despite the significant difference, however, the data continued to support a continuum of gradience and interlanguage influence because the Chicano English speakers produce /l/ with neither a completely typical Spanish nor English accent. I have created Figure 2 to better visualize the range of /l/ productions.

<table>
<thead>
<tr>
<th>/l/ Velarization</th>
</tr>
</thead>
<tbody>
<tr>
<td>extremely nonvelarized</td>
</tr>
<tr>
<td>light</td>
</tr>
<tr>
<td>/i/-like</td>
</tr>
</tbody>
</table>

*Figure 2* The Gradient Continuum of /l/ Velarization

Further defining /l/ articulatory gestures and syllabic identity, Sproat & Fujimura’s (1993) work also recorded the various degrees of velarization produced by their participants. Referencing Sproat & Fujimura’s (1993) then soon-to-be-published work, Browman & Goldstein (1992) supported this definition of degrees of velarization: “gestural organization varies as a function of position,” (p. 166). Though not a focal point of their research, Sproat & Fujimura’s (1993) F2-F1 results for the dark /l/ tokens show /l/ gradience so broad that there is actually an overlap because they ranged from 515.34 Hz to 908.96 Hz whereas the light /l/ productions range from 904.23 Hz to 1315.71 Hz. The F2-F1 definition to distinguish [l] from [l] is yet further proof that the two allophones are gradient rather than binary. Sproat & Fujimura (1993) themselves remarked that “the observed continuum is not what would be expected on the assumption that /l/ has two distinct light and dark allophones: in particular, the data did not appear to show a bimodal distribution (each mode corresponding to one of the putative allophones)” (p. 301). In other words, perhaps it is better to not define [l] and [l] as two
allophones of the same phoneme. Rather, it is best to redefine [l] and [ɫ] as gradiently velarized based on such an abundance of research.

**English-specific /l/ Phonology**

Notwithstanding Sproat & Fujimura’s (1993) motion to declassify [l] and [ɫ] as separate allophones of /l/, the /l/ phoneme presents a variety of /l/ possibilities. To better understand what to expect from the L2 learners involved in this study and how to analyze their speech as they strive to produce target-like Spanish /l/s, it is important to understand the velarization continuum unique to their L1’s onset, coda, and ambi syllabic /l/.

**Onset versus coda /l/**

One need not dig deep to find research detailing the [l] and [ɫ] allophonic differentiation in English /l/. Even Spanish-English literature that touches only lightly on the subject to illustrate a cross-linguistic difference points out that, in general, the nonvelarized [l] is characteristic of AE syllable onsets whereas [ɫ] is characteristic of syllable codas (e.g. Barrutia & Terrell, 1982; Bowen & Stockwell, 1960; Hualde, 2005; Van Hofwegen, 2009). In other terms, [ɫ] is also described as postvocalic or preconsonantal, but both descriptions fit the larger category of syllable coda in the case of English (Bowen & Stockwell, 1960; Gussenhoven & Jacobs, 2005). Although it is true that the onset [l]-coda [ɫ] distribution varies from one dialect to another and even within idiolects, the widely accepted generalization is to pronounce {light} as [læt] and {tail} as [tæl']. In short, the English syllable-initial /l/ is generally a light [l] and the syllable-final and syllabic [l] is typically dark and velarized, sometime to the extent of becoming a vowel itself (Gick, 2003; Gussenhoven & Jacobs, 2005; Ÿavaş, 2006).
Word and syllable boundaries and (ambi)syllabicity

In addition to having a light onset versus dark coda /l/ distribution, English /l/ can be syllabic as a syllable nucleus, or ambisyllabic as a member of two sequential syllables, whether within or across word boundaries because of its vocalic properties (Carter, 2003; Gick, 2003; Yavaş, 2006). Consequently, the /l/ may be considered part of the coda, the onset, or both (e.g. Browman & Goldstein, 1992; Carter, 2003; Gick, 2003; Recasens, 1996; Sproat & Fujimura, 1993). The variety of possible contexts in which to find /l/ could easily give rise to and be an explanation for /l/ velarization gradience in English. Such velarization gradience crosses linguistic boundaries and because each language has unique articulatory and acoustic [l]-[ɫ] parameters, and it must be accounted for both in L1 and SLA research.

Sproat & Fujimura’s (1993) seminal work on allophonic English variation shed light on classifying the ambisyllabic /l/, revealing that it exhibits characteristics of both a coda and onset /l/. That is, the /l/ in mellow is spoken as though it were part of the first and second syllables, /mel.low/, with the first as a coda-induced [ɫ] and the second as an onset [l]. This should come as no surprise because if /l/ is often a coda but could be resyllabified to become an onset based on its word boundary context, it only makes sense that it would exhibit features of both the light and dark allophones. Furthermore, Sproat & Fujimura’s (1993) timing results revealed that such ambisyllabic results in two unique but perceptually united articulations, which agreed well with their proposition that all /l/ realizations involve two gestures, with the consonantal gestures being associated with syllable boundaries, and vocalic gestures with syllable nuclei. The two asynchronous but almost simultaneous gestures involved in ambisyllabic /l/ also contest the need to define word boundary /l/ in terms of resyllabification. If anything, one could define the word-boundary /l/ as partially resyllabified to be associated with the nuclei of two syllables, which is
how Gick (2003) presented the issue in his study. In other words, the ambisyllabic /l/ requires both dark and light elements and can be considered part of two syllables sequentially.

*English [l]-[ʃ] variation*

The existing research regarding the nature of /l/ in onsets, codas, and both onset and coda in an ambisyllabic position through coarticulation, conveys the sense that the extent of /l/ velarization is in all actuality rather complex. Indeed, although it is simpler to draw a clear-cut difference between onset [l] and coda [ʃ] in English allophony, it is more accurate to say that laterals are on a gradient scale of lightness and darkness depending on the amount of velarization, particularly in AE (Yavaş, 2006). In fact, one may go so far as to say that finding a clear /l/ in AE is difficult due to the range of dark /l/ coloring (Carter, 2003). Oxley and colleagues (2006) found such to be the case in their study, attributing the degree of variation and velarization to the variety of vocalic and prosodic contexts involved. Moreover, when and where velarization occurs can further depend on idiolect (Whitley, 2002). Because English is no exception to the /l/ velarization gradience and because the AE speakers exhibit an increased propensity to always use some degree of velarization in their native /l/ production, it is even more important and pertinent to investigate their /l/ production in L2 Spanish.

**Cross-linguistic Allophonic Discrepancies**

Quilis (1999) lists the existing Spanish allophones for /l/, including [l], but excluding [ʃ]. The difference in Spanish /l/ allophony and that of English presents difficulty for L1 English speakers learning Spanish. Hualde (2005) confirmed this interlanguage discrepancy because both state that although [l] in syllable onsets and the [ʃ] in codas are natural in English speech, such an allophonic difference does not exist in Spanish. That is to say, regardless of syllable positioning in Spanish, a light [l] is expected and the tongue contacts the alveolar ridge and only allows
lateral air flow, whereas syllable positioning in English means the difference between a similarly
formed light [l] and a dark [ɻ] formed with the dorsum bunched toward the velum. Gussenhoven
& Jacobs (2005) define this as a velarized alveolar lateral approximant, a sound which speakers
create postvocalically in a word such as all. Moreover, as the tongue tip approaches the alveolar
ridge and the dorsum to the velum, there is “considerable pre-dorsal lowering” which results in a
relatively higher F₁ and lower F₂ (Simonet, 2010).

Hualde (2005) explains the interlanguage articulatory difference that consequently exists
between English and Spanish:

In most English varieties ‘clear’ [l] is used in syllable onset and ‘dark’ [ɻ] in the
coda…. In Spanish, instead, /l/ is always light. It is always produced without
bunching the tongue body, whether in the onset or in the coda: lata [láta] ‘can’,
tal [tá] ‘such’. This is except in Catalonia, where Catalan-dominant bilingual
speakers sometimes transfer the dark [ɻ] of this language to Spanish. (p. 178-179)

Indeed, standard Spanish /l/ is characteristically light, even after assimilation. In Spanish,
/l/ can assimilate place of articulation and is produced as a more interdental [ɻ] when followed by
the interdental fricative /θ/, a more dental [ɻ] when followed by the dental occlusives /t/ or /d/,
and a more alveolar palatal [l] when followed by palatal consonants such as the alveo-palatal
fricative /ʃ/. In all other standard phonotactic sequences, [l] is the expected realization in Spanish
(e.g. D’Introno, 1995; Navarro Tomás, 1974; Quilis, 1999). In none of these cases is [ɻ] even
considered as an L1 Spanish result of assimilation, even when /l/ is followed by the high back
vowel /u/ or a velar consonant /ɡ/.

Nevertheless, as Hualde (2005) noted when he mentioned Catalan-dominant bilinguals
who utilize [ɻ] in their Spanish, dialectal variations do exist. Presenting a few more dialectal /l/

variations, Quilis (1999) expounded on some regional variation in the Americas. He commented that the Spanish syllable-final /l/ may be devoiced before a voiceless consonant, become a vocoid, be assimilated to transform into a geminate, or be elided altogether. That is to say, *alto* could be pronounced as [á̞l̥to] (devoicing), [á̞ţo] (vocalization), [áːţo] (gemination), or [á̞t̪o] (elision). Noting that /ɾ/-/l/ neutralization occurs in L1 Spanish, Hualde (2005) noted that *carne* is a word that exhibits a gamut of allophonic variation. Typical dialectal variants include: [kárne], [kárne], [kálne], [káhne], and [kán:e] (Hualde, 2005). These phonetic transcriptions offer examples of neutralization, aspiration, and germination, validating Quilis’s (1999) notes. Hualde (2005) further discussed the process of vocalizing rhotic and lateral liquids in the Dominican Republic. This vocalization results in productions of *algo* as [á̞i̞γo] with a front vowel in place of a lateral, or even deletion of the utterance-final /l/ in *el árbol* [eláiβo]. Although such regional variation presents other possibilities that are dependent on syllable positioning, none but those in contact with Catalan allows a dark [l] as is found in English, and even so, the [l] is considered nonnative (Recasens, 1996; Simonet, 2010). In an extreme situation, Whitley (2002) even goes so far as to tell his readers that were a dark /l/ transferred into Spanish, it would result in [á̞u̞to] and [kausár] instead of [á̞lto] and [kalsár], which would completely alter the speaker’s meaning.

**Theories of Second Language Acquisition of Phonology**

As pertains to the acquisition of a foreign phonology, Major (2001, 2008) classified the transfer of L1 allophones to an L2 as a “phonological process.” Flege (1995) also commented, “Phonetic categories established in childhood for L1 sounds evolve over the life span to reflect the properties of all L1 or L2 phones identified as a realization of each category,” and, “A new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound if bilinguals discern at least some of the phonetic differences between the L1 and L2
sounds” (p. 239). Simonet (2010) emphasized the interaction and interrelationship that exists between the phonologies present in a bilingual and a goal of his study was to better comprehend the phonetic qualities of L2 speech, particularly when it involves a “reorganization” of preexisting phonologies (p. 664). Flege (1981) warned, “The fact that phonetically similar sounds in two languages might be transcribed with the same IPA symbol should not obscure the fact that sounds may be produced differently at the phonetic level,” (p. 446). Due to some overlap in the phonemic similarities of Spanish and English and the shared orthographic symbol that represents /l/ in both languages, L2 Spanish learners might easily assimilate their L1 usage to their newly forming L2 phonology. Reinforced by similar acoustic, articulatory, and visual input, L2 learners most likely assign the foreign (Spanish) sound to the same phonological category as in their L1.

This observable transfer from an L1 to an L2 resulting from acoustic similarities directly coincides with Best’s (1995) Perceptual Assimilation Model (PAM), which states that non-native segments may be directly associated with and consequently assimilated to a preexisting native phonological category. In all likelihood, this direct association is further facilitated by the fact that the AE /l/ varies in degree of velarization between the lighter [l] and the darker [ɫ], whereas the Spanish allophones to the L1 English ear all sound much like a lighter form of their native /l/, so the non-native (Spanish) /l/’s are then collapsed into the preexisting L1 phonological category, as Best’s PAM predicts (1995). Whether the L2 learner identifies the linguistic difference in velarization remains dubious, meaning that the L2 /l/ could be completely lumped in with L1 patterns or it could be associated in particular with nonvelarized L1 habits. Other authors have referenced the PAM phenomenon as the erroneous classification of a native and non-native sound as being identical due to L1 and L2 sound similarities. Subsequently, the learners
unwittingly substitute L1 sounds for those of the L2 (Flege & Hillenbrand, 1984; González-Bueno, 1997).

According to Flege (1995), sounds that exist in the L1 but not in the L2 may be erroneously transferred, and sounds existent in the L2 but not in the L1 are predicted to be harder to acquire, therefore requiring more time and exposure. In response, Major (2001) references his Ontogeny Phylogeny Model (OPM), remarking that acquisition difficulty or ease is arbitrary, so it is better instead to say that noticing and producing a distinction between similar sounds takes more time. However, as L1 transfer effects wear off and developmental processes take over and the learner advances in the acquisition process, it is predicted that phonological improvement will occur because the L2 learner becomes more familiar with the foreign language and has developed a heightened awareness of previously imperceptible L2 differences. For this reason, it is expected that the more advanced L2 Spanish participants in my study will produce more target-like, less velarized /l/s than their heavily L1-influenced beginner L2 counterparts.

**SLA Research**

The remainder of the literature review moves beyond L1 specifics and is dedicated to existing SLA research related to the present study. Of particular note are the small handful of studies that have also investigated acquiring foreign /l/ phonology. Additionally, L2 level of learning (e.g. beginner, intermediate, advanced), task type, and motivational intensity and attitude are discussed one by one, supporting the inclusion of such factors in the current study’s L2 /l/ analysis.

**L2 phonetics and phonology**

Despite the vast array of information available about concepts relating to similarities and differences between AE and Spanish /l/ phonology, there is a sad lack of research related to L2
phonological acquisition between the two languages. One of the few to report L2 /l/ findings, Díaz-Campos (2004), compared study abroad (SA) versus at home (AH) L2 learners by measuring phonetic gains in the word-final lateral /l/, among other phonemes, over a 10-week period. His reasoning for including results for lateral production is the same as mine for my study: L1 English speakers acquiring Spanish tend to produce L2 /l/ s with more velarization than is typical in L1 Spanish due to influence from their English phonology. For his study, Díaz-Campos (2004) gave the participants an entrance and exit questionnaire and read-aloud text consisting of 60 words. The questionnaire helped to determine the most important learning factors, based on a VARBRUL logistic regression analysis. From the read-aloud text, he extracted the phonetic information necessary and impressionistically categorized the data, putting the 368 lateral tokens into the target-like [l] category or the L1 transfer [ɫ]. The regression analysis showed that the strongest factors (aside from SA or AH) were gender (females performed better overall in the study), time spent in formal instruction (7+ years), and time spent speaking Spanish outside the classroom (4+ hours). In both the SA and AH groups, he found that initially the non-target-like variant was favored in 72% of the tokens, but the exit data show that both groups improved, with the AH students favoring the target-like [l] more than the SA students. In both groups, though, improvements were found, indicating that even though there is L1 /l/ transfer, it does decrease over time with acquisition, particularly when instruction and effort outside of class are considered.

Two years later, Díaz-Campos (2006) published another article inspired by his 2004 findings. This time, he had a SA and AH group and again used a 60-word read-aloud task, and he also selected 2-minute portions of students’ Oral Proficiency Interviews (OPI) that students participated in both in pre- and post-testing. Using the elicited data, he then applied a
VARBRUL regression analysis to find that target-like [l] production was favored in conversation, disfavored in the read-aloud task, and that it was favored in the SA group but not the AH group. Out of 368 read-aloud tokens, 104 were target-like (28%); out of 433 conversational tokens, 302 were target-like (69%). Also, AH students produced the target-like [l] 34% of the time and SA students did 62% of the time. When the four variables were combined, AH conversation tokens showed a .368 weight, whereas the SA conversation tokens showed a .904 weight. Díaz-Campos’s (2006) results imply that interacting in Spanish more often and with L1 Spanish speakers in a Hispanic environment helped the SA students improve significantly.

Despite the significant findings in Díaz-Campos’s (2004, 2006) work, there is yet room for research. Although he took into account the tendency for AE speakers to velarize a word-final /l/, he did not analyze /l/ in other word-internal coda-positioned /l/’s. Secondly, he viewed /l/ velarization as being a binary phenomenon, not as a gradient phenomenon. Had he measured L2 /l/ acquisition as being gradiently velarized, he may have found that his study participants were making greater L2 /l/ pronunciation gains than he gave them credit for. Moreover, he may have found that they were being more successful in producing target-like /l/’s in positions other than word-finally, such as word-initially or word-internally.

Llisteri and Martínez-Daudén (1991) also conducted /l/ acquisition research, and theirs is from a velarization gradience standpoint not addressed in Díaz-Campos’s (2004, 2006) work. They examined speech samples taken from three Spanish-Catalan bilingual males learning French. The authors gathered Spanish, Catalan, and French /l/ utterances, specifically in [Vle] position because it is a phonotactically possible environment in all of the three languages. The authors measured the mean F2 (Hz) of each participants’ [l] from each language and compared it to previously established L1 Spanish, Catalan, and French means. They found that although none
of the three speakers successfully produced a native-like [l] in French, they all approximated it by producing [l] with a higher F2 while speaking French than while speaking their more practiced L1 or L2 Spanish or Catalan. Furthermore, one L1 Spanish speaker produced a higher mean F2 in all three languages than his L1 Catalan-L2 Spanish counterparts. These results coincide neatly with the other literature, both to attest the velarization gradience existent in language and to show the L1 influence of /l/ production in other languages.

*L2 level of learning*

Second language instruction at a university, particularly in the early stages of acquisition, is associated with L2 learner level (e.g. beginning, intermediate, advanced). SLA research has reached a general consensus in affirming the positive effect of level of learning or experience on improved L2 pronunciation. Face (2006) and Shively (2008) are only two of many studies whose L2 data coincided neatly with the consensus that a significant factor in more successful language acquisition is the time spent learning the language. Furthermore, Tanner (2012b) investigated overall L2 perceived foreign accent, tested a number of factors and found level to be one of only two significant factors in his results. He found that as subjects increased in learner level and overall acquisition, they tended to speak with less foreign accent in their L2 Spanish. His results on the matter of L2 learner level are yet another attestation to the significantly positive relationship between L2 improvement and learner level.

Recognizing that experience extends beyond the classroom, a number of studies have also compared students who have had extended stays abroad in an L2 environment culture with their classroom-only counterparts, but their conclusions have varied (e.g. Alvord & Christiansen, 2012; Díaz-Campos, 2004; Martinsen, 2010; Martinsen & Alvord, 2012; Martinsen, Baker, Dewey, Bown, & Johnson, 2010; Shively, 2008). For example, Díaz-Campos (2006) reported
that the study abroad students disfavored target-like production of intervocalic \([\beta, \delta, \gamma]\), but at the same time they favored target-like production of syllable-final \([l]\). Others have compared improvement in study abroad participants or classroom learners before and after explicit phonetics instruction (e.g. Díaz-Campos, 2006; Elliott, 1995b; González-Bueno, 1997; Lord, 2005; Shively & Cohen, 2008). In like manner, the present study accounts for level of learning and experience.

**Task type**

The next aspect in review that can affect SLA is task type, which is another means of referring to speech style/register. Task type is used to discuss a difference in speech modes: formal, calculated written selections to read, and informal, spontaneous, conversational topics/questions to discuss. Pioneered by Labov (1966, 1972), SLA research now accepts that pronunciation in all reality differs depending on the task type and the phonetic segment in question. Speaking in generalizations, formal tasks tend to result in less negative L1 influence and elicit more careful (and thus more target-like) productions because L2 learners can focus on pronunciation (e.g. Alvord & Christiansen, 2012; Tarone, 1979, 1982). Indeed, this is frequently the case when a reader sees a word that orthographically represents the same or a similar allophone between languages, such as \([l]\) in English *light* and Spanish *luz* or French *lumière*. Shively (2008) and Zampini (1994) agreed that orthography plays an important role in creating the phonetic divergence in task types.

Conversely, in the conversational process, pronunciation loses focus and is often juggled with other skills. When the same reader moves to conversing from reading *light* and *luz* or *lumière*, he/she no longer has the visual reinforcement and must communicate personal thoughts through simultaneously coordinated actions of remembering vocabulary and conjugations,
altering pronunciation to approximate the L2, and responding instantaneously to aural input from another speaker. Essentially, as detailed in Major’s (2001) OPM, attention shifts between function and form: how L2 words and sounds are pronounced in a reading task and what L2 words and sounds are pronounced in a conversational task, respectively.

Often, SLA phonological research is based on either reading or conversational data, but some research has compared reading results with those of conversation (e.g. Alvord & Christiansen, 2012; Díaz-Campos, 2006; Shively, 2008; Zampini, 1994). The consensus for most phonemes under observation is that the more formal the task, the more precise and target-like the resultant production. SLA research on spirantization has shown the opposite to be the case, most likely due to orthographical reinforcement of a stop rather than a spirant, but spirantization tends to be considered an exception (e.g. Alvord & Christiansen, 2012; Díaz-Campos, 2006; Shively, 2008; Zampini, 1994). Notwithstanding, when Díaz-Campos (2006) compared task types and AH versus SA, he found syllable-final /l/ to also be an exception to the expectation that more formal tasks result in more target-like speech. His SA participants performed worse in a reading task than those who had learned the L2 solely in a classroom setting, perhaps because they had studied abroad, so they would have had more experience in conversational settings with L1 Spanish input to imitate.

Motivational intensity

Moving beyond task type, there are the closely connected subject-internal factors of learner motivational intensity and attitude. Among the SLA literature there are a few recent reports that include motivational intensity to learn another language. A natural assumption is that L2 learners who are more motivated to acquire the L2 in its many facets will try harder and consequently make greater gains in a variety of L2 contexts than their lesser-motivated
counterparts. Notwithstanding, SLA research has been contradictory in this respect. Much of the research frequently associates motivational intensity with attitude towards the L2 language and culture and for this reason, I include together results and conclusions that are connected with motivational intensity, attitude, or both.

In two studies, Elliot (1995a, 1995b) regarded motivational intensity as similar to attitude toward the culture associated with the foreign language. His results were contradictory: One study indicated that attitude towards pronunciation was the most significant of all the variables examined, but the other indicated it to not be significant to pronunciation improvement. Shively (2008) also reported mixed results when phonological gains were measured in relation to learner attitude. These three studies measured motivational intensity by assessing L2 learners’ attitude and concern for acquiring native-like pronunciation determined through a Likert-like self-rating scale. In contrast with Elliott’s (1995a, 1995b) polarized results regarding correlational significance of attitude, Shively (2008) was surprised to find that while attitude towards pronunciation had a significance value of \( p < .01 \) and those who were very concerned with pronunciation were more accurate, the correlation was not linear; to the contrary, the next best in accuracy were the very unconcerned participants, and those who were only marginally concerned were the least accurate.

Nevertheless, recent studies have continued to investigate motivational intensity and attitude as factors for more successful, more target-like L2 production. One report, by Alvord & Christiansen (2012), focused on L2 acquisition of Spanish /b, d, q/ in L1 English students. Their participants were a highly homogenous group of young males who had spent approximately two years immersed in a Spanish-speaking country, many of whom had had little if any Spanish instruction prior to their extended stay abroad. Participants were recorded while reading aloud
selections and word lists and they responded to a series of items on a Likert-like scale, which scale was meant to ascertain individual motivational intensity (Gardner, 1985). Subsequently, the motivational intensity results were tested for a significant relationship with target-like/nontarget-like production. Although all the participants’ motivational intensity scores were relatively high, Alvord & Christiansen (2012) nevertheless observed a correlation between target-like pronunciation and reported motivational intensity: “Those who scored ‘low’ [in motivational intensity] received a factor weight of 0.413 and disfavored a target-like pronunciation, while those who scored ‘mid’ or ‘high’ had factor weights of 0.509 and 0.573, respectively, and favored a target-like pronunciation” (p. 265). Given the homogeneity of the group under examination, such a difference in L2 pronunciation resulting from varying motivational intensity levels is striking.

The literature about motivational intensity affecting L2 gains included herein investigates but one aspect affecting SLA. A number of variables ultimately influence individual and general L2 acquisition. Accordingly, I seek to combine and investigate a number of aspects in relation to /l/ acquisition. Chapter 3 details my study and how it connects syllabic context, preceding and following segments, level of learning, task type, and motivational intensity as potential influences on L2 /l/ and target-like /l/ gains.
CHAPTER 3: Research Design and Methods

I now explain in detail the organization of the present study. I begin with descriptions of the L2 participants, followed by descriptions of L1 English and L1 Spanish participants whose /l/ realizations will be used as a comparison benchmark. In the process, I explain the data collection process and instruments, and then I expound on the /l/ data classification systems and their subsequent statistical analyses.

Participants: L2 Spanish Learners

Following up on Bean’s (2012) study, this study includes speech samples from 21 L1 English speakers learning Spanish, ranging in age from 17-24 years old. Aside from one who had also learned basic ASL, none of the participants had an L3 that would possibly affect their L1-L2 phonology. They were recruited at Brigham Young University from seven university-level instruction groups of beginning, intermediate, and advanced Spanish:

- Spanish 102,
- Spanish 106,
- Spanish 206,
- Spanish 321 AH (those who advanced in L2 proficiency through university courses),
- Spanish 321 RM (RM=returned missionary; these individuals spent extended time abroad residing in a Hispanic environment),
- Spanish Major AH (those who advanced in L2 proficiency through university Spanish courses beyond Spanish 321), and
- Spanish Major RM.

The Span 102 students were beginners and typically had very limited or no contact with Spanish before having arrived at the university and were in their second semester of Spanish.
The next level of beginners were the Span 106 students who either had taken the preceding university beginner courses (i.e. Span 101, 102, and 105) or had taken one or two years of Spanish in high school. Next, the Span 206 students were intermediate learners who ranged in experience, with the possibility of having taken high school classes and/or all or some of the preceding college courses (i.e. Span 101, 102, 105, 106, and 205). The Span 321 AH students were intermediate-advanced learners and resembled the Span 206 students in terms of previous high school and college-level experience, but they generally had already completed Spanish 206 or had in some other way gained a better grasp of the language than the Span 206 participants. The Span 321 RMs, however, were completely different from any of the other previous levels because they were advanced learners who had learned Spanish principally by living immersed in a Spanish speaking country for two years. They potentially had some high school experience before their religious missions but most often were without college-level course experience. The Span Major AH students were advanced learners nearing graduation after having enrolled in several university-level Spanish courses, including Spanish 321, and had 0-4 months' experience abroad in a Spanish-speaking country. Lastly, the Span Major RMs, like their Span Major AH counterparts, had completed several university Spanish courses, but like their Span 321 RM counterparts had spent two years immersed in a Spanish-speaking country. The six Span Major AH and Span Major RM participants had the additional advantage of having benefitted from explicit phonetics instruction in a semester-long Spanish phonetics course.

As seen in Table 1, the Span 102, Span 106, Span 206, and Span 321 AH instruction groups consist of 2 females and one male, while the Span 321 RM and Span Major RM groups consist of only males, and the Span Major AH group consists of only females. The participant selection was random, but the number of males and females was intentional for all instruction.
groups with the exception of the Span Major AH. For a study with such a range of instruction groups as this one, three participants per instruction group seemed appropriate, including males as well as females for a balanced view of acquisition. Simonet (2010) noted that it would be ideal to have equal numbers of males and females among the participants. Nonetheless, circumstances prevent the inclusion of equal numbers of males and females, not only because there is a larger female population in the beginning instruction groups and a larger male population in the more advanced courses, but also because most male Spanish majors learned Spanish from being missionaries and would therefore be part of the Span Major RM group. For this reason, there are more females than males in the beginning and intermediate levels and the Span Major AH level is comprised of only females.

Table 1 *Participant Distribution by Sex*

<table>
<thead>
<tr>
<th>Level</th>
<th>n males</th>
<th>n females</th>
<th>n total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span 102</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Span106</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Span 206</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Span 321AH</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Span 321 RM</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Span Major AH</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Span Major RM</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>L1 English</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>L1 Spanish</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total participants</strong></td>
<td><strong>12</strong></td>
<td><strong>13</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

To include more participants and to add their /l/ tokens would have been beyond the scale of this study, but is a possibility for future research. Nevertheless, although the quantity of participants is small, each one produced approximately 200 /l/ tokens for analysis in a variety of syllabic and phonetic contexts. Consequently, while the large amount of total /l/ productions enables me to make valid conclusions regarding linguistic contexts, the small participant population per level of learning creates measurement error. Therefore, I will still seek a general
trend in L2 /l/ gains based on level of learning, but generalizing this study’s level of learning-related /l/ results to a larger population is not recommended.

Furthermore, explanation is necessary regarding the background of the RM participants in the study population and regarding why the RM groups are male-only. “RM” is a general term for males and females who have completed a religious mission for the Church of Jesus Christ of Latter-day Saints. Many young men 19-21 years old and many young women 21-23 years old volunteer to dedicate two years or 1.5 years to preaching, respectively. Because they choose to volunteer, but do not choose where to serve, but are assigned to a country or region in which to preach, they can be sent anywhere in the world. At the onset of their missions, all missionaries enter a training center and are taught language basics and how to preach for 2-12 weeks, generally for 9 weeks for learning Spanish unless the missionary is already an advanced speaker.

However, the language instruction is intended as a basic survival skill and as a means to preach, not as an end in and of itself; after leaving the training center, it is the missionaries’ responsibility to study grammar in their daily routine. Notwithstanding, they often learn slang rather than academic speech because of their constant interactions with people of every socioeconomic level, particularly the impoverished. Every missionary is assigned a mission companion of the same sex. The companion may be either an L1 or L2 speaker of the mission language; they are encouraged regardless to speak only the language spoken in the mission. The missionaries learn the L2 through daily communication with a missionary companion and from those with whom they interact. At six-week intervals until the end of their missions, missionaries are commonly reassigned to a different mission companion and/or to a different geographic area. Dewey and Clifford (2012) reported that by the time male and female missionaries return, many have attained an Advanced or Superior speaking proficiency according to the American Council
on the Teaching of Foreign Languages (ACTFL) scale. More importantly, missionaries often have a passion for the language, culture, and people of their missions and, like the RMs in this study, incorporate the language into their college education.

Upon return to the university, both male and female RMs who served in a foreign, Spanish-speaking country often enroll in Spanish 321. Due to the difference between male and female mission lengths, however, only male RMs were included in this study in order to avoid a confounding of factors connected to language exposure based on time abroad. Furthermore, the RMs who learned Spanish on missions within the United States were disqualified: The amount of L2 Spanish exposure varies drastically from mission to mission and would be cause for less homogenous groupings for acquisition analysis. The RMs included in this study were sent to the foreign countries of Mexico, Honduras, Chile, and Argentina. Of the Spanish varieties spoken in these countries, none exemplify the /l/ transformations so characteristic of Caribbean speech, such as rhotacism, vocalization and gemination. As such, it was assumed that their Spanish /l/ input was only that of the clear, nonvelarized standard and they would be more likely to produce clearer, more /i/-like /l/s. In addition to linguistic factors, it is also important to recognize how a missionary’s motivational intensity is unique: A missionary’s motivational intensity to learn the mission language and adapt to the foreign culture is to facilitate interaction and understand the people and culture in daily life.

Although there are a number of dialectal variants of Spanish /l/ production (D’Introno, 1995; Hualde, 2005; Navarro Tomás, 1974; Quilis, 1979, 1999; Whitley, 2002), most of the participants of the present study, particularly the beginning and intermediate learners and to some extent the Spanish majors who came up through the traditional levels of instruction, have not evidenced lengthy exposure to such dialects. While it is true that the L2 participants may
have been influenced phonetically by Spanish instructors who may have acquired and demonstrated a range of dialectal variation, no one dialect is explicitly instructed. In fact, many students in this study have had little if any phonetic instruction unless they had taken an actual phonetics course, which course only the Spanish majors had completed during the data collection period. Furthermore, none had extended exposure to Caribbean or Catalan-influenced Spanish. Thus it stands to reason that on the whole, the participants’ speech is representative of the typical university L2 Spanish student.

Participants: L1 English and Spanish Benchmarks

In order to more clearly identify and understand the gradient continuum of /l/ velarization present between English and Spanish, I also solicited the participation of two L1 English speakers and two L1 Spanish speakers, one male and one female for each language. The female Spanish speaker is from Colombia and is an advanced L2 English speaker pursuing a master’s degree at the university; the male Spanish speaker is from Guatemala and is an intermediate English speaker studying at the university’s English Language Center. For English, both the L1 participants are monolingual English speakers from the United States.

Instruments and Measures

Participants were recruited at the semester’s end and responded to a background questionnaire and the Survey of Motivational Intensity (see Appendices A and B). Next, they produced two recordings, one formal through a reading selection and one informal though an interview similar to an Oral Proficiency Interview, henceforth referred to as an OI. They were recorded at a 44.1 bitrate in Audacity on university-owned computers with Plantronics USB headset microphones. The resultant acoustic data formed the basis in determining L2 Spanish /l/
acquisition and provided approximately 1,800 tokens in a variety of phonetic contexts present in the reading and OI tasks.

The background questionnaire provided general information regarding the participants. For example, there were standard demographics questions such as age and sex, in addition to questions of slightly more detail, such as years of Spanish in high school and current Spanish course enrollment. Lastly, there were questions that helped in determining who did not qualify for the present study. For example, if the answer to “Did you serve a Spanish-speaking mission in the United States?” was “yes,” they were automatically disqualified, regardless of sex, as per study specifications regarding the learning environment of RMs.

Immediately following the background questionnaire, the participants completed the Survey of Motivational Intensity, which is a compendium of nine statements regarding their personal everyday efforts to learn, practice, and utilize their Spanish skills; Gardner’s (1985) study on psychological motivation and attitude was the basis for creating the Likert-type scale format implemented in this study’s survey. In response to Likert item questions such as “I learn Spanish by working on it almost every day,” students rated themselves from 1-Strongly Disagree to 4-Strongly Agree. The sum of their scores is indicative of their motivational intensity, with 9 as the lowest sum possible, representing a highly unmotivated learner and 36 as the highest sum possible, representing a highly motivated learner.

The first oral measure collected from each student was a formal task to read aloud a short story, “Rita la fabulosa” (see Appendix C). Upon completion of the reading selection, all participants were instructed to read and answer simple questions testing comprehension in order to induce a greater focus on meaning rather than form. They had the option of reading the questions aloud or to themselves and answers were given in either in English or Spanish, most
often in English for the beginning students and in Spanish for the intermediate and advanced students. Lastly, they read a word list consisting of a series of words extracted from “Rita la fabulosa.”

Additionally, to obtain spontaneous speech samples, each L2 student participated in an informal oral task, an OI. Patterned after the ACTFL guidelines, the OI conversations were conducted in small, isolated rooms and typically lasted between five and fifteen minutes per participant. Interviewers were university-affiliated L1 or advanced L2 Spanish speakers and topics generally included topics such as: why the participant was learning Spanish, where he/she is from, what his/her family is like, what their professional goals and future plans are, and/or a retelling of experiences from their pasts. By touching on such a variety of topics, L2 Spanish student participants communicated with vocabulary that ranged in familiarity and frequency, thereby producing /l/ in a variety of contexts.

Although the Survey of Motivational Intensity was irrelevant for the L1 speakers, the four benchmark participants still performed two 5-10 minute oral tasks in their respective native tongue: reading and conversation. All four benchmark participants were recorded on the same equipment as the L2 Spanish learners and, like their L2 counterparts, the L1 Spanish speakers read “Rita la fabulosa”. However, the L1 English speakers needed to read “Laurel the Loner” so as to have authentic English tokens with which to compare the L2 data (see Appendix D). It is of comparable length to “Rita la fabulosa” and also includes a list of comprehension questions at the end.

**Linguistic Factors**

Based on the actual utterances of the participants, the subsequent classification of /l/ production as being part of an onset or coda was rather straightforward because intervocalic /l/
was not evaluated in the data. In excluding tokens such as /ela/, I simultaneously avoided the ambiguity associated with English ambisyllabicity transferred to L2 Spanish as well as reduced the phonetic influence of a wide gamut of vowel reduction characteristic of AE-influenced L2 Spanish on either side of the /l/. The actual remaining tokens in the data set, therefore, are easily identified as onset or coda in English and Spanish.

Classification of preceding and following segments was more difficult to organize, however. It was ultimately determined that the preceding segments to be examined initially be categorized into front vowels (i.e. /il/ and /el/ together), mid vowel (i.e. /al/), back vowels (i.e. /ol/ and /ul/ together), voiced and voiceless obstruents (i.e. /pl/, /bl/, /k/, /g/ and /sl/, respectively; not including /dl/ nor /tl/ as they are not typical of standard Spanish), nasals (i.e. /nl/; /ml/ never occurred in L2 Spanish productions), rhotics, and pause. The following segments factor consisted of the same consonantal and vocalic categories in contact with /l/, as well as /ld/ and /lt/, respectively. Table 2 contains the preceding and following segments’ coding.

<table>
<thead>
<tr>
<th>Preceding Segment</th>
<th>Example</th>
<th>Following Segment</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back vowel (/ul, ol/)</td>
<td>/kulto/, /espaɲol/</td>
<td>Back vowel (/lu, lo/)</td>
<td>/lus/, /los/</td>
</tr>
<tr>
<td>Low vowel (/al/)</td>
<td>/alto/</td>
<td>Low vowel (/a/)</td>
<td>/a/</td>
</tr>
<tr>
<td>Front vowel (/il, el/)</td>
<td>/mil/, /miel/</td>
<td>Front vowel (/li, le/)</td>
<td>/libro/, /le/</td>
</tr>
<tr>
<td>/kl/</td>
<td>/klase/</td>
<td>/lk/</td>
<td>/tal#kosa/</td>
</tr>
<tr>
<td>/fl/</td>
<td>/flauta/</td>
<td>/lf/</td>
<td>/el#fin/</td>
</tr>
<tr>
<td>/bl/</td>
<td>/biblioteka/</td>
<td>/lb/</td>
<td>/bolber/</td>
</tr>
<tr>
<td>/pl/</td>
<td>/playa/</td>
<td>/lp/</td>
<td>/kulta/</td>
</tr>
<tr>
<td>/ɡl/</td>
<td>/iɡlesia/</td>
<td>/lg/</td>
<td>/algo/</td>
</tr>
<tr>
<td>.</td>
<td>.</td>
<td>/ld/</td>
<td>/kaldo/</td>
</tr>
<tr>
<td>.</td>
<td>.</td>
<td>/lt/</td>
<td>/alto/</td>
</tr>
<tr>
<td>/nl/</td>
<td>/en#la/</td>
<td>/ln/</td>
<td>/el#no/</td>
</tr>
<tr>
<td>.</td>
<td>.</td>
<td>/lm/</td>
<td>/alma/</td>
</tr>
<tr>
<td>/rl/</td>
<td>/ser#lo/</td>
<td>/lr/</td>
<td>/alrededor/</td>
</tr>
<tr>
<td>/sl/</td>
<td>/es#lo/</td>
<td>/ls/</td>
<td>/el#se/</td>
</tr>
<tr>
<td>pause+/l/</td>
<td>/le/</td>
<td>/l+pause</td>
<td>/espaɲol/</td>
</tr>
</tbody>
</table>
Although a number of these categories do not appear within a typical Spanish syllable, they can be found across syllable and word boundaries, for which reason they are included. Where applicable in English, L1 tokens were marked and coded under the same preceding and following categories as detailed for the L2. For example, [lát] would be coded as preceding segment: “pause+/l/” and following segment: “low vowel.” An utterance such as {all the} [ɔl#ðə] would be eliminated because [lð] is only a sequence possible in English, not Spanish because the /l/ and /d/ would mutually assimilate, the /l/ to be a dental [J] and the /l/ to be a dental [d] rather than the otherwise possible dental approximant [ð].

**Analysis**

Viewing the 25 participants’ collected audio files in Praat for both the reading and OI tasks, I selected all pertinent /l/ tokens per participant in a variety of contexts in a textgrid, labeling them by their phonological representations. Certain /l/ tokens were disqualified, typically when the speaker stopped mid-word, created nonce words, produced noise rather than actual words (generally while hesitating), combined a Spanish production with English, elided the /l/, or vocalized the /l/.

In view of a velarization continuum, the extent to which my participants’ L2 /l/ is deemed target-like will not be binary, but will instead depend on its F2 and F2-F1, in accordance with the research presented in the literature: a higher F2 and greater difference between the first and second formants is indicative of clearer, less velarized, and therefore more Spanish-like [l]. Conversely, a lower second formant and lesser difference between it and the first formant is indicative of a darker, more velarized, and therefore more English-like [l] transference. Also, based on what is known of the high front vowel, /i/, affecting the F2 of a typically dark [l], it is logical to conclude that syllabic position (i.e. onset vs. coda) and surrounding phonemic
segments will influence L2 /l/ production (Carter, 2003; Gick, 2003; Recasens, 1996; Sproat & Fujimura, 1993; Van Hofwegen, 2009).

Having identified all the remaining qualifying tokens and marked them on the Praat textgrid, I then ran a script in Praat and used a Bark normalization to measure F1 and F2 midpoint values for all 25 speakers in both tasks. As previously mentioned, in-depth cross-linguistic research (Recasens, 1996, 2004, 2012; Simonet, 2010) has shown that F2 is indicative of vocalic fronting/backing and F2-F1 is also a useful measure in determining /l/ velarization. Consequently, I have included both the Bark F2 and Bark F2-F1 values in determining L2 /l/ acquisition and those evident in the L2 recordings as the dependent variables. As far as independent variables contributing to /l/ Bark F2 and F2-F1 are concerned, I consider syllabic context and preceding/following segments to be the principal focus here. Nevertheless, potential extralinguistic factors contributing to L2 target-like /l/ acquisition are the aforementioned participant level of learning (Span 102, Span 106, Span 206, Span 321 AH, Span 321 RM, Span Major AH, or Span Major RM), task type (OI or reading), and motivational intensity.

I categorized all the qualifying L2 tokens of utterances and factors in Excel. Separately, L1 Spanish and L1 English tokens were categorized in a fashion similar to that of the L2 data, except only with the phonetic/phonological data and the task type. That is, each L1 token was coded for syllabic context (i.e. onset vs. coda), preceding segments, and following segments (see Table 2). However, because extralinguistic factors such as L2 level of learning, and motivational intensity are irrelevant to the L1 speaker benchmark, these factors were excluded from the L1 token.

A mixed models analysis was then conducted to show the relationship between the dependent variables (Bark F2 and Bark F2-F1) and the factors and covariates (i.e. level of
learning, task, syllabic context, preceding and following segments and motivational intensity, respectively. The analysis takes into account main effects for Type III fixed effects and random effects, as well as estimated marginal means with a post hoc Bonferroni adjustment for all multiple comparisons.

Keeping in mind the known acoustic patterns of /l/ gradience, target-likeness will be determined by F2 height and F2-F1 difference; a higher F2 and larger F2-F1 indicate a more target-like, less velarized /l/ and conversely, a lower F2 and smaller F2-F1 indicate a more foreign, more velarized /l/. Accordingly, the less velarized a subject’s /l/ is, the more native Spanish-like it will be and less foreign-accented it will sound.

Taking the aforementioned literature into account, I understand that /l/ production ranges from a very clear, /i/-like [l] to a very velarized /u/-like [ɫ], often correlating with syllabic and segmental contexts. Accordingly, target-likeness of L2 /l/ as defined by F2 and F2-F1 is analyzed in terms of syllabic context, preceding phonological segment, following phonological segment, level of learning, task type, and motivational intensity. Based on what has been noted in the literature and Bean’s (2012) results, the effect of the high front /i/ in contact with /l/, whether preceding or following it, is of particular interest. Moreover, I expected to find that the lower the level of learning, the less experience a participant would have with L2 pronunciation, which would result in more velarization and [ɫ] production, while more experience would result in more target-like [l] production. In like manner, I expected that a higher motivational intensity to learn Spanish would also be indicative of improved, target-like L2 /l/. Lastly, I expected the L2 /l/ results would be gradient in nature, with L1 English speakers producing the darkest /l/s, L1 Spanish speakers producing the lightest /l/s, and L2 Spanish speakers producing /l/s with intermediate velarization.
CHAPTER 4: Results

As expected, the students produced a wide range of F2 and F2-F1 values as a result of syllabic context, preceding segments, following segments, participant level of learning, task type, and motivational intensity. As shown in Table 3, the quantities of /l/ tokens vary from one level to another. The differing quantities is largely attributable to the disqualification of some /l/ tokens due to mispronunciations, the spontaneous nature of the OI conversations, and the tendency of some speakers to produce more /l/’s than others, particularly the more fluent advanced speakers who produce more words than beginners in a conversation.

Table 3. L2 /l/ Token Distribution by Level of Learning

<table>
<thead>
<tr>
<th>Level</th>
<th>n /l/</th>
<th>/l/ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span 102</td>
<td>226</td>
<td>12.8</td>
</tr>
<tr>
<td>Span 106</td>
<td>204</td>
<td>11.6</td>
</tr>
<tr>
<td>Span 206</td>
<td>241</td>
<td>13.7</td>
</tr>
<tr>
<td>Span 321 AH</td>
<td>248</td>
<td>14.1</td>
</tr>
<tr>
<td>Span 321 RM</td>
<td>315</td>
<td>17.9</td>
</tr>
<tr>
<td>Span Major AH</td>
<td>248</td>
<td>15.8</td>
</tr>
<tr>
<td>Span Major RM</td>
<td>278</td>
<td>14.1</td>
</tr>
<tr>
<td>L1 English</td>
<td>240</td>
<td>11.0</td>
</tr>
<tr>
<td>L1 Spanish</td>
<td>178</td>
<td>8.2</td>
</tr>
<tr>
<td>Totals</td>
<td>2178</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 3 is a visual representation of all /l/ tokens for both their Bark F2 and Bark F2-F1 values. Arranged by level of learning on the x-axis and Bark values on the y-axis, the results for the two dependent variables were filtered within levels of learning from smallest to largest Bark F2. As a result, the similar trends reflected in the dependent variables attest that they are both useful in measuring /l/, just like the literature reported. Both dependent variables follow a similar trend: As Bark F2 moves up, so does Bark F2-F1. In other words, Bark F2 and Bark F2-F1 together illustrate /l/ velarization as a gradient phenomenon, but with overlap between groups. All levels produced relatively darker /l/s and lighter /l/s, but the more advanced L2 speakers and the L1 Spanish speakers produced substantially higher, clearer /l/ than the beginner L2 speakers. For
this group of participants, there was an overall upward movement in Bark F2-F1 as /l/ tokens moved from one level of learning to another, with the exception of the two RM levels.

Figure 3 Bark F2 and Bark F2-F1 Data per Level of Learning

Furthermore, the speakers demonstrated a slightly more frequent use of onset rather than coda /l/, resulting in 1161 (53.3%) onset tokens and 1017 (46.7%) coda tokens. No doubt this is related at least in part to the high frequency of the syllable initial /l/ articles *la, las, los* and the pronoun *lo* juxtaposed with the lone syllable final /l/ article *el*, especially in spontaneous speech when the use of an article is common in hesitative speech. Phonotactically, because Spanish as a language tends to favor open syllables over closed syllables, syllable-onset /l/ naturally occurs more frequently than syllable-coda /l/ (Quilis, 1999). As for phonetic context, vowels alone accounted for 1006 (46.1%) preceding segments and 1163 (53.4%) following, which should not be surprising considering the vowel-dependent V and CV syllable patterns typical of the Spanish
lexicon. Despite the difference in task type, there were almost equal amounts of L2 Spanish /l/ productions collected from the reading selection and OIs (52.3% and 47.7%, respectively).

Motivationally, learners ranged from 23-35 on the Survey of Motivational Intensity. This response range indicates that the L2 participants were all relatively highly motivated, providing mostly “Agree” and “Strongly Agree” responses. Despite their wide range of levels of learning, they were rather homogenous in terms of motivational intensity, which homogeneity proved problematic and resulted in motivational intensity as not being a significant L2 /l/ factor.

According to the mixed models analysis, “subject” had a random effect and most of the independent variables were statistically significant to at least some extent. Interestingly, syllabic context and motivational intensity measures appear not to be statistically significant factors to F2 height, as will be shown. Nevertheless, the other independent variables resulted in statistical significance.

**Syllabic Context**

Estimated marginal means for syllabic context further show that onset-positioned /l/ (*predicted value*=10.937; *SE*=.538) was clearer (i.e. less velarized) than when positioned in the coda (*predicted value*=10.286; *SE*=.296). This result coincides neatly with the English onset-[l] and coda-[l] literature. Nevertheless, contrary to what was expected, the mixed models analysis conducted on the syllabic context data show that the onset versus coda position has neither a positive nor negative significant effect on F2 height nor on the F2-F1 gap. Univariate tests on syllabic context also show it to not be significant for either F2 or F2-F1. Statistical significance for all the results is indicated by asterisks by coefficient estimates and bolded *p*-values, but Table 4 shows only the *p*-value for the intercept to be significant. The lack of asterisks and bolded *p*-values for variables such as syllabic context indicates that they did not reach statistical
significance. In the case of syllabic context, this lack of statistical significance may be due to conflation due to collinearity with the preceding and following segments.

Table 4 Syllabic Context Fixed Effects Estimates (Compared Against Coda)

<table>
<thead>
<tr>
<th></th>
<th>Bark F₂</th>
<th></th>
<th>Bark F₂-F₁</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
<td>p-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept</td>
<td>7.196</td>
<td>2.334</td>
<td><strong>.002</strong></td>
<td>8.626</td>
</tr>
<tr>
<td>Onset</td>
<td>.637</td>
<td>.715</td>
<td>.373</td>
<td>1.390</td>
</tr>
<tr>
<td>Coda</td>
<td>.</td>
<td>.</td>
<td></td>
<td>.</td>
</tr>
</tbody>
</table>

*Note.* Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

Table 5 Syllabic Context Estimated Marginal Means

<table>
<thead>
<tr>
<th></th>
<th>Bark F₂</th>
<th></th>
<th>Bark F₂-F₁</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted</td>
<td>SE</td>
<td>Comparison</td>
<td>Predicted</td>
</tr>
<tr>
<td></td>
<td>value</td>
<td></td>
<td>p-value</td>
<td>value</td>
</tr>
<tr>
<td>Onset</td>
<td>10.937</td>
<td>.538</td>
<td>.363</td>
<td>7.080</td>
</tr>
<tr>
<td>Coda</td>
<td>10.286</td>
<td>.296</td>
<td></td>
<td>5.673</td>
</tr>
</tbody>
</table>

*Note.* Dependent Variables: Bark F₂; Bark F₂-F₁.  
*Note.* Pairwise comparison test of whether means are statistically different or not.

As shown in Table 4, an onset-positioned /l/ had a coefficient .637 greater than a coda-positioned /l/ for Bark F₂, but the *p*-value does not reach significance at the *p*<.05 level. The Bark F₂-F₁ coefficient for onset /l/ is 1.390 more than a coda /l/, but the *p*-value does not reach significance at the *p*<.05 level. Table 5 provides more specifics, including a predicted mean Bark F₂ value of 10.937 and mean Bark F₂-F₁ value of 7.080 for onset versus a predicted mean Bark F₂ value of 10.286 and mean Bark F₂-F₁ value of 5.673. Simply put, the reading task elicited higher Bark F₂ and Bark F₂-F₁, but the difference was not statistically significant.

**Preceding Segment**

Despite the counterintuitive insignificance of syllabic positioning, phonotactical evidence based on preceding and following segment data is promisingly significant. Univariate tests on the preceding segment show it to be significant at the *p*<.001 level for F₂ and F₂-F₁. Tables 6, 7 and 16 further demonstrate the relationships between the preceding segments (see Table 16 in Appendix F).
Table 6 Preceding Segment Fixed Effects Estimates (Compared Against Pause)

<table>
<thead>
<tr>
<th></th>
<th>Bark F2</th>
<th></th>
<th>Bark F2-F1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
<td>p-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept</td>
<td><strong>7.196</strong></td>
<td>2.334</td>
<td><strong>.002</strong></td>
<td>3.444</td>
</tr>
<tr>
<td>Back vowel (/ul, ol/)</td>
<td>-.735</td>
<td>.316</td>
<td><strong>.020</strong></td>
<td>-.289</td>
</tr>
<tr>
<td>Mid vowel (/al/)</td>
<td>-.327</td>
<td>.308</td>
<td>.289</td>
<td>-.582</td>
</tr>
<tr>
<td>Front vowel (/il, el/)</td>
<td>.238</td>
<td>.306</td>
<td>.437</td>
<td>.164</td>
</tr>
<tr>
<td>kl</td>
<td>-.172</td>
<td>.112</td>
<td>.125</td>
<td>***-.597</td>
</tr>
<tr>
<td>fl</td>
<td><strong>-.947</strong></td>
<td>.307</td>
<td><strong>.002</strong></td>
<td><strong>-1.141</strong></td>
</tr>
<tr>
<td>bl</td>
<td>-.066</td>
<td>.095</td>
<td>.489</td>
<td>-.209</td>
</tr>
<tr>
<td>pl</td>
<td>-.237</td>
<td>.182</td>
<td>.193</td>
<td>-.381</td>
</tr>
<tr>
<td>gl</td>
<td>-.004</td>
<td>.162</td>
<td>.979</td>
<td>-.271</td>
</tr>
<tr>
<td>nl</td>
<td>.054</td>
<td>.077</td>
<td>.482</td>
<td>-.043</td>
</tr>
<tr>
<td>rl</td>
<td>***-.439</td>
<td>.113</td>
<td><strong>.000</strong></td>
<td>***-.702</td>
</tr>
<tr>
<td>sl</td>
<td><strong>-.271</strong></td>
<td>.088</td>
<td><strong>.002</strong></td>
<td>***-.430</td>
</tr>
<tr>
<td>pause+/l/</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F2; Bark F2-F1. Bolded values indicate statistical significance.  
* p<.05 ** p<.01 *** p<.001

Table 7 Preceding Segment Estimated Marginal Means

<table>
<thead>
<tr>
<th></th>
<th>Bark F2</th>
<th></th>
<th>Bark F2-F1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted value</td>
<td>SE</td>
<td>Predicted value</td>
<td>SE</td>
</tr>
<tr>
<td>Back vowel (/ul, ol/)</td>
<td>10.139</td>
<td>.288</td>
<td>6.481</td>
<td>.380</td>
</tr>
<tr>
<td>Mid vowel (/al/)</td>
<td>10.549</td>
<td>.280</td>
<td>6.190</td>
<td>.368</td>
</tr>
<tr>
<td>Front vowel (/il, el/)</td>
<td>11.115</td>
<td>.281</td>
<td>6.397</td>
<td>.369</td>
</tr>
<tr>
<td>/kl/</td>
<td>10.696</td>
<td>.292</td>
<td>6.165</td>
<td>.385</td>
</tr>
<tr>
<td>/fl/</td>
<td>9.919</td>
<td>.408</td>
<td>5.618</td>
<td>.540</td>
</tr>
<tr>
<td>/bl/</td>
<td>10.805</td>
<td>.286</td>
<td>6.557</td>
<td>.376</td>
</tr>
<tr>
<td>/pl/</td>
<td>10.633</td>
<td>.324</td>
<td>6.383</td>
<td>.427</td>
</tr>
<tr>
<td>/ql/</td>
<td>10.867</td>
<td>.313</td>
<td>6.496</td>
<td>.413</td>
</tr>
<tr>
<td>/nl/</td>
<td>10.924</td>
<td>.280</td>
<td>6.721</td>
<td>.368</td>
</tr>
<tr>
<td>/rl/</td>
<td>10.431</td>
<td>.272</td>
<td>6.063</td>
<td>.358</td>
</tr>
<tr>
<td>/sl/</td>
<td>10.598</td>
<td>.282</td>
<td>6.334</td>
<td>.372</td>
</tr>
<tr>
<td>pause+/l/</td>
<td>10.874</td>
<td>.276</td>
<td>6.770</td>
<td>.363</td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F2; Bark F2-F1.  
* Includes a pairwise comparison test of whether means are statistically different or not. A complete listing of the preceding segment pairwise comparison test is found in Table 16, Appendix F.

Table 6 shows that when other preceding segments are measured in comparison to “pause+/l/,” the fixed effects for /fl/, back vowels, /rl/, and /sl/ are significantly different in relation to F2 with significance at the p<.05 level or less. Also, /fl/, /rl/, /kl/, and /sl/ behave in a
significantly different way than do pauses in relation to F2-F1. Moreover, they all affect the
coefficient negatively, meaning that the significant preceding segments lower F2 height and
decrease the distance between F2-F1, resulting in overall more velarized /l/ productions than
“pause+/l/”. Table 7 supports these findings, indicating /fl/ to result in the lowest predicted Bark
means of all the preceding segments measured, at 9.919 for Bark F2 and 5.618 for Bark F2-F1.

In contrast, “front vowel” and /nl/ are the only two preceding segments that result in an
estimated F2 higher than /l/ after a pause, and “front vowel” an F2-F1 coefficient larger than /l/
after a pause. Of all the measured preceding segments, “front vowel” resulted in the highest
predicted Bark F2 mean at 11.115 and “pause+/l/” resulted in the highest predicted Bark F2-F1
mean at 6.770, closely followed by /nl/ at 6.721. The positive effect of these segments results in
overall less velarized /l/ productions, although the effect is not statistically significant.

Although the fixed effects indicate that front vowels are not statistically significant from
other vowels and pauses, a closer investigation based on the preceding segments’ estimated
marginal means and their pairwise comparisons shows that the vowels behave significantly
different from one another (see Table 16 in Appendix F). In fact, the estimated marginal means
show that in comparison with a pause, when a front vowel (predicted value=11.115; SE=.281)
preceded /l/, it resulted in higher average Bark scores than any other preceding segment. The
front vowels resulted in statistically different Bark estimated marginal means than other
preceding vowels, both low (Bark F2: p=.000; Bark F2-F1: p=.000) and back (Bark F2: p=.000;
Bark F2-F1: p=.040).

Given that rhotics and laterals are both considered liquids, it is interesting to observe that
the estimated marginal means designate rhotics as statistically different from only pauses (Bark
F2: p=.007; Bark F2-F1: p=.000) and /n/ (Bark F2: p=.003; Bark F2-F1: p=.003) for both dependent
variables. The statistical difference may be most attributable to the variety of articulatory means used to realize the vibrant, ranging from thick English retroflexes to Spanish-like trills and taps. Interestingly, none of the other consonants differed statistically from one another in both Bark F₂ and F₂-F₁.

**Following Segment**

As with the preceding segments, fixed effects estimates and estimated marginal means for “following segment” proved useful in analyzing L2 /l/ gains. Univariate tests on estimated marginal means for the following segment category, like those on the preceding segment category, show the Bark F₂ and F₂-F₁ variable to be significant at the p<.001 level.

<table>
<thead>
<tr>
<th>Table 8 Following Segment Fixed Effects Estimates (Compared Against Pause)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coefficient</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Back vowel (/lu, lo/)</td>
</tr>
<tr>
<td>Mid vowel (/la/)</td>
</tr>
<tr>
<td>Front vowel (/li, lo/)</td>
</tr>
<tr>
<td>/lk/</td>
</tr>
<tr>
<td>/lf/</td>
</tr>
<tr>
<td>/lb/</td>
</tr>
<tr>
<td>/lp/</td>
</tr>
<tr>
<td>/lg/</td>
</tr>
<tr>
<td>/ld/</td>
</tr>
<tr>
<td>/lt/</td>
</tr>
<tr>
<td>/ln/</td>
</tr>
<tr>
<td>/lp/</td>
</tr>
<tr>
<td>/lg/</td>
</tr>
<tr>
<td>/ls/</td>
</tr>
<tr>
<td>/l+/pause</td>
</tr>
</tbody>
</table>

*Note. Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance. * p<.05 ** p<.01 *** p<.001*
Table 9 Following Segment Estimated Marginal Means

<table>
<thead>
<tr>
<th>Segment</th>
<th>Predicted value</th>
<th>SE</th>
<th>Predicted value</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back vowel (/lu, lo/)</td>
<td>9.897</td>
<td>.360</td>
<td>5.547</td>
<td>.475</td>
</tr>
<tr>
<td>Mid vowel (/la/)</td>
<td>10.204</td>
<td>.360</td>
<td>5.404</td>
<td>.476</td>
</tr>
<tr>
<td>Front vowel (/li, le/)</td>
<td>10.975</td>
<td>.360</td>
<td>6.776</td>
<td>.476</td>
</tr>
<tr>
<td>/lk/</td>
<td>10.626</td>
<td>.364</td>
<td>6.527</td>
<td>.480</td>
</tr>
<tr>
<td>/lf/</td>
<td>10.260</td>
<td>.493</td>
<td>5.956</td>
<td>.653</td>
</tr>
<tr>
<td>/lb/</td>
<td>10.682</td>
<td>.369</td>
<td>6.435</td>
<td>.487</td>
</tr>
<tr>
<td>/lp/</td>
<td>10.435</td>
<td>.402</td>
<td>6.070</td>
<td>.531</td>
</tr>
<tr>
<td>/lg/</td>
<td>10.623</td>
<td>.376</td>
<td>6.424</td>
<td>.497</td>
</tr>
<tr>
<td>/ld/</td>
<td>10.894</td>
<td>.368</td>
<td>6.910</td>
<td>.486</td>
</tr>
<tr>
<td>/lt/</td>
<td>10.958</td>
<td>.370</td>
<td>6.951</td>
<td>.488</td>
</tr>
<tr>
<td>/ln/</td>
<td>11.134</td>
<td>.371</td>
<td>7.512</td>
<td>.490</td>
</tr>
<tr>
<td>/lm/</td>
<td>10.633</td>
<td>.368</td>
<td>6.462</td>
<td>.487</td>
</tr>
<tr>
<td>/lr/</td>
<td>10.158</td>
<td>.373</td>
<td>5.840</td>
<td>.493</td>
</tr>
<tr>
<td>/ls/</td>
<td>11.032</td>
<td>.358</td>
<td>6.511</td>
<td>.484</td>
</tr>
<tr>
<td>/l/+pause</td>
<td>10.717</td>
<td>.367</td>
<td>6.680</td>
<td>.473</td>
</tr>
</tbody>
</table>

Note: Dependent Variables: Bark F2; Bark F2-F1.

*a* Includes a pairwise comparison test of whether means are statistically different or not. A complete listing of the following segment pairwise comparison test is found in Table 17, Appendix F.

The sheer fixed effects estimates in Table 8 show that /r/ ($p=.000$), /n/ ($p=.001$), /s/ ($p=.008$), and /t/ ($p=.041$) resulted in significantly different Bark F2 coefficients than a pause following /l/, and /r/ ($p=.000$), /n/ ($p=.000$), /t/ ($p=.005$), and /d/ ($p=.020$) resulted in significantly different Bark F2-F1 coefficients than a pause following /l/. Yet again though, as with the preceding segment category, the fixed effects indicate that vowels were not statistically significant. However, this lack of significance for the vowel categories may be due to collinearity either between vowel types or with the following pauses with which they were compared, and the estimated marginal means using both dependent variables separately show the vowels to differ significantly from one another.

The results show that /n/ (predicted value=11.134; $SE=.371$) and /s/ (predicted value=11.032; $SE=.358$) yielded higher estimated marginal means for F2 than the front vowel
Moreover, Table 9 provides evidence that front vowels were outranked in the largest F2-F1 by /t/ (predicted value=6.951; SE=.488) and /d/ (predicted value=6.910; SE=.486).

Notwithstanding, the estimated marginal means pairwise comparisons between all the following segments show that the front vowel category behaved in a significantly different manner than the other two vowel categories for both F2 and F2-F1 at the p<.001 level (see Table 17 in Appendix F). The only other significant differences in both dependent variables resulted from pairwise comparisons with /r/. Actually, /r/ turned out to be significantly different than /d/, /t/, /n/, /s/, and “pause” and /r/ resulted in lower (more velarized) /l/ productions than “/l/+pause”.

**Level of Learning**

Tables 10, 11 and 12 are results based on participant level of learning. Estimated marginal means, standard errors, and significance levels are provided for each coefficient.

Univariate tests on level of learning show it to be significant at the p<.001 level for F2 and F2-F1.

| Table 10 Level of Learning Fixed Effects Estimates (Compared Against Span 102 Level) |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                                              | Bark F2                                        | Bark F2-F1                                    |
| Coefficient                                   | SE                                            | p-value                                       | Coefficient                                   | SE                                            | p-value                                       |
| Intercept                                    | **7.196**                                     | .002                                         | 3.444                                        | 3.094                                         | .266                                         |
| Span 102                                      | .                                             | .                                            | .                                            | .                                             | .                                            |
| Span 106                                      | **.286**                                      | .011                                         | ***.519                                      | .116                                         | **.000**                                     |
| Span 206                                      | **.235**                                      | .005                                         | **.350**                                     | .112                                         | **.002**                                     |
| Span 321 AH                                   | .117                                         | .164                                         | ***.427                                      | .111                                         | **.000**                                     |
| Span 321 RM                                   | ***-.449                                      | .018                                         | .018                                         | .107                                         | .865                                         |
| Span Major AH                                 | **1.466**                                     | .000                                         | **2.112**                                    | .111                                         | **.000**                                     |
| Span Major RM                                 | -.152                                        | .063                                         | ***.680                                      | .108                                         | **.000**                                     |
| L1 Eng                                        | ***-1.234                                     | .000                                         | ***-1.428                                    | .118                                         | **.000**                                     |
| L1 Span                                       | ***.962                                       | .000                                         | ***1.707                                     | .124                                         | **.000**                                     |

*Note:* Dependent Variables: Bark F2; Bark F2-F1. Bolded values indicate statistical significance.

* p<.05 ** p<.01 *** p<.001
Table 11 Level of Learning Estimated Marginal Means

<table>
<thead>
<tr>
<th>Span 102</th>
<th>Bark F²</th>
<th>SE</th>
<th>Predicted Value</th>
<th>SE</th>
<th>Bark F²-F₁</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.474</td>
<td>.252</td>
<td>5.892</td>
<td>.332</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.760</td>
<td>.253</td>
<td>6.411</td>
<td>.333</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.708</td>
<td>.252</td>
<td>6.241</td>
<td>.331</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.590</td>
<td>.252</td>
<td>6.319</td>
<td>.331</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.025</td>
<td>.250</td>
<td>5.874</td>
<td>.329</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.939</td>
<td>.252</td>
<td>8.004</td>
<td>.331</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.322</td>
<td>.251</td>
<td>6.572</td>
<td>.331</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.249</td>
<td>.253</td>
<td>4.475</td>
<td>.333</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.436</td>
<td>.255</td>
<td>7.599</td>
<td>.336</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F²; Bark F²-F₁.

Table 12 Level of Learning Pairwise Comparisons

<table>
<thead>
<tr>
<th>Span 102</th>
<th>Bark F²</th>
<th>.040</th>
<th>Bark F²-F₁</th>
<th>.000</th>
<th>Bark F²-F₁</th>
<th>.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.000</td>
<td>.067</td>
<td>.004</td>
<td>1.000</td>
<td>.000</td>
<td>1.000</td>
<td>.000</td>
</tr>
<tr>
<td>1.000</td>
<td>.000</td>
<td>.000</td>
<td>1.000</td>
<td>.000</td>
<td>1.000</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F²; Bark F²-F₁. Bolded values indicate statistical significance.

Despite the extensive and varied linguistic /l/ tokens, the results shown in Table 12 are likely best suited for this study, but not for generalization to other studies. Using the few Span
102 level participants as the “baseline” group with which to compare the handful of other L2 levels, the fixed effects estimates show both RM groups as not statistically different at the $p<.05$ level for Bark F2 and the Span 321 RM level to be the only group not statistically different at the $p<.05$ level for Bark F2-F1. Moreover, the RM and NE levels are the only levels that resulted in lower, more velarized F2 predicted values than the Span 102 level.

The estimated marginal means and their pairwise comparisons provide further details regarding estimated values of Bark F2 and Bark F2-F1 for all levels of instruction. According to the predicted Bark F2 values, the order from most velarized to least velarized was: L1 English, Span 321 RM, Span Major RM, Span 102, Span 321 AH, Span 206, Span 106, L1 Spanish, and Span Major AH. According to the predicted Bark F2-F1 values, the order from most velarized to least velarized was: L1 English, Span 321 RM, Span 102, Span 206, Span 321 AH, Span 106, Span Major RM, L1 Spanish, and Span Major AH. Pairwise comparisons show that almost all the levels of learning are statistically different from one another at the $p<.05$ level or less. The least statistically differing levels are Span 206 and Span 321 AH.

**Task**

SLA literature presented evidence that task type in relation to its level of formality affects L2 accuracy, and the results of this study reaffirm it. In this case, the more formal task, one in which L1 and L2 participants alike could focus more on form than meaning while they read, elicited statistically higher, less velarized (and thus more accurate) F2 values than the more spontaneous, less formal OI task. Univariate tests on task estimated marginal means show it to be significant at the $p<.001$ level for F2 and F2-F1.
Table 13 Task Fixed Effects Estimates (Compared Against OI)

<table>
<thead>
<tr>
<th></th>
<th>Bark F₂</th>
<th></th>
<th>Bark F₂-F₁</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
<td>p-value</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept</td>
<td>7.196</td>
<td>2.334</td>
<td>.002</td>
<td>3.444</td>
</tr>
<tr>
<td>Reading</td>
<td>***.173</td>
<td>.042</td>
<td>.000</td>
<td>***.296</td>
</tr>
<tr>
<td>OI</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

* p<.05  ** p<.01  *** p<.001

Table 14 Task Bark Estimated Marginal Means

<table>
<thead>
<tr>
<th></th>
<th>Bark F₂</th>
<th></th>
<th>Bark F₂-F₁</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted value</td>
<td>SE</td>
<td>Comparison p-value</td>
<td>Predicted value</td>
</tr>
<tr>
<td>Reading</td>
<td>10.698</td>
<td>.247</td>
<td>.000</td>
<td>6.524</td>
</tr>
<tr>
<td>OI</td>
<td>10.525</td>
<td>.246</td>
<td>.</td>
<td>6.228</td>
</tr>
</tbody>
</table>

Note. Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

a Pairwise comparison test of whether means are statistically different or not.

Table 13 shows that, based on fixed effects estimates, the reading task yielded a higher coefficient for Bark scores than the OI task for F₂ (predicted value=.173; SE=.042) and for F₂-F₁ (predicted value=.296; SE=.055). Additionally, the difference between task types is significant at the p<.001 level for both Bark F₂ and Bark F₂-F₁. These higher, less velarized Bark scores for reading indicate that /l/ productions are more /i/-like in the reading task than in the OI. A pairwise comparison also shows the difference between the two tasks to be highly significant (p=.000) for both dependent variables. The reading task results in higher F₂ and greater F₂-F₁ Bark values and therefore clearer, more native-like /l/ tokens in L2 speech (see Table 14).

Motivational Intensity

Table 15 presents the fixed effects estimates for the motivational intensity results. No estimated marginal means were calculated because this measure is scalar rather than categorical.
### Table 15 Motivational Intensity Fixed Effects Estimates

<table>
<thead>
<tr>
<th></th>
<th>Bark F₂</th>
<th></th>
<th></th>
<th>Bark F₂-F₁</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
<td>p-value</td>
<td>Coefficient</td>
<td>SE</td>
<td>p-value</td>
</tr>
<tr>
<td>Intercept</td>
<td>7.196</td>
<td>2.334</td>
<td>.002</td>
<td>8.626</td>
<td>6.156</td>
<td>.161</td>
</tr>
<tr>
<td>Motivational Intensity</td>
<td>.003</td>
<td>.008</td>
<td>.671</td>
<td>-.016</td>
<td>.011</td>
<td>.144</td>
</tr>
</tbody>
</table>

*Note.* Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

* p<.05 ** p<.01 *** p<.001

Unexpectedly, the fixed effects tests show that the participant motivational intensity measure based on the Survey of Motivational Intensity was not statistically significant at the p<.05 level in relation to L2 /l/ acquisition for Bark F₂ (p=.671) and Bark F₂-F₁ (p=.144). This means that motivational intensity levels as determined by Gardner’s (1985) scale were not indicative of language gains in relation to /l/ velarization. Therefore, those with lower motivational intensities were neither more likely nor less likely to have more pronunciation gains and reduced /l/ velarization than those who were more highly motivated.
CHAPTER 5: Discussion

What do we learn from all the numbers and statistics presented in the previous tables? The general information of the means and the nitty-gritty of the post hoc pairwise comparisons ultimately provide the overall view and the details to help enlighten our understanding regarding /l/ acquisition. From the data, it has been determined that syllabic context was not a significant factor for dark versus light /l/; the front vowels and some consonants were the most significant segments phonotactically when they preceded or followed /l/; there is significant difference between levels of learning; the reading task was more conducive than the OI to clearer realizations of /l/; and the motivational intensity proved not to be statistically significant. The following sections are dedicated to discussing these results in greater depth.

Syllabic Context

Why, of all the factors, syllabic context is not statistically significant is unclear and puzzling, particularly because the literature so frequently cites [l]-[l] as so heavily dependent on coda or onset position in L1 English and as best pronounced in L1 Spanish as /l/ in an onset, rather than subject to reductive phenomena like vocalization or elision in a coda. One potential explanation is that syllabic position, onset versus coda, is most important in English. It is possible that, contrary to previous research, syllabic context was not significant in this study because the learners are inconsistent with their syllabification due to influence from word boundaries and orthography, mixing knowledge of their L1 with that of their L2, while L1 Spanish speakers are not hindered by word boundaries and orthography, simply resyllabifying a coda /l/ to the following syllable onset. That is, onset /l/ is frequently clearer and coda /l/ is frequently darker in English, but such drastic gradience and low F₂ values characteristic of English do not apply to Spanish. Furthermore, ambisyllabification is a common phonetic
phenomenon intervocally in English but not Spanish. Instead, in Spanish, word and utterance-final /l/ is far less frequent and is as a rule resyllabified when followed by a vowel. The closed syllable preference of English in all likelihood competes with the open syllable preference in Spanish, creating conflicting patterns in /l/ syllable placement in an L2 learner’s interlanguage. In short, because learners have syllabification patterns unique to their developing interlanguage that are inconsistent with either L1 English or L1 Spanish, perhaps the syllabic context is less relevant and conclusive in L2 Spanish.

One last possible explanation is that syllabic context is so intimately connected to preceding and following segments that the statistical significance of syllabic context is getting mixed in with the detail of the results of the preceding and following segments. Onset and coda are so closely related to preceding and following segments that there may have been a conflation of the significance of these three independent variables. In fact, when the mixed models analysis is run without the preceding or following segments included, significance reaches $p=.000$, which means that were this study not to include all the preceding and following segment data, the syllabic context variable would have resulted in strong statistical significance. When the preceding and following segments are included as they are here, however, they function as subcategories of syllabic context rather than as completely separate variables. Preceding segments turn out to be a subset of syllable onset and the following segments turn out to be a subset of syllable coda. This interrelatedness of the segments with syllable positioning then results in a sort of redundancy; the individual preceding segments comprise syllable onsets and the individual following segments comprise syllable codas. Therefore, the two phonological segment variables together account for what the syllabic context variable would have found, but
in further depth and detail, investigating /l/ variation in dozens of contexts rather than a binary onset-coda position.

**Preceding and Following Segments**

The large number of /l/ tokens is a strength of this study and allowed me to investigate on a segmental level the influence of a variety of phonetic and phonological categories on L2 acquisition. Delving deeper into the linguistic variables and somewhat disguised significance of L2 syllable onsets and codas, the preceding and following segments that comprise these onsets and codas, were significant.

The preceding segments categorized as /fl/, back vowels, /rl/, and /sl/ were significantly different than “pause+/l/” in relation to F2, and /fl/, /rl/, /kl/, and /sl/ were significantly different than “pause+/l/” in relation to F2-F1. As was expected from the literature, the preceding pause, typical of a syllable onset with a clearer /l/, production resulted in less velarization than most of the other preceding segments. The finding that /fl/ and /sl/ result in more velarization is intriguing because the literature focuses mainly on pauses and vowels as affecting /l/ velarization, without mention of /fl/ and /sl/. The negative effect of these two segment combinations on F2 and F2-F1 of /l/ may be due to the fact that /l/ and /s/ are both fricatives. As for back vowels and /rl/, I will explain those in detail later. Lastly, /kl/ resulted in lower Bark F2-F1 most likely because /k/ is a velar consonant and could draw the /l/ production toward the velum. Furthermore, /kl/ often resulted in some /l/ devoicing, which would easily affect the accuracy of formant measurement.

As was the case with the preceding segments, the following segments categorized as /r/ and /s/ were again statistically different than a pause in contact with /l/ for both dependent variables. Additional following segments that reached statistical significance for the two
dependent variables were /t/ and /n/. Standard Spanish phonology recognizes that /l/ and /d/ mutually assimilate to one another, and /t/ is much like /d/ but without voicing. Perhaps /l/ and /t/ also mutually assimilate to some extent, or at least enough to result in less velarization than /l/ in combination with other segments. The relationship between /l/ and /n/ is described next.

Articulatory and acoustic similarities between /l/ and /r/ and /n/ are particularly useful in this study’s findings. Interestingly, few of the following consonants other than /r/ and /n/ differed statistically from one another. Moreover, /r/, like /l/, is a liquid and as such is characterized by vocalic and consonantal features that would distinguish it from the pure consonants and vowels. Anecdotally, /rl/ and /lr/ sequences were not altogether common in the study’s data and /lr/ most frequently occurred in alrededor, or at least they should have. Rather frequently, however, the /lr/ tokens for alrededor were not marked because the L2 speakers vocalized /l/ or deleted it altogether for ease of pronunciation as they transitioned into the /r/. This sort of /lr/ behavior occurred occasionally in almost every level of learning. In a different way than /r/, /n/ is also acoustically similar to /l/ in that it is an alveolar sonorant and it is difficult to tease the two apart on a spectrogram. Difficulty arises in distinguishing them because their first and second formants are nearly the same and the main visible difference lies in a slight change in acoustic wave periodicity and antiformants (characteristic of nasals) for the /n/ and not the /l/. Thus, the similarity to /l/ inherent in /r/ and /n/ results in statistical significance when combined in speech with /l/ and contrasted with other segments. The varying articulation of /r/, ranging in tongue shape from a velar bunched retroflex to an alveolar flap or rigidly straight trill, most likely contributed to the overall statistically negative influence of /r/ in both preceding and following position. In comparison, the alveolar articulation of the /n/ resulted in positive coefficients.
Moving on to the preceding and following vowel categories’ results, the literature described highly velarized /l/ to have lower F2 frequencies and smaller F2-F1 gaps, causing it to be /u/-like. On the other end of the velarization continuum, highly nonvelarized /l/ has higher F2 frequencies and smaller F2-F1 gaps. More specifically, the Hz values given in L1 and L2 /l/ literature noted that the typical light [l] in English is generally lower than in Spanish. The close relationship between laterals and high vowels (i.e. [l], /i/ and [l], /u/) is highly relevant in this study, despite the apparent lack of significance in terms of the effect of vowels on L2 /l/ gains, which lack may be attributed to collinearity. The estimated marginal means with lower /l/ realizations when preceded by back vowels versus front vowels reaffirmed this, with back vowels resulting in a statistically negative Bark F2 coefficient and front vowels resulting in higher Bark F2 coefficients than any other preceding segment.

Figures 4, 5, and 6 illustrate the effect of preceding high front and high back vowels in contact with /l/, a contrast observed here in L1 and L2 OI data. In general, the L1 Spanish speakers tended to produce [l] tokens with F2 heights ranging between 1800-2500 Hz (12.200-14.397 Bark value). Sometimes, the Bark F2 was even as high as 3000 Hz (15.641 Bark value) when the preceding and/or following segment was /i/. For example, as seen in Figure 4, the L1 Spanish siluet was produced with an F2 at approximately 3001 Hz (15.641 Bark value).
The extensiveness of the front vowel’s effect in raising the F2 in both L1 and L2 Spanish was not appreciated until after tokens were collected for a pilot, smaller version of this study (Bean, 2012). In fact, /i/ was found to be so conducive to light [l] that a Span 102 learner who produced some of the lowest F2 values still produced /il/ sequences as high as 1895 Hz (12.539 Bark value). Figure 5 presents a sample /il/ token present in /familia/.

Figure 4 Waveform and Spectrogram of Nonvelarized /il/ in L1 Spanish

Figure 5 Waveform and Spectrogram of Nonvelarized /il/ in L2 Spanish
Furthermore, the high $F_2$ and the large $F_2-F_1$ gaps, in L1 and L2 speech alike, shown in Figures 4 and 5 are obvious from a brief glance. Meanwhile, in stark contrast to the high $F_2$ and gap between $F_2$ and $F_1$ other /il/ production also found in the L2 speech, Figure 6 depicts an extremely dark, velarized /l/ exhibited by a low $F_2$ production possible of /ul/ in sul (a mispronunciation of sur, a production error not included in the statistical analysis).

![Figure 6 Waveform and Spectrogram of Velarized /ul/ in L2 Spanish](image)

It is true that the pictorial representations of /l/ in Figures 4, 5, and 6 are of tokens that I did not include in my statistical analysis, the former two because they are intervocalic and the latter because it is the result of a pronunciation error. Nevertheless, the figures serve to highlight the vast extremes present in /l/ productions and the statistics available regarding factors such as level of learning confirm the reality of /l/ velarization gradience. In fact, all the preceding and following segment data together show that /l/ velarization gradience varies depending on the phonotactic environment in which /l/ is produced. Lastly, /l/ is always going to be affected by at least one vowel in a CIV or VlC context or at least two in a VlV context because syllabic and ambisyllabic /l/ do not exist in L1 Spanish, so both vowels and consonants immediately surrounding /l/ are all constantly affecting /l/ production.
Level of Learning

Unlike the extensive data available for linguistic factors, the level of learning data is much smaller in quantity, which prevents generalizability, despite the statistically significant differences between levels of learning. As predicted by the OPM (Major, 2001), instruction advancement and gained experience led to less L1 phonological influence and overall better, nonvelarized /l/ production for the participants observed as the participants increased in L2 abilities, at least in the case of the non-RM L2 groups. When considered as a whole, even the earliest beginners, the Span 102 students, performed with less velarization than the L1 English benchmark. As university-based learning advanced, /l/ gains did as well for these students in particular.

The predicted values of Bark F2 for all the instruction levels together ranged from 10.025 to 11.939, and those of Bark F2-F1 from 5.874 to 8.004 (see Table 11). These Bark values represent a wide range of results, but all are less velarized than in the English benchmark and some even more so than the Spanish benchmark. The significant differences between learner levels show that initial progress is indeed achieved in L2 [l] production because of how drastically different the L1 English group is from the Span 102 level, and even more different from the other levels as the participants advanced in /l/ acquisition. Of the L2 levels, the Span 106, Span 206, Span AH, Span Major AH, and Span Major RM were those that resulted in significantly higher Bark F2 and/or Bark F2-F1 than the Span 102 baseline learners. Unexpectedly, the RM levels did not outperform their peers, despite their supposed advantage of higher proficiency and time immersed in the L2 language and culture. On the contrary, the participants in both the Span 321 RM and Span Major RM levels produced lower, more velarized /l/ F2 productions than all their L2 peers.
It is possible that the RM levels focused on other aspects of communication or pronunciation than /l/ production as they progressed in their languages skills, which resulted in more L1 phonological transfer and more velarized /l/ utterances, as the PAM predicts (Best, 1995). If such were to indeed be the case, the statistics would imply that the RMs somehow missed a step in their phonological progress, but the study’s small population, combined with the RM levels’ counterintuitive results prevent me from drawing firm conclusions based on interlanguage and SLA phonological acquisition theories.

Nevertheless, anecdotal evidence leads me to believe that one of the participants in particular was especially responsible for the unexpectedly low /l/ realizations and subsequent negatively significant correlation for the Span 321 RM level. I believe this is due to measurement error present in the Span 321 RM level resulting from a small sample size per level of learning. Of the three participants, one in particular seemed to sacrifice accuracy in exchange for speed. In his haste to finish the reading task or communicate in his OI, he ended up with atypical /l/ productions. To the natural ear, he seemed to pronounce /l/, but then on the spectrograms the /l/ appeared to be some cross between /l/, a vocalization, an obstruent, or a deletion when followed by an obstruent.

The potential effect of one participant’s poor pronunciation, however, may not entirely explain why the Span Major RMs as well as the Span 321 RMs performed unexpectedly worse than their AH counterparts. Due to their extended experience abroad, I expected all the RMs to outperform the other L2 groups, and the Span Major RMs particularly so because they had immersion experience in addition to some explicit phonetics instruction. As with the Span 321 RMs, measurement error may be the reason for the relatively poor results from the Span Major RMs. While the Span 321 RM group appears to have had a significantly worse speaker to skew
the results, perhaps the Span Major RMs had been away from the immersion environments long enough that they had lapsed somewhat into using L1 English phonetic patterns in their L2. Moreover, the phonetics instruction is one semester-long course that covers a wide range of Spanish phonetics topics. Although it includes some detail on acoustics and articulation, it is possible that not much time was dedicated to overt Spanish /l/ production and implementation.

Another explanation for the overall negative results for both RM levels versus the positive results of their AH counterparts is self-confidence differences. Because the RMs lived for two years utilizing Spanish in an L2 environment, they are comfortable speaking the L2 and tend to be highly self-assured, which contrasts greatly with the timidity to speak frequently demonstrated by beginning, intermediate, and sometimes advanced AH participants. Consequently, an RM will be less concerned with pronunciation and more with quick, efficient communication while one who learned in a university setting will pay more attention to pronunciation with slower, more calculated speech. The haste of the RM could easily result in sloppy pronunciation, as was seen in one Span 321 RM participant’s speech, while the slower, more cautious speech of the university-only learners could produce more careful and L2-like /l/. Such a difference in confidence level is only visible when RMs are compared with those university-only learners at a similar level of learning, as is the case in the 321 RM vs. 321 AH and Span Major RM vs. Span Major AH groups.

One last fascinating finding of the present study is that the Span Major AH participants yielded significantly higher /l/ productions than even the L1 Spanish benchmark. Once more, this could be attributed to measurement error. The participant population was small and, unlike the Span 321 AH participants, this group lacked a male, which might possibly have affected the results. Future research would benefit from a replication of this study, except with more
participants per level of learning and with perhaps an analysis of the males’ versus the females’ results.

**Task**

Regardless of L2 acquisition experience and progress, odds are that the task type and associated level of formality affect elicited speech samples. Just like the beginners’ increased focus on meaning resulted in overall darker /l/ productions, the meaning-inherent focus of the OIs did likewise. The reading task, however, allowed students to focus less on conjugations and syntactic order, freeing up their thinking processes to focus more on form in general, especially because they knew their speech patterns would be later analyzed, whether they thought to alter their /l/ usage or not.

Furthermore, the student motives probably differed between the two tasks: The OI task for this study doubled as a final graded oral for the Span 102, Span 106, and Span 206 participants, whereas the reading task was extracurricular and intended solely for this study. This motivational intensity difference likely caused the already conversationally challenged beginner and intermediate participants to focus more on communicational fluidity and grammatical accuracy in the OI and more on pronunciation in the reading task.

Motives aside, the data prove that L2 participants produced higher F2 and F2-F1 while they read than while they conversed. Therefore, this finding can be implemented in L2 pedagogy because if students are taught proper /l/ pronunciation and practice by reading aloud, they can repeatedly hear and produce a clearer /l/, perhaps resulting in a better L2 /l/ accent.

**Motivational Intensity**

Motivational intensity was not found to be statistically significant to this model on L2 /l/ progression. Though unexpected, it is possible that the motivational intensity measure was not
significant because of a ceiling effect: All the L2 participants rated themselves as motivated or
highly motivated. Consequently, even the L2 beginners with the worst pronunciation scored as
high in motivational intensity as some of the advanced speakers with the best pronunciation.
Indeed, some of the most advanced L2 speakers had lower motivational intensities than their
beginner counterparts, probably because they had become contented with their level of
proficiency. Moreover, many of the L2 beginners and intermediate participants were enrolled
during a summer term and therefore needed to be more motivated because a university summer
term requires the same amount of work in half the time. Besides, they are all students who have
willfully chosen to enroll in the course. Overall, the Survey of Motivational Intensity is not a
good indicator of L2 /l/ gains for this population in particular.
CHAPTER 6: Conclusion

At the beginning of this thesis, two research questions were presented: Is there a significant relationship between syllabic and/or phonetic contexts and L1 English speakers’ L2 Spanish acquisition of L1 Spanish /l/; and is there a significant relationship between L2 level of learning, task type, and/or motivational intensity and L1 English speakers’ L2 Spanish acquisition of L1 Spanish /l/? The results firmly support higher, less L1 English-like F2 and F2-F1 productions in certain preceding segments, certain following segments, and the reading task. To some extent, level of learning advancement was somewhat indicative of L2 /l/ native-like gains also. Consequently, it is safe to answer, “Yes,” to nearly all the factors in question, with the exception of syllabic context and motivational intensity.

Standard Spanish features /l/ velarization gradience, but with a much higher Hertz range than in English, so L2 learners of Spanish need to learn to lighten their /l/ productions. All the data collected from the nearly 1800 L2 tokens and 400 L1 tokens utilized in this study help illuminate the process of L2 /l/ acquisition and its connection with previously established L1 English and Spanish literature, SLA acquisition theories, and SLA literature.

This study includes a detailed analysis of the effects of preceding and following phonetic segments and the results are useful for L2 instruction and learning. The most useful vowels to teach L2 learners to produce clearer, nonvelarized /l/ pronunciation are the front vowels, whether before or after the /l/ segment, such as in abril, libro, or familia, and the most useful consonants are those that are articulatorily similar to /l/, such as /r/ and /n/. These consonants are in contact with target-like L2 /l/ in common contexts such as verbal infinitives with object pronouns (e.g. verlos, decirlos, etc.) or prepositions combined with articles (e.g. con los, en las, etc.). To do so, the statistics in the current study show that experience (based on level of learning) is important.
Notwithstanding the improved /l/ in L1 English participants’ L2 Spanish in particular linguistic contexts, my study here shows that participant level of learning is also important to consider. L2 /l/ gains were not completely linear and learners did not necessarily make progress at a constant rate in adjusting their interlanguage phonology to consistently producing more target-like /l/s. As a result, the beginner levels produced relatively darker and more English-like [l]s than the more advanced L2 participants, but they also produced clearer, less velarized /l/s than their monolingual English peers. At the other extreme, the Spanish Major AH participants of this study outperformed all other learner groups in the sense that they produced clearer, less velarized /l/s than all the other L2 levels.

While it is true that the small participant population per level of learning substantially limits the generalizability of this study’s results, the level of learning results still follow phonological acquisition patterns predicted by theories such as the OPM for the non-RM groups (Major, 2001). On the whole, the participants’ tendency to continue to velarize to some extent while also simultaneously making a gradual shift to clearer /l/ production and acquisition as the interlanguage developed is an example of the PAM and the OPM: At first, the similarities between these students’ English and Spanish /l/ phonemes and allophones caused them to transfer their L1 knowledge into the L2 because the L1 phonology still exists, but their interlanguage phonology then shifted and adjusted as they gained more L2 input (Best, 1995; Major, 2001).

Task type, especially reading, is also a significant factor for foreign language instructors to contemplate for effective L2 instruction. To improve /l/ pronunciation, instructors can apply this study’s findings by encouraging their students to read aloud in the L2. As the students do so, they will focus more on their speech and can be more attentive to L2 pronunciation, including /l/.
In the process, they will practice more target-like Spanish /l/ and can decrease the salience of their L1 English transference to their developing L2 Spanish.

Keeping the results of this study in mind, it will be easier for foreign language instructors to know how to foster clearer, more target-like /l/ production from their pupils. Not only will the instructors be more aware of the L1 phonology but also of the contexts and segments that best foment higher F2 and greater F2-F1 values. If the students are in turn made aware of the common pitfalls of L1 English transfer into their L2 Spanish, they can more consciously work toward decreasing their foreign accent and, more importantly, improve their L2 intelligibility.

**Further Research**

To present a better, more accurate view of L2 Spanish /l/ acquisition, the number of participants per level of learning could be increased, and perhaps even extended beyond the university level to include high school or even immersion program Spanish based on /l/ data. In doing so, results would be more generalizable and applicable to the greater L2 Spanish population. Additionally, Simonet (2010) emphasized in his study the importance of evaluating gender differences, and to do so with this study, more male data is needed, particularly in the Span Major AH level.

One last suggestion for further research is that this same study be repeated but with the inclusion of cultural sensitivity measures. Alvord & Christiansen (2012) and Martinsen & Alvord (2012), as mentioned in the review of literature, found that cultural sensitivity based on Cushner’s (1986) ICCS, plays an interesting role in L2 acquisition. Shively & Cohen (2008) and Tanner (2012 a, 2012b) also tested for a correlation between L2 gains and cultural sensitivity, but with the Intercultural Development Inventory (IDI), whose validity has been extensively tested (Bennett, 1993; Hammer, Bennett, & Wiseman, 2003; Hammer, 2011; M. R. Paige,
Jacobs-Cassuto, Yershova, & DeJaeghere, 2003). All L2 participants of the present study completed the IDI, in fact. However, copyright issues currently prevent me from implementing the IDI results, but the results were promising and may be published at a later date.
REFERENCES


Tanner, J. D. (2012b, June). *Factors affecting the acquisition of pronunciation: Culture, motivation, and level of instruction* (Master’s Thesis). Brigham Young University, Provo, UT.


APPENDIX A

Name: _____________________________

ID#: _____________________________

Background questionnaire

**Demographic Information:**

Age _____  Sex _____

Where were you born?

Where did you attend school?

What level of formal education have you completed?

What level of formal education did your mother complete?

What is your mother’s occupation?

What level of formal education did your father complete?

What is your father’s occupation?

**Linguistic Background:**

What Spanish classes are you currently enrolled in?

How many years of Spanish instruction did you receive in high school?

How many semesters of University Spanish instruction have you taken?

Have you ever taken a Spanish phonetics class? If so, when?
Do you live, or have you ever lived, in the Foreign Language House?

Have you lived in or visited a Spanish-speaking country (e.g. study abroad, mission, vacation)?

If so, please list the countries that you have visited here:

How long did you visit each place?

If you were a missionary, when did you return (month, year)?

Did you serve a Spanish-speaking mission in the United States?

Do you speak or have you studied any languages other than English or Spanish?

If so, please list other languages that you speak or have studied, and the number of years that you have spoken or studied them.
APPENDIX B

Survey of Motivational Intensity

This section provides information about your motivation to learn Spanish. Please be as sincere and accurate as possible. It is vital that you answer ALL of the questions in order for the test to be a useful measurement of motivation. Thank you for your time and attention!

1. I make a point of trying to understand all the Spanish I see and hear.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

2. I learn Spanish by working on it almost every day.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

3. When I have a problem understanding something we are learning in a Spanish class, I always try to find the answer. (Think back to your most recent class)
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

4. I really work hard to learn Spanish.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

5. When I am learning Spanish, I ignore distractions and stick to the job at hand.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

6. I intend to improve my Spanish as much as I can.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

7. Being a person who knows Spanish is important to me.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

8. I am willing to dedicate time and effort to learning Spanish even if it is not convenient.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree

9. I will not stop trying to learn until I have reached I reach the skill level in Spanish that I seek.
   1 strongly disagree  2 disagree  3 agree  4 strongly agree
APPENDIX C

Please read the following story. After reading the story, you will be asked to answer several questions about what you have read.

Rita la fabulosa

Rita cerró el libro y suspiró.

Leo Corazón de León el niño más valiente del mundo.

¡No era justo!

Rita estaba harta de leer historias sobre gente.

De pronto…se dio cuenta. En ese momento supo exactamente qué le faltaba.

Un nombre.

¡Por supuesto! Pero no un nombre cualquiera. Ya tenía uno de esos: Rita Contreras.

Vaya nombre. Y qué aburrido.

Lo que Rita necesitaba era un nombre que la describiera perfectamente. Un nombre que lo dijera todo. Un nombre que no fuera aburrido.

Le echó un vistazo a todos los libros que estaban sobre la mesa de la biblioteca y volvió a suspirar

–¿Qué te pasa? –dijo su amiga Beatriz Ambrosio asomando la cara por detrás de su libro–. ¿Estás bien?

Como Rita siempre estaba suspirando, Beatriz no se preocupó mucho.

–No, no estoy bien –dijo Rita cruzando los brazos.

–¿Por qué? –preguntó Beatriz mirando a su alrededor–. ¿Israel te está molestando otra vez?

Beatriz miró al niño que estaba recargado en la pared de al lado. Rita también lo miró.

Israel Rojas era muy pecoso, muy pelirrojo y si le preguntabas a Rita, muy difícil de mirar por mucho rato. Por eso ella nunca lo hacía.

–No, no es eso –dijo Rita moviendo la cabeza

–Vamos Rita, cuéntame –dijo Beatriz arrugando la frente.
–Que no soy nadie – dijo Rita–. ¡Quiero ser Rita la tal cosa! Los personajes famosos tienen un nombre como Ramona la Valiente o Ezra el Espía.

Beatriz comenzó a reírse.

–No me estás ayudando –murmuró Rita con una risita nerviosa.

Beatriz tomó la mano de Rita.

–Perdón –murmuró–, yo tampoco soy nadie. Creo que Beatriz la Grande suena bastante atractivo.

Rita se recostó en la silla y volvió a abrir el libro y en lugar de leerlo trató de concentrarse.

Rita la…

Rita la…

Rita la… ¡¿qué?!

No podía ser que nada rimara con Rita

–Oye, ya tengo uno –murmuró de pronto Beatriz.

Rita la miró con el ceño todavía fruncido.

–¿Cuál?

–Rita la Cascarrabias –respondió Beatriz.

Rita viró los ojos pero sabía que algo se le iba a ocurrir.

Mientras tanto, Beatriz seguía hablando en voz baja.

–Ramona la Valiente, Bob el Constructor, Marvín el Magnífico…

El corazón de Rita se aceleró. ¡Pero Claro! ¿Cómo no se le había ocurrido antes?

Increíble.

Maravillosa.

Excelente.

O tal vez…fabulosa.

–¡Mi nombre será Rita la Fabulosa!
Preguntas

1. ¿Por qué a Rita no le gustaba su nombre?

2. ¿Cómo se llama la amiga de Rita?

3. ¿Qué es lo que quería Rita?

4. ¿Cómo se llama el niño que molestaba a Rita?

5. ¿Qué nombre le darías a Rita?

6. ¿Qué nombre se puso Rita?

7. ¿Cuál sería tu nombre perfecto?
Please read the following words. Do your best to pronounce each one carefully.

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<td>52.</td>
<td>vamos Rita</td>
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</table>
Please read the following story. After reading the story, you will be asked to answer several questions about what you have read.

Laurel the Loner

Laurel the Loner wasn’t really all that different from any other girl, but ever since she moved into town, that sleaze ball, Raul, never left her alone. He was the worst bully around, and Laurel cringed whenever he so much as glanced at her because that meant she was in for another round of endless jibes and insults, the worst of which being his terrible, loathsome corruption of her precious name.

Today was no different. Or so Raul thought. As fate would have it, Laurel had no sooner stepped through the door to first period than he caught sight of her and began to make his way towards her, already (and unwittingly) falling into her trap—and it was only 8:00am! There was no avoiding the encounter, either, because their classmates continued filing through the door behind her and he stood between her and her desk. There was no turning back now. She said a little prayer and took a breath to gather her courage, putting on her best face of defiance.

“Whuddya want, Raul?” Perhaps her being the first to talk would somehow deter him from being too confident this time. Much to her dismay, he simply snickered and grinned.

“Ooh, I’m so scared! Laurel the Loner, tryin’ to be tough! Give it up. You aren’t even tough enough to hurt a fly. But you’re so ugly, it would die anyways with one look at you!”

“Why you gotta be so mean?” said one.

“Yeah, wha’d she ever do to you, ya punk?” continued the second.

“Why you gotta be so mean?” said one.

“Yeah, wha’d she ever do to you, ya punk?” continued the second.

“We’re sick of hearing you pick on her. From now on, if you mess with her, you mess with us. Now back off.” Laurel stared in amazement as Raul skulked away without so much as a peep to sit as far away from them as possible. To tell the truth, she was slightly disappointed that her retort had been cut short and her scheme had been spoiled by these two strangers. Nevertheless, she couldn’t deny that the tables had been turned and Raul was still the loser in the end; it just wasn’t her who’d done the damage. Suddenly she was startled out of her musings
when she realized her two curly-headed peers hadn’t left. Why? What did they want? To make some sort of deal in exchange for their protection? She braced herself for their forthcoming demand as the first spoke again, but this time in friendlier tone, “Hi, I’m Miles and this is my twin sister Michelle. Forget that guy; he won’t bother you again.” He held out a calloused hand for her to shake.

Then Michelle piped in, “Yeah, sorry it took us so long to do anything. He thinks he owns the world and when we saw him coming after you again today, it was the last straw.” She clenched her tiny, delicate fists and added, “Ugh, that Raul! I could just growl at him!”

“Wasn’t that what you just did?” Letting her guard down for the first time since she’d moved in, Laurel ventured to banter and it was well received. She had done it, she had made them laugh!

The teacher then entered the room and made a motion as though to start the lesson. “Wanna come sit by us?” Michelle pointed to three nearby seats. All of a sudden reality set in: Someone had noticed her! What’s more, Laurel wasn’t a loner anymore; she had friends at last!

Questions
1. About how old is Laurel?
2. In what setting does the story take place?
3. Who is Raul?
4. What did Raul do to Laurel?
5. What stopped Raul?
6. What would you have done to Raul if you were Miles and Michelle?
**Target words from the story [as a reference not for L1 Benchmark to see]:**

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APPENDIX E

CONSENT FORM

Culture and the Acquisition of Spanish

You are invited to participate in a research study about the role of culture in the process of learning a second language. You were selected as a possible participant because you are currently studying Spanish at Brigham Young University. Please read this form and ask any questions that you may have before agreeing to be in this study.

This study is being conducted by Joshua Tanner, Ixchel Zarco, and Brandon Rogers, Hispanic Linguistics Graduate Students at Brigham Young University in Provo, Utah. Supervising the project are Scott M. Alvord and Rob A. Martinsen, Assistant Professors of Spanish and Portuguese at BYU.

Procedures:

If you agree to participate in this study, you will be asked to read a short story and a list of words in Spanish. While you are reading you will be recorded. You will also be asked to give us permission to record the oral exam that you will take as part of your Spanish course. Finally, you will be asked to complete a short questionnaire.

Risks and Benefits of Participating in the Study:

There are neither risks nor benefits associated with your participation in this project.

Confidentiality:

The records of this study will be kept private. In any sort of report that might be published, no information that will make it possible to identify you will be included. Research records will be kept in a locked file; only the researchers will have access to the records.

Compensation:

As part of your participation in this study, your class will be provided with some refreshments.

Voluntary Nature of the Study:

Involvement in this study is strictly voluntary. If you do not wish to be a part of this study you may withdraw or refuse entirely to participate at any point with no penalty. There will be no reference made to your identity at any point in the research.

Contacts and Questions:

If you have any questions with regards to this study, you may contact Ixchel Zarco (ixchel.zarco@gmail.com), Joshua Tanner (jtanner@byu.edu) or Brandon Rogers (L2Phonology@gmail.com). You may also contact Dr. Scott M. Alvord (salvord@byu.edu) or Dr. Rob A. Martinsen (rob.martinsen@byu.edu). If you have questions that you do not feel comfortable asking the researchers with regards to your rights as a participant in this study you may contact the IRB Administrator, A-285 ASB Campus Drive, Brigham Young University, Provo, UT 84602; Phone: (801) 422-1461; Email: irb@byu.edu

Statement of Consent:

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

Signature: ___________________________ Date: ______________
Table 16 *Preceding Segments Pairwise Comparisons*\(^a\) p-values

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*Note.* Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

\(^a\) Pairwise comparison test of whether means are statistically different or not.
### Table 17 Following Segments Pairwise Comparisons with p-values

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*Note.* Dependent Variables: Bark F₂; Bark F₂-F₁. Bolded values indicate statistical significance.

*a* Pairwise comparison test of whether means are statistically different or not.