

## **Lenition of voiced stops in L2 Spanish speakers: Going from [b d g] to [β ð ɣ]**

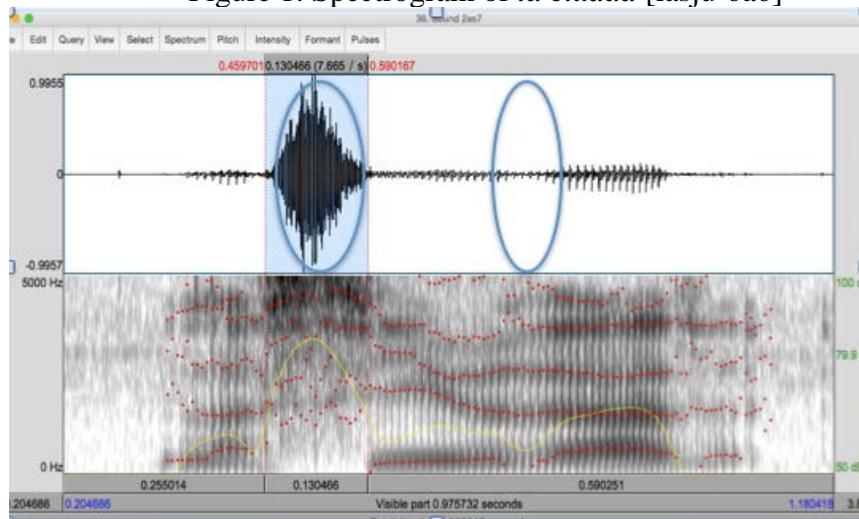
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### **1 Introduction**

A lot of research has been done on lenition of voiced stops in Spanish. We know that, even though there is dialectal variation (Carrasco, P., Hualde, J., and Simonet, M. 2012), most varieties of Spanish weaken the voiced stops /b d g/ and produce them like approximants in intervocalic position, as in [β ð ɣ]. However, English does not lenite these same stops, so it can be a challenge for L1 speakers of English who learn Spanish as an L2.

[β ð ɣ] used to be considered fricatives but, thanks to new technology and measures like relative intensity and the type of activity of the sound wave (absence of turbulence in approximants), we now classify them as approximants. What the spectrogram shows is a formant structure that creates a transition between the two flanking vowels. In Figure 1 we can see the difference between a fricative and an approximant in *la ciudad*. The first circle is the fricative [s] and the second one is the approximant [ð].

Figure 1: Spectrogram of *la ciudad* [lasju'ðað]



According to Hualde (2005), spectrographic analysis shows considerable variation in the amount of periodic energy in Spanish [β ð γ], reflecting variation in the degree of constriction. One of the effects that contribute to this variation is stress: /b d g/ have more open, vowel-like, articulations after a stressed vowel than in the onset of a stressed syllable. The place of articulation of the surrounding vowels also appears to have an effect, at least for /g/, with more open articulation between low vowels than between high vowels.

The sound /ð/ exists in English as a phoneme, as in “the”, but not as a result of lenition. In English it is a phoneme and not an allophone but still it would be a matter of transferring the sound from English to Spanish and resetting the parameter. [β] and [γ] don’t have an equivalent in English.

In this study we compare the production of /b d g/ in intervocalic position in low-intermediate and advanced speakers of Spanish whose L1 is English to see if level makes a difference and if/when they acquire lenition. We also have a native speaker control group. We look at word position (internal vs. initial), stress (stressed vs. non-stressed) and orthography (“b” vs. “v”).

## 2 Previous studies

Zampini (1994) conducted a study in which she investigated the role that native language transfer plays in the acquisition of the Spanish voiced stops by native speakers of English studying Spanish, as well as the effect that task formality has on the pronunciation of these phones. She found out that language transfer plays a role in the L2 acquisition of the Spanish voiced stops and spirantization in three main ways. First, the absence of an obligatory allophonic rule of voiced stop

weakening in English manifested itself in the failure of students to spirantize Spanish /b d g/ in the necessary contexts. Secondly, the transfer of English /ð/ to Spanish produced a much slower rate of acquisition compared to [β] and [ɣ]. Thirdly, orthography plays a role in the production of “b” and “v”, since it was a source of errors in the L2 Spanish participants in her study because they are pronounced with two different phonemes in English (/b/ and /v/) but with the same one in Spanish (/b/). This last error occurred more during the formal reading task than during the informal conversation task.

González Bueno (1995) conducted a study on the acquisition of approximants in low-intermediate students of Spanish. Participants were three women and two men enrolled in a Spanish course at Penn State. The data was obtained from recorded interviews that were administered at the beginning of the semester. They analyzed all the cases in which a stop must be lenited to see whether they weakened it or not. She found that her participants only produced the allophone accurately about 50% of the time.

Cole, Hualde and Iskarous (1999) conducted a study on /g/ spirantization in native speakers of Castilian Spanish. She found significant variation in the degree of /g/ spirantization conditioned by stress and the quality of the vowels adjacent to the consonant. Their data revealed that weakening is inhibited when it is flanked on both sides by the low vowel /a/, /i e/, or when it is followed by /i e/.

Ortega-Llebaria (2004) conducted a study in which she compared the production of intervocalic /b/ and intervocalic /g/ in Spanish and English. She investigated the interaction of phonetic factors (stress and vowel context) with inventory constraints in determining the degree of spirantization of intervocalic voiced stops. She found out that the phonetic factors had similar effects in the lenition of intervocalic /b/ and /g/ in both languages. Consonants were more weakened in trochee words than in iambs. However, inventory constraints limited the effect of phonetic factors accounting for cross-linguistic and speaker variation. For example, the lack of the contrast between /b/ and /v/ in Spanish explained the higher degree of lenition of Spanish /b/ in comparison with English /b/ in trochee words. Thus, lenition of intervocalic consonants is a gradient phenomenon whose variability is better described by the interaction of phonetic factors with inventory constraints rather than a categorical fashion.

Face and Menke (2009) conducted a study on L1 English speakers who were learning Spanish. They looked at how spirantization develops over time, effects of orthographic “v”, syllable stress and position. Participants were classified into three groups: university students enrolled in a fourth-semester Spanish course, graduating Spanish majors, and Ph.D. students in Spanish. Participants had to read a short story in Spanish. Face and Menke found that stops account for the majority of fourth-semester learners’ production for these phonemes. Beyond that level, learners begin to spirantize with greater frequency.

Regarding the effect of orthographic “v”, both the fourth-semester and graduating Spanish majors produced “v” as a fricative with greater frequency than the other phonemes. These same groups produced more stops in stressed syllables than in unstressed syllables. The productions of Ph.D. participants do not appear to be affected by syllable stress in the same way. All three groups of learners produce more spirants when /b d g/ occur word-internally than word-initially

Colantoni and Marinescu (2010) conducted a study in which they tried to determine the degree of lenition in voiced and voiceless stops in Argentine Spanish. After that, based on the evidence obtained, they wanted to test the predictions of three competing approaches to lenition. The system-oriented hypothesis (1) predicts that there is a correlation between an increasing rate of approximation and deletion of voiced stops and voicing of voiceless stops. The effort-based hypothesis (2) predicts that consonants involving more effortful gestures should lenite first. That means that that voiceless stops should lenite first, and a higher rate of lenition is expected when a consonant is flanked by open vowels. The perception-based hypothesis (3) makes the prediction that lenition will not be affected by the degree of constriction of the flanking vowels and that voiced stops will lenite first. Their results did not support either the first hypothesis or the second one. The third hypothesis was partially confirmed. Lenition was not consistently promoted by more open flanking vowels and voiced stops lenited the most. However, they observed some effects of the flanking vowels in the direction predicted by the second hypothesis.

Eddington (2011) conducted a study in which he analyzed informal telephone conversations between native Spanish speakers from different Spanish speaking countries. He claims that, when followed by a stressed syllable, /b / and /d/ exhibit more constriction when compared to /g /, while all three phones are less lenited when they fall between two stressed syllables. /b / and /d/ are also less weakened when they appear intervocalically in word-initial position when compared to word-internal intervocalic tokens, while the same is not true for /g/.

Hualde, Shosted and Scarpace (2011) did a study in which they compared acoustic and EPG results on the realization of /d/ in different contexts. Three native speakers of Peninsular Spanish participated in the experiment. Participants were fitted with custom-made artificial palates and were asked to read the experimental materials as they appeared on a computer screen. Their articulatory results show that /d/ is most occluded after /n/ and /l/ and least occluded after a vowel or /r/, the context after /s/ is intermediate. Their acoustic results show that /d/ is especially constricted after /s/ and has less constriction after /m/ or /l/.

Carrasco, Hualde and Simonet (2012) compared the production of /b d g/ by Costa Rican speakers and Peninsular Spanish speakers from Madrid in postconsonantal (after a liquid, sibilant or glide) and postvocalic (after /a/) contexts. Their analysis showed that in Cost Rican Spanish postconsonantal

realizations of /b/ and /d/ are very different from postvocalic ones, with a clear separation in the degree of constriction between these two contexts. In Madrid, on the other hand, there is a continuum of constriction degrees, depending on the nature of the specific preceding segment, without a clear separation between postvocalic and postconsonantal realizations.

### **3 The Present Study**

Inspired by the discussion to this point, the current study examines the following research questions:

- Does level make a difference in lenition?
- Does stress play a role in lenition? Are /b d g/ more weakened in non-stressed syllables than in stressed syllables?
- Does word position play a role in spirantization? Are /b d g/ more weakened in word internal position than in word initial position?
- Do they pronounce “b” and “v” differently? Do they produce a fricative, like in English, or something different?

Our hypotheses are that the advanced group will lenite much more than the low-intermediate group and the results of the advanced group will be really similar to those of the native control group. There will be more weakening in internal position than in initial position, especially for the low-intermediate group. There will be more lenition in non-stressed syllables than in stressed syllables. The results for “b” and “v” will be different for the low-intermediate group.

#### **3.1. Methods**

##### **3.1.1. Participants**

There were four participants in each group. Participants in the low-intermediate group were enrolled in a third-semester Spanish course at UW Madison taught by the researcher. The author recruited them in class. She asked for volunteers and they offered. They are all females who have been studying Spanish for four to six years. None of them has studied abroad.

Participants in the advanced group are four Ph.D. students in the Spanish program in the Department of Spanish & Portuguese at UW Madison. The researcher contacted them by email and they agreed to participate in the study. They are two males and two females who have had between 10 and 18 years of experience with Spanish.

Participants in the control group are four native speakers from Spain who live in the US and are currently students in the Department of Spanish and Portuguese at UW Madison. They were contacted by email and agreed to participate in the study. They are two males and two females who have been living in the US between three and 15 years.

Informants were given a background questionnaire at the beginning of the session. There are two questionnaires, one for native speakers, and another for non-native speakers. They were asked questions about their exposure to Spanish/how long they have been living in the US, if they speak other languages, and whether they have studied abroad or not. Based on that information we formulated tables 1 and 2. IS means Intermediate Speaker, AS means Advanced Speaker and NS means Native Speaker.

Table 1: native participants

Participant	Length of stay in the US	Age of arrival	Languages spoken besides Spanish and English	Age	Gender	Place of origin
NS1	15 years (non-continuous)	23 years old	German, Portuguese, French, Italian	47	Female	Madrid
NS2	3	31 years old	Portuguese and Italian	34	Male	Castilla la Mancha
NS3	3	35 years old	Catalan	38	Male	Baleares
NS4	4	27 years old	Galician	34	Female	Galicia

Table 2: non-native participants

Participant	Years of experience with Spanish	Study abroad	Languages spoken besides Spanish and English	Age	Gender
AS1	16	2 months	French	28	Female
AS2	14	no	French, Portuguese, Italian	28	Male
AS3	18	9 months	Portuguese	33	Male
AS4	10	6 months	French	25	Female

IS1	4	no	none	20	Female
IS2	4	no	Japanese	19	Female
IS3	5	no	none	18	Female
IS4	6	no	none	18	Female

### 3.1.2. Procedure

Participants were recorded using a *MacBook Air*, a *Logitech ClearChat Comfort/USB Headset H390* and *Praat* in one of the conference rooms in Van Hise. After they filled the questionnaire they were given a list of ten sentences and they were asked to read them out loud.

These ten sentences include 20 tokens. Each sentence has between one and three tokens. There are eight tokens of /b/, four in internal position, two with “b” and two with “v”, and four more in initial position, two with “b” and two with “v”. There are six tokens with /d/, three in internal position and three in initial position. Finally, there are six tokens with /g/, three in internal position and three in initial position. We controlled for stress, ten of the tokens were in stressed position and ten were in non-stressed position. All of these tokens were later analyzed with *Praat*. Some examples of the sentences the participants had to read are:

- (1) *Ella bebe agua*  
she drink-3SG water  
'She drinks water'
- (2) *El avión es muy rápido*  
the-M.SG plane is very fast  
'The plane is very fast'
- (3) *La hermana de Gabriel es mi amiga*  
the-F.SG sister of Gabriel is my friend-F.SG  
'Gabriel's sister is my friend'
- (4) *El bebé de la dama llora mucho*  
The-M.SG baby of the-F.SG lady cry-3.SG a lot  
'The lady's baby cries a lot'

### 3.2. Data Analysis

All the tokens were analyzed using *Praat*. We looked at relative intensity with respect to the following vowel because that is what has been done in recent studies and what we have done in class. Greater differences indicate greater levels of occlusion and, subsequently, lesser degree of weakening and a more

“consonant-like” production. We compared the production on word-internal vs. initial position, stressed vs. non-stressed syllables, and “b” vs. “v”.

The tokens were classified as pure approximants (PA), tense approximants (TA), fricatives or stops. To classify them we looked at the presence or absence of turbulence in the sound wave. We classified them as fricatives if there was turbulence in the sound wave and as stops or approximants if there was no turbulence. We used the following scale to classify them depending on relative intensity:

- PA (0-5 dB)
- TA (6-20 dB)
- Stop (+20 dB)

Below we have included an example of a spectrogram of a pure approximant (figure 2), one of a tense approximant (figure 3) and one of a stop (figure 4).

Figure 2: Example of a pure approximant in *ciudad*

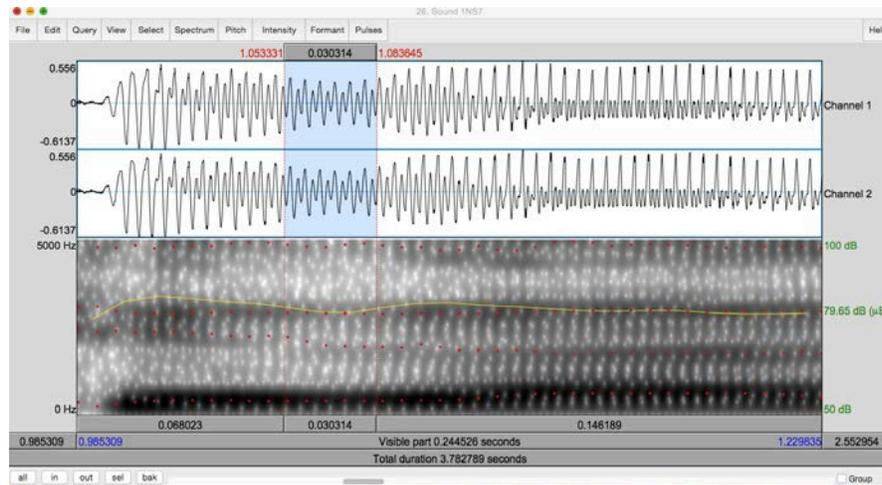
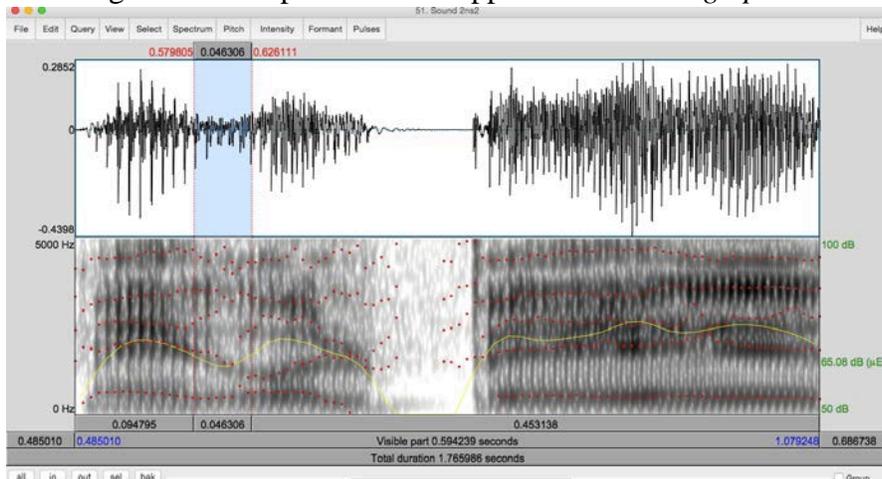
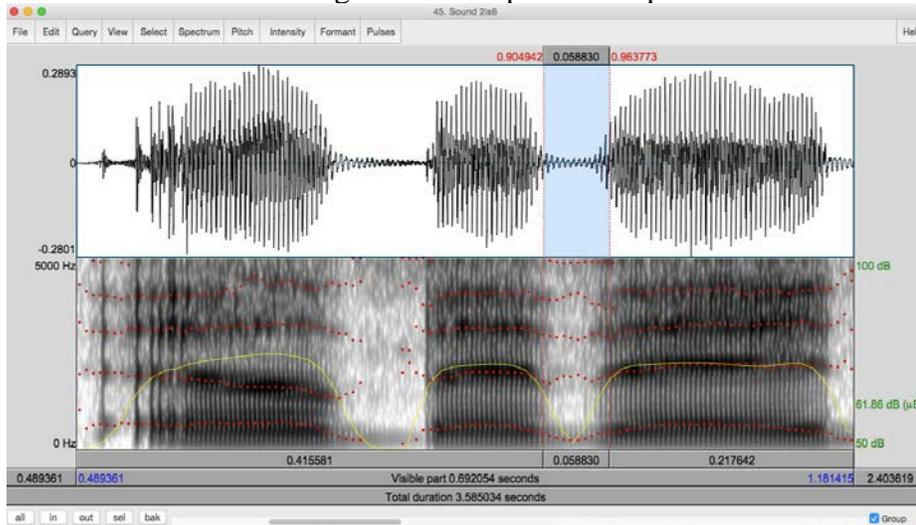


Figure 3: Example of a tense approximant in *me golpeé*



F  
i

Figure 4: Example of a stop in *el bebé*



We can see that the pure approximant has a periodic wave with lower amplitude than that of the adjacent vowels, low relative intensity with respect to the adjacent vowels, and a constant formant structure. The stop, on the other hand, has an inactive sound wave, a drastic relative intensity difference, and a complete absence of formants. Finally, the tense approximant is kind of an intermediate articulation. It has an active sound wave, the relative intensity is higher than for pure approximants but lower than for stops, and there is no constant formant structure<sup>1</sup>.

#### 4 Results

In table 3, we can see that, even though there are within group differences, overall the low-intermediate group produced more stops than the advanced group and the native speaker group. Only one of the low-intermediate participants produced any pure approximants. Again, “NS” means native speaker, “AS” means advanced speaker, and “IS” is intermediate speaker.

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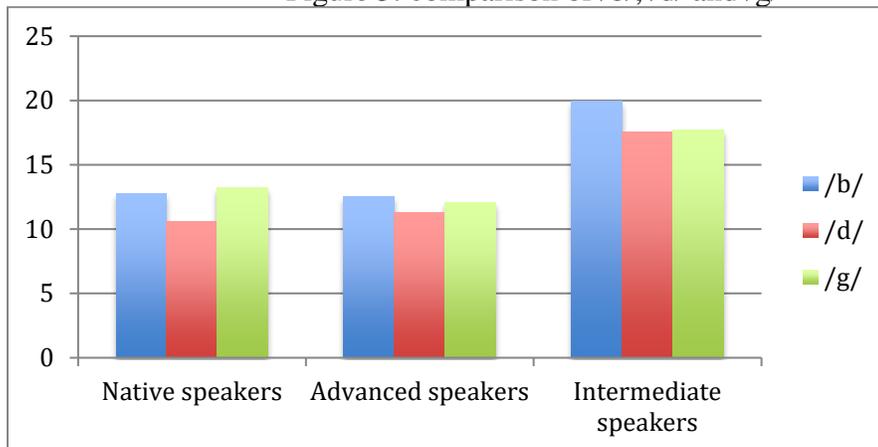
<sup>1</sup> There were a few issues with the data. One of the sentences that one of the participants read was not recorded, so we lost two of her tokens (*me golpeé* and *dedo*). Some of the informants read *Dublín* like in English, or with the stress on the first syllable, so we proceeded to get rid of that token. Therefore, we ended up with 19 tokens per speaker except for IS1, who only has 17 tokens.

Table 3: Results by participant

	PA	TA	Stop
NS1	6/19	6/19	2/19
NS2	6/19	13/19	0
NS3	3/19	15/19	1/19
NS4	0	12/19	5/19
AS1	2/19	15/19	2/19
AS2	3/19	16/19	0
AS3	1/19	16/19	2/19
AS4	4/19	14/19	1/19
IS1	0	8/17	9/17
IS2	0	11/18	7/18
IS3	0	11/18	8/18
IS4	2/18	8/18	8/18

However, these results don't tell us anything except that low-intermediate speakers lenite less than advanced and native speakers. To look at the factors that influence weakening, we compared their production in stressed vs. non-stressed syllables, initial vs. internal position and "b" vs. "v". In figure 5, we can compare their production of /b/, /d/ and /g/. In all these figures, the numbers correspond to relative intensity in dB. The lower the number, the more lenition was produced.

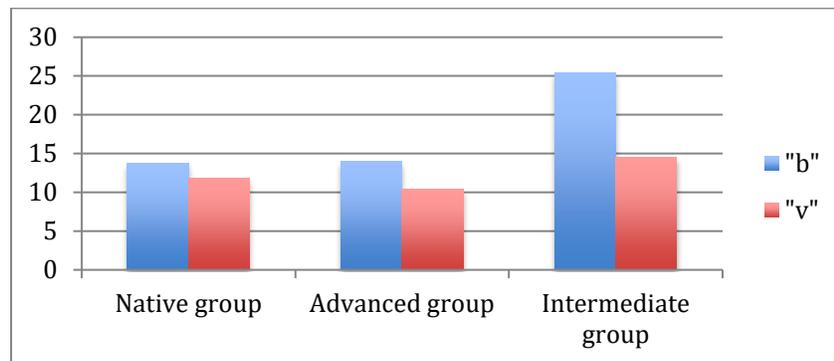
Figure 5: comparison of /b/, /d/ and /g/



We can see that native and advanced speakers lenite more than intermediate speakers but there are no major differences between the three phonemes.

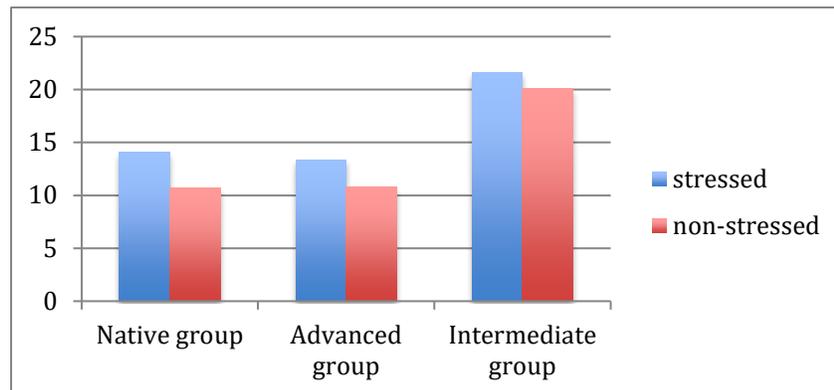
In figure 6, we can compare their production of “b” and “v”. We can see that orthography makes a difference for the low-intermediate group. They weaken “v” much more than “b”. It makes a smaller difference for the advanced group, who follows the same pattern. It even makes a really small difference for the native group, but it’s probably non-significant.

Figure 6: comparison of “b” and “v”



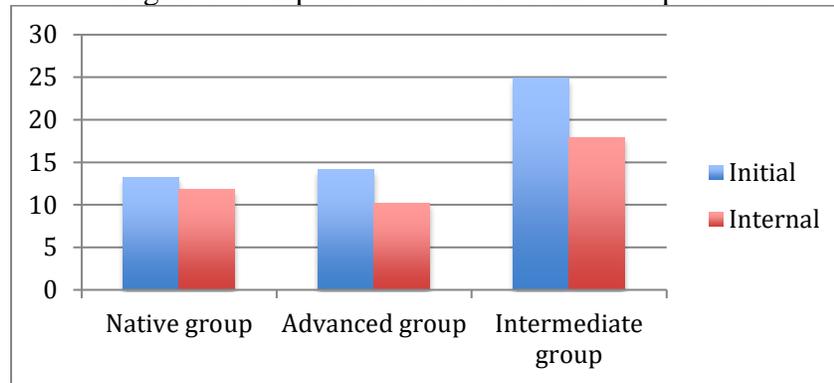
In figure 7, we can compare the production of these phonemes in stressed and non-stressed syllables. We can see that stress makes a bigger difference for the native and advanced speakers than for the low-intermediate group.

Figure 7: comparison in stressed vs. non-stressed syllables



In figure 8, we compare the production of /b d g/ in word-initial vs. word-internal position. We can see that position barely makes a difference for the native participants but it does make a difference for the advanced group and, especially, the low-intermediate group.

Figure 8: comparison in initial vs. internal position



To see whether these differences were significant or not we ran a UNIANOVA using SPSS with intensity as a dependent variable and level, stress, phoneme, position and ‘b’/‘v’ as independent variables. As we can see in figure 10, the only statistically significant variable was level.

Figure 10: UNIANOVA

**Tests of Between-Subjects Effects**

Dependent Variable: intensity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2030.098 <sup>a</sup>	5	406.020	6.847	.000
Intercept	6627.481	1	6627.481	111.759	.000
level	1133.915	2	566.958	9.561	.000
stress	71.564	1	71.564	1.207	.275
position	7.663	1	7.663	.129	.720
b	484.505	1	484.505	8.170	.005
Error	5337.147	90	59.302		
Total	29145.210	96			
Corrected Total	7367.245	95			

a. R Squared = .276 (Adjusted R Squared = .235)

To compare the different levels and see where that difference was, we ran a Tukey HSD with intensity as a dependent variable. As we can see in figure 11, we found a difference between the intermediate group and both the advanced and the native speakers, but no difference between the advanced group and the native speaker group.

Figure 11: Tukey HSD

**Multiple Comparisons**

Dependent Variable: intensity  
Tukey HSD

(I) level	(J) level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	7.4259*	1.92519	.001	2.8380	12.0139
	3	7.1472*	1.92519	.001	2.5593	11.7351
2	1	-7.4259*	1.92519	.001	-12.0139	-2.8380
	3	-.2787	1.92519	.989	-4.8667	4.3092
3	1	-7.1472*	1.92519	.001	-11.7351	-2.5593
	2	.2787	1.92519	.989	-4.3092	4.8667

Based on observed means.  
The error term is Mean Square(Error) = 59.302.

\*. The mean difference is significant at the 0

One surprising thing is that we did not find any fricative examples. Not even the intermediate participants produced “v” as a fricative. They produced either a stop or an approximant. It would have made sense for them to produce “v” as a fricative because it’s a fricative in English but not in Spanish. Face and Menke (2009)’s fourth-semester participants produced “v” as a fricative in approximately 30% of the cases.

Something else that we were not expecting is that the low-intermediate participants produced the second “d” in *dedo* as a tap instead of a stop or an approximant. That makes sense from an L1 transfer point of view because it’s the context in which a tap would be produced in American English. It’s an intervocalic “t” or “d” in a non-stressed syllable that is preceded by a stressed syllable, like in “water” or “ladder”.

## 5 Discussion and Conclusions

In this section, we are going back to our hypotheses to see if they still stand. Hypothesis (1) was “The advanced group will lenite much more than the low-intermediate group”, which is true regardless of phoneme or phonetic factor.

Hypothesis (2) was “The results of the advanced group will be really similar to those of the native control group”. This is partially true. Both groups follow the same pattern when we look at the different phonemes and when we look at stress. However, when we compare “b” and “v”, orthography makes a bigger difference for the advanced speakers than for the native speakers. Position (initial vs. internal) also plays a bigger role for the advanced group than for the native group.

Hypothesis (3) was “There will be more weakening in internal position than in initial position, especially for the low-intermediate group”. This is true for both the low-intermediate and the advanced groups but not so much for the native group.

Hypothesis (4) was “There will be more lenition in non-stressed syllables than in stressed syllables”. This is true for the native and advanced groups but not so much for the low-intermediate group. In Menke and Face (2009), stress was significant for the fourth-semester students and the graduating Spanish majors but not for the Ph.D. students and the native speakers.

Hypothesis (5) was “The results for “b” and “v” will be different for the low-intermediate group”. This is true, the low-intermediate participants lenite “v” more than “b”. This same pattern is repeated in the advanced group. It even makes a small difference for the native speakers, which is surprising because the literature says that there is no phonological difference between “b” and “v” in Spanish.

One of the results that we were not expecting is that we did not find any fricative productions of “v”, not even among the low-intermediate participants. They pronounced “v” mostly as a tense approximant. This might indicate that, at least this particular group of students, has already noticed that “v” is not produced as a fricative in Spanish.

Another surprising result was the production of the second “d” in *dedo* as a tap instead of a stop or an approximant. As mentioned above, this makes sense from an L1 transfer point of view. Orthography might have played a role in the production of this token. We would have to test it using an elicitation task without a written component.

In the future it would be interesting to include an oral interview to see if task formality plays a role because Zampini (1994) found out that lenition is more likely to happen in informal contexts than in a formal task, like reading. It would also be a good idea to either avoid cognates like “*Dublín*” or to look at how they affect pronunciation. One of the limitations of the study is the small number of participants in each group, so doing a bigger study with more participants and tokens would be interesting.

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