MAPPING SECOND LANGUAGE LEARNERS' ACCENT OF SPANISH

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ABSTRACT

The goal of this study is to provide a global view of Spanish second language (L2) accent and to identify the sounds and structures that lead to the perception of foreign accent. We designed a list of real Spanish monosyllabic words with various syllable structures that covers all phonemes in Spanish. The words were produced by L2 learners and native speakers and rated by native listeners. We used mixed effects regression models to evaluate the contributions of factors including consonant, vowel, and syllable structure, among others, to the perceived accent rating of each word. The results of this study are consistent with the predictions of prevailing theories in second language acquisition (SLA), while providing a global view with a quantitative measurement of L2 Spanish accent for all sounds.

Keywords: Foreign accent, global pronunciation rating, second language phonology, Spanish.

1. INTRODUCTION

Theories of SLA address many questions related to language learning. One common topic is to explore the relationship between the sound inventories of a learner's native language (L1) with that of their second language (L2) to explain why some speech sounds appear to be more difficult than others. Leading theories include the Perceptual Assimilation Model (PAM) [2, 3], the Speech Learning Model (SLM) [4, 5], and the Perceptual Magnet Effect [7], which acknowledge that learners acquire a L2 sound easily if there is an identical counterpart in their L1. Alternatively, if a new L2 sound can be easily discriminated from any L1 sound, learners can also form a new sound category, given time. In contrast, the most difficult L2 sound is different yet very similar to a L1 counterpart, which may prevent the forming of a new sound category by a L2 learner.

Following the methods described in [10, 11, 12], the present study intends to map L2 leaners' accent of Spanish, and to identify difficult sounds and structures that lead to the perception of strong foreign accent. Given that Spanish has a strong letter-to-sound correspondence [6], accent rating can be obtained without complication from learners' difficulties in orthography. The goal of this study is to provide a global view of L2 Spanish accent with perceptual rating of all speech sounds.

2. METHODOLOGY

2.1. Materials and speakers

The present study is part of a larger project which investigates global pronunciation of L2 learners at various levels of linguistic structure. A subset of the data was used, which consists of Spanish monosyllabic words in four different syllable structures (i.e., V, CV, VC, CVC) that include all vowels and consonants (see Table 1 for an example of words in CV syllable structure). This resulted in 59 items (V: 5 items, CV: 29 items, VC: 8 items, CVC: 17 items). Apart from the monosyllabic words, 6 longer words with varying numbers of syllables (3-5 syllables) were also included to examine whether stronger foreign accent is detected in longer words.

Table 1: Spanish words in CV syllable structure which were included in the word list

	a	e	i	o	u
b	va	be	vi		
d	da	de	di		
g					
p		P			
t		te	ti		tu
k	ka	que			cu
m		me	mi		
n			ni	no	
ɲ					ñu
f		fe			
s		se	si		su
tʃ		che			
j	ya			yo	
l	la	le		lo	
r					
x		ge			

The speech corpus was obtained from productions of 10 female speakers. Five of the speakers were native Spanish speakers (NS) (mean age = 27.2 years) and the other five were L2 learners of Spanish (L2) (mean age = 20.8 years). All the

NSs were from Spain, except for one speaker who was from Colombia. We included productions of the NSs to provide a reference point for the rater to assign scores to L2 accent. The wide range of contrast also helps to encourage raters to pay attention to each recording. All the L2s were L1 English speakers who are learning Spanish as a second language at an American university in the Midwest. None of the L2s started learning Spanish before the age of 7 (mean age of acquisition of Spanish = 11.2 years) and none of them learned any other languages before then.

The productions were audio-recorded on an iMac desktop computer using Reaper software. The recordings were done in a sound-attenuated booth using a Shure SM-7 Broadcast microphone and an Apogee Quartet 4-channel Microphone interface with a sampling rate of 48 kHz and a sample size of 16 bits. All speech files were converted from .wav to .mp3 for a faster download speed. In total, 650 items were obtained from the 10 speakers, among which 9 items were removed due to issues such as overlapping background noise (e.g., flipping pages) and missing items. Thus, the remaining 641 items were used for the foreign accent rating task.

2.2. Raters and procedures

For the foreign accent rating task, Qualtrics, a web-based survey software tool, was used. 15 native Spanish speakers (9 F) (mean age = 31.27 years) from various Spanish-speaking countries (8 from Spain, 2 from Chile, 2 from Mexico, 1 from Argentina, 1 from Ecuador, and 1 from Costa Rica) participated as raters. The raters completed a brief background questionnaire asking information such as age, gender, and place of origin. After a practice activity to become acquainted to the task, the raters rated each recording on a continuous scale from 0 (= very strong foreign accent) to 100 (= perfect like a native speaker) by moving a slider to the desired point. The initial position of the slider was positioned in the middle of the scale. With additional time for filling out their background information and training in the beginning, the overall task was considered to be very long, which may affect the quality of the data. Thus, the task was divided into three blocks to allow raters to take a break between blocks. The speech files from each speaker were randomly split into three groups for each of the three blocks. Thus, each block had roughly equal number of files from each speaker (including both NSs and L2s). File presentation order in each block was randomized.

3. RESULTS

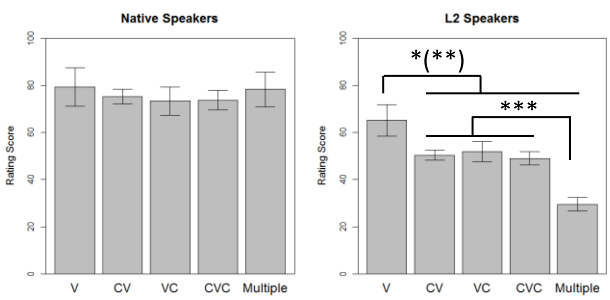
3.1. Syllable structures

When comparing the ratings between the NSs and the L2s, as expected, overall the NSs received higher ratings (75.26%) than the L2s (49.41%) and the group difference increased when comparing their ratings of monosyllabic (NS: 75.45%, L2: 54.14%) and multisyllabic words (NS: 78.43%, L2: 29.53%).

In order to examine whether L2s produce varying degrees of foreign accent depending on different syllable structures, the effects of speaker group (NS and L2) and syllable structure (V, CV, VC, CVC, and multisyllabic) on foreign accent rating were analysed using linear mixed effects modelling with speaker, rater, and item as random factors. The *lmer*() function in the *lme4* package in R [1] was used for statistical analysis. For post-hoc pairwise comparisons, the *lsmeans*() function in the *lsmeans* package in R [1] was used.

Results showed that there was a significant main effect of speaker group (β = 26.109, t= 4.062), indicating that overall the NSs received higher ratings than the L2s (i.e. the baseline speaker group). Moreover, significant interaction between speaker group and syllable structures were found in all syllable structures (CV: β = 13.165, t= 6.853; VC: β = 4.556, t= 3.898; CVC: β = 14.914, t= 8.422; multisyllabic: β = 23.708, t= 12.151). This suggests that the rating difference between the two speaker groups was larger in CV, VC, CVC, and multi-syllabic words than in V words (i.e., the baseline syllable structure).

Figure 1: Foreign accent ratings of different syllable structures produced by native speakers and L2 speakers (0 = very strong foreign accent) (*: p < 0.05, **: p < 0.01, ***: p < 0.001).

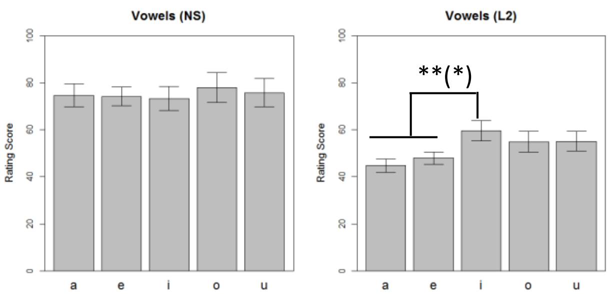


Pairwise comparisons of speaker group and syllable structure confirmed that while the two speaker groups did not differ in their productions of V structures, the L2s' productions of the other syllable structures received significantly lower ratings than those of the NSs (CV & CVC: $p < 0.01$, VC: $p < 0.05$, multisyllabic: $p < 0.001$). The pairwise comparisons also showed that while the NSs received similar ratings across syllable structures, the L2s received significantly higher ratings for the V structures than the other structures (CV & CVC: $p <0.01$, VC: $p < 0.05$, multisyllabic: $p < 0.001$ for all), and their ratings for the CV, VC, and CVC structures were significantly higher than the multisyllabic words ($p < 0.001$ for all).

3.2. Vowels

In order to examine whether L2s produce varying degrees of foreign accent depending on different vowels, the effects of speaker group and vowel (/a/, /e/, /i/, /o/, and /u/) on foreign accent rating were analysed using linear mixed effects modelling with speaker, rater, and item as random factors. Results showed that there was a significant main effect of speaker group ($\beta = 23.74$, $t= 3.932$), which suggests that overall the NSs' vowels were rated significantly higher than those of the L2s. Moreover, significant interactions between vowel and speaker group were found in all vowels except for /u/ (/e/: $\beta = -7.834$, $t= -5.991$; /i/: $\beta = -8.441$, $t= -6.702$; /o/: $\beta = 7.964$, $t = 4.968$). That is, the difference in the ratings of /a/ (i.e., the baseline vowel) between the two speaker groups was significantly different than that of /e/, /i/, and /o/.

Figure 2: Foreign accent ratings of different vowels produced by native speakers and L2 speakers (0 = very strong foreign accent)
(*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$).

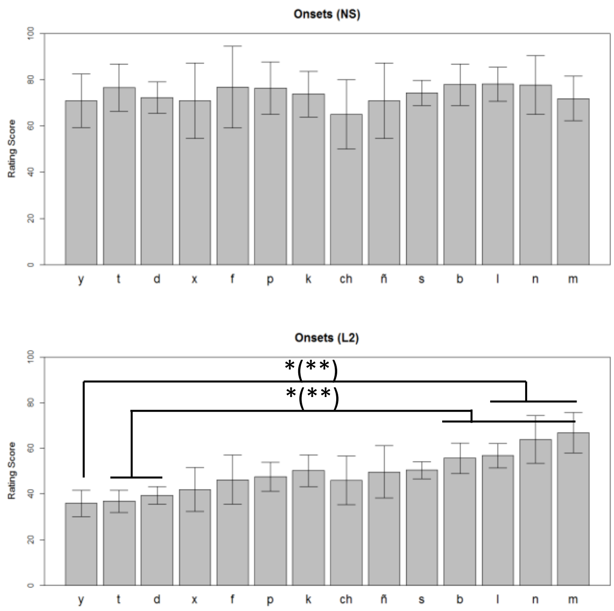


Pairwise comparisons of vowel and speaker group showed that when comparing the two speaker groups, only L2s' /i/ received comparable ratings to that of the NSs, while the other vowels received significantly lower ratings than the NSs (/a/: $p < 0.001$, /e/ & /o/: $p < 0.01$, /u/: $p < 0.05$). Indeed, when comparing the ratings across vowels, while no significant difference was found in the ratings across the NSs' vowels, the L2s' /i/ received significantly higher ratings than /a/ ($p < 0.001$) and /e/ ($p < 0.01$). Although the ratings of L2s' /i/ was also higher than /o/ and /u/ (see Figure 2), this did not reach significance level.

3.3. Consonant onsets

Accent rating of consonants was examined separately by syllable position. For consonant onsets, the effects of speaker group and consonant onset (see Table 1 for the list) on foreign accent rating were analysed using linear mixed effects modelling with speaker, rater, and item as random factors. Results showed that there was a significant main effect of speaker group ($\beta = 25.089$, $t= 4.077$) and significant interactions between onset and speaker group for /b/ ($\beta = -4.622$, $t = -2.601$), /l/ ($\beta = -7.694$, $t = -3.167$), /n/ ($\beta = -11.966$, $t = -4.765$), and /m/ ($\beta = -8.74$, $t = -2.335$). This suggests that overall the NSs received higher ratings than the L2s and the rating difference between the two groups was significantly larger for /ʝ/ (i.e., the baseline consonant onset) than for /b/, /l/, /n/, and /m/.

Figure 3: Foreign accent ratings of different consonant onsets produced by native speakers and L2 speakers (0 = very strong foreign accent)
(*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$).

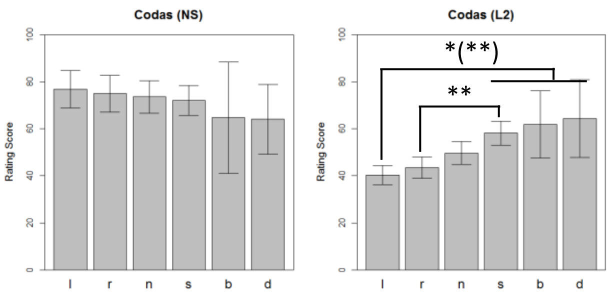


Pairwise comparisons of onset and speaker group showed that while the NSs received similar ratings across onsets, L2s' /ʝ/ received significantly lower ratings than /l/ ($p < 0.05$), /n/ ($p < 0.01$), and /m/ ($p < 0.001$), and L2s' /t/ and /d/ received significantly lower ratings than /b/, /l/, /n/, and /m/ (/b/: $p <0.05$, /l/, /n/, & /m/: $p <0.001$). The pairwise comparisons also showed that, when compared with the NSs, the L2s' /ʝ/, /t/, and /d/ were rated significantly lower than those of the NSs ($p < 0.001$ for all). Apart from these three consonants, L2s' /x/, /s/, /k/ ($p < 0.05$), /f/, and /p/ ($p < 0.01$) also received significantly lower ratings than those of the NSs.

3.4. Consonant codas

Lastly, for consonant codas, the effects of speaker group and coda (/l/, /r/, /n/, /s/, /b/, and /d/) on foreign accent rating were analysed using linear mixed effects modelling with speaker, rater, and item as random factors. Results showed that there was a significant main effect of speaker group (β = 24.176, t= 3.262) and significant interactions between coda and speaker group for all codas, except for /d/ (/r/: β = -12.342, t= -5.89; /n/: β = -14.443, t= -6.617; /s/: β = -15.88, t= -6.343; /b/: β = -9.83, t= -2.632), which indicates that overall the NSs received higher ratings than the L2s and, except for /d/, the rating difference between the two groups was significantly larger for /l/ (i.e., the baseline consonant coda) than for other codas.

Figure 4: Foreign accent ratings of different consonant codas produced by native speakers and L2 speakers (0 = very strong foreign accent) (*: p < 0.05, **: p < 0.01, ***: p < 0.001).



Pairwise comparisons of coda and speaker group showed that while L2s' /s/, /b/, and /d/ received similar ratings to those of the NSs', their ratings for /l/ (p < 0.001), /r/ (p < 0.01), and /n/ (p < 0.05) were significantly lower than those of the NSs. Indeed, the L2s' ratings for /l/ were significantly lower than for /s/ (p < 0.001), /b/, and /d/ (p < 0.05) and their ratings for /r/ was significantly lower than /s/ (p < 0.01), whereas the NSs received similar ratings regardless of the coda type.

4. DISCUSSION AND CONCLUSION

The findings of this study are in general consistent with the predictions of prevailing theories in SLA. Our results also showed that foreign accent does not occur in L2 speech equally at all levels. Foreign accent was more noticeable in longer words. When examining L2s' vowels, foreign accent was perceived strongest for /a/. According to [9], of the five Spanish vowels, /a/ is the one that is the most challenging to produce for L2s, because this vowel tends to centralize the most in unstressed position in English. Given that the target items in the present study were mostly function words such as prepositions (e.g., *por* 'for') and clitics (e.g, *lo* 'it/him'), it is likely that the L2s produced them as unstressed and thus their /a/ underwent centralization the most.

With regard to consonants, in onset position, L2s' productions of words with onset /ʝ/, /t/, and /d/ were perceived to have stronger foreign accent than the others. While the strong foreign accent in /ʝ/ may be explained by cross-linguistic differences between Spanish and English, in that <y> (the letter used for /ʝ/ in the present study) is pronounced with stronger constriction utterance-initially in Spanish ([ɟ]) than in English, which is produced as an approximant [j] [6, 8], it is interesting that the plosives /t/ and /d/ were perceived as more strongly accented (36.83% and 39.42%, respectively) than other plosives (i.e., /b, p, k/). One possible explanation is that, unlike /b, p, k/, the place of articulation of /t, d/ are different in Spanish and English: Spanish /t, d/ are dental while English /t, d/ are alveolar [6, 8]. While both Spanish and English do not use dental-alveolar contrast in their respective phoneme inventory, as in Hindi, it is interesting to note that Spanish listeners are sensitive to the differences and use it to identify foreign accent. This is a topic that is worthy of further investigation.

Of the 6 Spanish consonants that can occur in the syllable coda position, L2s' productions of words with final /l, r, n/ were perceived with stronger accent than /s, b, d/. The strong accent detected in the liquids can be explained by phonetic transfer from English in that English /l/ undergoes velarization ([ɫ]) in syllable-final position, while Spanish /l/ does not. Similarly, English /r/ is produced as a retroflex approximant [ɻ], while Spanish /r/ is produced as an alveolar tap [ɾ] [6, 8]. However, with regard to the nasal /n/, it is unclear why a strong accent was detected, because /n/ is produced similarly in both languages. Currently we don't have an explanation for the lower score of coda /n/. It is possible that it is an artifact of sample choice (most samples of coda /n/ were used with vowel and initial consonants with low scores). Further analyses should be carried out to examine possible confounding effects of items with multiple segments (i.e., CV, VC, and CVC).

The current work has applications in pronunciation training and accent reduction. Creating a detailed L2 accent map, such as the one introduced in this study, for individual learners may provide further applications to L2 pedagogy, providing feedback to learners while assisting instructors to design effective and individualized training methods to help students reduce foreign accent.

5. REFERENCES

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