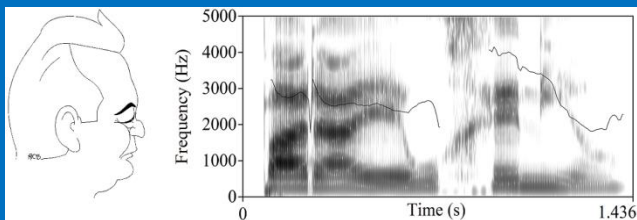


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Phonological awareness in Spanish-English inter-phonology: the case of spirantization

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My interest in the sounds of speech started as a first-year undergraduate in 1982. I had enrolled in a course in general phonetics and it was the first time I heard of speech acoustics. Eugenio Martínez Celdrán was the teacher.

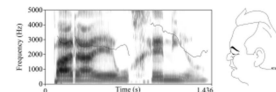
Joan C. Mora

1. INTRODUCTION

In the first language (L1) acquisition literature, *phonological awareness* is often operationalized as the ability to segment and manipulate speech units. In the field of second language (L2) acquisition L2 phonological awareness has been defined as *explicit* metalinguistic knowledge of the L2 phonological system, or L2 metaphonological awareness (Venkatagiri and Levis, 2007; Wrembel, 2015). However, phonological awareness has also been proposed to include *implicit* knowledge about the phonological system of the target language at the segmental, suprasegmental and phonotactic levels (Kivistö-de Souza, 2012, 2015).

The aim of the present study is to assess L2 learners' awareness of non-distinctive phonetic differences between L2 (English) and L1 (Spanish) speech sounds. Learners often encounter sound units that are equivalent in their L1 and L2 at the phonological level but are realized differently phonetically. For example, /p/ functions as a distinctive phonological unit in English (pet /pet/ vs. bet /bet/) and Spanish (paso 'step' /paso/ vs. vaso 'glass' /baso/), but phonetically /p/ is realized with long-lag VOT in English and with short-lag VOT in Spanish, a noticeable cross-language differences in degree of aspiration at the allophonic level. Such non-distinctive phonetic differences between the way equivalent L1 and L2 segments are implemented phonetically tend to go unnoticed by learners due to perceptual assimilation of L2 sounds to L1 categories (Best and Tyler, 2007; Flege, 1995). Learners' ability to notice and develop perceptual awareness of such differences may lead them to shape L2 phonetic categories more accurately and eventually produce L2 sounds with greater accuracy.

In a previous study with the same population Mora, Rochdi and Kivistö-de Souza (2014) had shown that learners significantly modified their native allophonic rules producing shorter VOT in Spanish than in English and English-accented Spanish. In the present



study we assessed learners' level of implicit awareness of non-distinctive phonetic differences between the segmental phonologies of Spanish and English through a delayed mimicry paradigm (Flege and Hammond, 1982). In this task Spanish learners of English were asked to mimic an English accent when producing sentences in Spanish. To the best of our knowledge no study to date has examined the distinction between the English intervocalic voiced stops (/b d g/, as in *about*, *adore*, *again*), realized with a voiced closure ([b d g]), and the intervocalic voiced stops of Spanish (/b d g/, as in *jabón* 'soap', *cada* 'every', *lugar* 'place'), realized as spirants (approximants) ([β ð ɣ]), within a delayed mimicry paradigm. This stop-spirant phonetic distinction in voiced stops has been shown to be difficult for English learners of Spanish to acquire (Face and Menke, 2009; Zampini, 1994) as well as for Spanish learners of English to suppress (Zampini, 1996). We hypothesized that this distinction might involve a lower level of perceptual salience than the VOT distinction in voiceless stops for Spanish speakers, due to the existence of a non-spirantized allophone of /b d g/ occurring after homorganic nasals and laterals (*ambos* 'both', *andar* 'walk', *mango* 'handle', *caldo* 'broth') and in word-initial position in Spanish (*bar* 'bar', *dar* 'give', *gol* 'goal'). The complementary distribution of the stop and approximant allophones of the voiced stops in Spanish result in a realizational rule of spirantization that applies across both morpheme and word boundaries whenever a voiced stop occurs between vowels or between a lateral or nasal and a following vowel (Hualde, 2005; Martínez-Celdrán, 2004). In English, however, intervocalic stops are realized with a full closure in normal non-casual speech (Gimson and Cruttenden, 1994). Consequently, in order for Spanish speakers to accurately imitate an English-accent on Spanish words containing intervocalic voiced stops, they would need to inhibit the «automatic» application of this realizational rule. If they inhibited spirantization when mimicking an English accent, this would suggest that they are aware of the cross-language non-distinctive phonetic distinction between the stop and spirant realizations of intervocalic voiced stops.

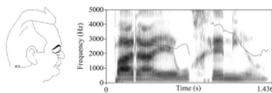
The following two research questions (RQs) were addressed in the present study:

1. To what extent can Spanish learners inhibit spirantization in L2 English?
2. Can Spanish learners inhibit spirantization when mimicking an English accent on their L1 Spanish?

2. METHODS

2.1. Participants

The participants were 23 Spanish speakers, learners of English as a foreign language (EFL; mean age=22.91 years, $SD=4.46$). We elicited voiced oral stops in intervocalic position in Spanish, English and English-accented Spanish through a read aloud task containing target words in sentence frames. Five native speakers of English (mean age = 28.20 years, $SD=4.15$) were asked to read the sentences in English to obtain baseline productions of the English words. The Spanish speakers were Spanish-dominant Spanish-Catalan bilinguals with an intermediate-to-advanced level of English. They had learned English as a foreign language in adulthood in formal instructional settings and at the time of testing were studying a degree in English at university.



2.2. Materials

Spanish and English target words were elicited in a read-aloud task consisting of carrier phrases with the following structure: *Digo CVCV una vez* for Spanish, and ‘I say CVCV again’ for English. The 3 voiced stops /b d g/ were in intervocalic position in disyllabic words. The sentences contained 5 words with intervocalic the voiced stops /b d g/ (15 intervocalic voiced stops) in each one of the two languages, Spanish and English. Five words (approximately 20% of the total) containing no oral stops were also embedded in the same sentence frames as distracters. The participants read the sentences three times in randomized order. A total of 45 voiced stops (15 x 3 repetitions) per participant were obtained for acoustic analysis (see table 1).

Spirantization of /b d g/ in intervocalic context					
Spanish [β ð γ]			English [b d g]		
[β]	[ð]	[γ]	[b]	[d]	[g]
<i>haba</i>	<i>nada</i>	<i>daga</i>	<i>abolish</i>	<i>adapt</i>	<i>again</i>
<i>loba</i>	<i>moda</i>	<i>saga</i>	<i>about</i>	<i>adore</i>	<i>ago</i>
<i>sebo</i>	<i>dedo</i>	<i>pego</i>	<i>above</i>	<i>adept</i>	<i>against</i>
<i>lava</i>	<i>cada</i>	<i>paga</i>	<i>reborn</i>	<i>reduction</i>	<i>begin</i>
<i>nabo</i>	<i>nado</i>	<i>hago</i>	<i>abort</i>	<i>adopt</i>	<i>regard</i>

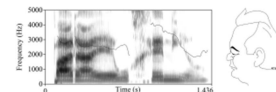
Table 1. *Word stimuli used in the read-aloud task.*

2.3. Procedures and measures

The participants in the read-aloud task were given instructions in Spanish on how to read at normal speed the randomized list of Spanish carrier phrases containing the target Spanish words. Then they were asked (in English) to read the English carrier phrases containing the target English words. Finally, they were asked (in Spanish) to read the Spanish carrier phrases again, but this time with what they considered to be an English accent. Following Flege and Hammond (1982), no demonstration of English-accented Spanish or any explicit instructions concerning how one might produce the effect of English-accentedness on the Spanish phrases were provided to participants. The participants’ oral productions were recorded on a Marantz PMD660 digital recorder at 48kHz sampling rate in a sound-proof booth. Each recording session lasted for approximately 40 minutes. The target word tokens were spliced for subsequent acoustic analysis in Praat.

3. RESULTS

In order to assess learners’ level of awareness of cross-language phonetic differences with respect to spirantization we compared the outcome of the acoustic measures for the English-accented words in the mimicking task to the outcome of the same measures in the Spanish (L1) and in English (L2) words.



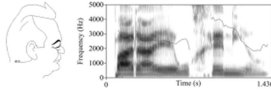
Spanish speakers' ability to inhibit their L1 spirantization rule in the intervocalic voiced stops of English and English-accented Spanish words was assessed by means of two measures: percentage of non-spirantized stops and closure duration. The acoustic measurements revealed that native English speakers hardly ever produced a spirantized intervocalic stop (these stops were realized with a closure of 82 milliseconds on average) whereas Spanish speakers' intervocalic stops were almost always spirantized (table 2). However, when producing English words, Spanish speakers succeeded in inhibiting spirantization in 81% of the cases, although the mean intervocalic closure duration (57.04 msec) was shorter than that obtained by the native speakers (82 msec).

Interestingly, success in inhibiting spirantization in English words did not appear to have to a similar corresponding spirantization inhibition pattern in English-accented Spanish words. The results show that Spanish speakers, despite their ability to produce non-spirantized voiced stops in English words, were largely unable to inhibit spirantization when mimicking English-accented Spanish words. This suggests that the Spanish learners may have developed a certain implicit knowledge about the phonetic realization of intervocalic voiced stops in English, but unlike the pattern observed by Mora et al. (2014) for VOT production, they were unaware of the non-distinctive phonetic difference between Spanish and English voiced stops in intervocalic position, as they did not succeed in inhibiting spirantization when imitating English-accented Spanish (see Figure 3a-b).

Words	/b d g/	
	non-spirantized stops (%)	closure duration (ms)
Spanish	0.38 (1.09)	0.18 (0.55)
English	81.73 (21.80)	57.04 (24.02)
English-accented	15.45 (10.03)	32.97 (18.52)
English (NSs, $N=5$)	99.55 (0.993)	82.60 (17.38)

Table 2. Percentage of non-spirantized stops and closure duration (in milliseconds) as a function of word type.

One-way ANOVAs on the percentage of non-spirantized stops (NSP) and closure duration (CD) with *word type* (Spanish, English, English-accented) as the within-subjects factor revealed a main effect of *task type* on NSP ($F(2, 21)=156.45, p<.001 \eta^2=.937$) and on CD ($F(2, 21)=68.67, p<.001 \eta^2=.867$). Bonferroni-adjusted pairwise comparisons indicated that NSP in Spanish words was significantly lower than in English words ($p<.001$) and English-accented Spanish ($p<.001$), and CDs were significantly longer in English words ($p<.001$) than in English-accented Spanish words ($p<.001$). In English-accented Spanish words learners obtained NSP scores that were much closer to the values of Spanish for this measure (intervocalic stops were spirantized) than to the values of English (intervocalic stops realized with a closure). Although only 15.45% of the English-accented /b d g/ were realized with a stop closure, the duration of the closures (CD) in the English and English-accented words appeared to be related to one another ($r=.429, p=.041$), suggesting that when a closure was present, learners who produced longer closure durations in English words also produced longer closure durations in



English-accented Spanish words. These findings suggest that Spanish learners had not developed implicit awareness of non-distinctive phonetic differences between Spanish and English as regards spirantization (see figure 1).

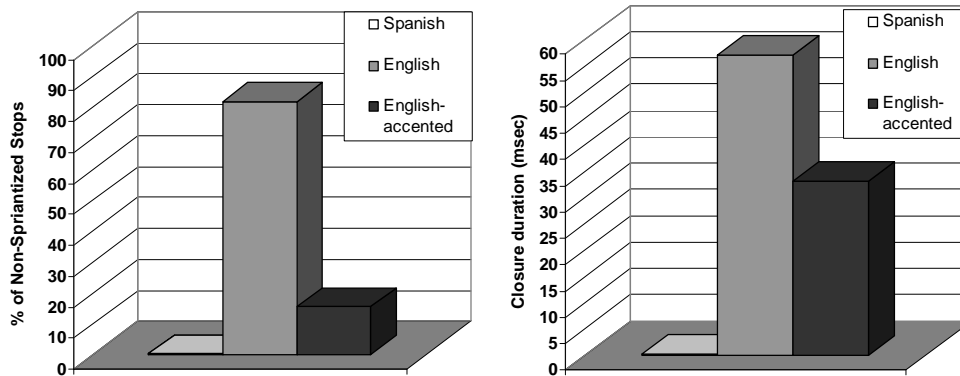
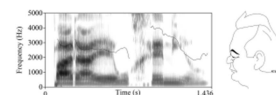


Figure 1. Mean percentage of non-spirantized stops (left) and closure duration (right).

4. DISCUSSION AND CONCLUSIONS

This study investigated Spanish EFL learners' level of awareness of a non-contrastive phonetic difference between the phonologies of Spanish and English using a delayed mimicry task. More specifically we examined the inhibition (or application) of a spirantization rule of Spanish yielding approximant realizations of voiced oral stops in intervocalic contexts to the L2 English of a group of Spanish learners.

The findings show that Spanish learners successfully inhibited spirantization in L2 English (RQ1) but failed to do so when imitating an English accent on their L1 Spanish (RQ2), indicating lack of phonological awareness of this non-contrastive feature of Spanish-English inter-phonology. This stands in contrast to the findings of a previous study with the same population and methods (Mora et al, 2014) as regards cross-language differences in VOT. In that study learners were able to modify their VOT in their English-accented L1 Spanish to the extent that they were able to modify it in their L2 English. As noted by Mora et al. (2014), the relative salience of the cross-language differences in aspiration may promote the development of L2 phonological awareness based on VOT differences. However, noticing the difference between the Spanish spirantized intervocalic stops and the English non-spirantized stops becomes a much more demanding task for at least two reasons. First, the English intervocalic voiced stops are realized in the same way as the Spanish voiced stops occurring in non-intervocalic position. Secondly, in order for Spanish learners to produce non-spirantized English intervocalic voiced stops, they need to inhibit (rather than learn to apply) an allophonic alternation rule that applies across the board in the phonology of Spanish. Consequently, we predicted that the EFL learners in the present study would find it much harder to inhibit spirantization in voiced intervocalic stops than to produce voiceless stops with longer VOT when imitating an English accent on Spanish words.

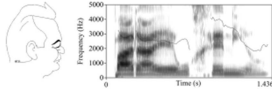


The fact that Spanish speakers were largely unable to inhibit spirantization when mimicking English-accented speech but mostly inhibited it when producing English speech provides important, compelling evidence that L2 PhonA may include, but is distinguishable from, implicit knowledge of the phonetic properties of L2 sounds. When speaking English Spanish participants largely avoided spirantization, showing that the phonetic codes they implemented were target-like, reflecting their underlying knowledge of the phonetic properties of L2 intervocalic voiced stops. However, when asked to imitate English-accented speech, they failed to inhibit spirantization, as if they did not possess the implicit knowledge they had used to avoid spirantization in the production of English words. We interpret this finding as providing evidence that Spanish speakers lacked implicit phonological awareness of the phonetic differences between Spanish and English stops in intervocalic position, and this is why they were unable to activate the appropriate articulatory scores to produce English-like non-spirantized (full-closure) intervocalic voiced stops in the mimicking task. Thus, participants were unsuccessful at modifying their L1-like spirantization when mimicking an English accent.

The present study has shown that a foreign accent mimicking task may be used successfully to access learners' implicit knowledge about non-distinctive phonetic differences between L1 and L2 allophonic variants of phonological segments, and to assess learners' level of awareness of such phonetic differences, which are hardly verbalizable explicitly. The findings provide support for including implicit knowledge about the phonological system of the target language in segmental, suprasegmental and phonotactic levels in an operational definition of L2 phonological awareness.

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