

A comparative study of Estonian and Spanish vowels in L1 and L2 production

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In this paper we compare the Estonian and Spanish vowel systems in the production of L1 and L2 speakers of the both languages. The Speech Learning Model (SLM) suggests that obtaining L2 categories that are “new” compared to L1 is easier than obtaining those that are “similar” to L1 categories. Spanish has 5 vowels /i, e, a, o, u/. Estonian has 9 vowels /i, y, e, ø, æ, a, o, x, u/. The vowels /i, u, e, o/ being identical in both languages, while Estonian /æ/ and /a/ are similar to Spanish /a/ and Estonian /y, ø, x/ do not have corresponding vowels in Spanish. In this paper we examine how the two L2 groups obtain the “new” and the “similar” categories compared to the categories that are identical in both languages. Additionally we show that the learning time has a great effect on obtaining the L2 vowel categories.

Keywords: Estonian vowels, Spanish vowels, L2 vowel production

1. Introduction

Languages differ in their vowel inventory size while there are certain patterns how the vowel space is covered in most languages (Liljencrants & Lindblom 1972). All languages use at least three different vowels /a, i, o/ or /a, i, u/. Languages tend to use those three vowels because they are far apart in the vowel space. It also seems that languages prefer to use odd number of vowels, probably because the vowel space has a triangular shape (Ladefoged 2005).

Cross-linguistic studies have shown the perceptual space of each vowel category is expanded to cover the space evenly in the case of smaller number of vowels in a language (e.g. Näätänen et al. 1997). On the other hand a smaller number of categories does not necessarily consequence greater within-category variation in production, and the distribution of the vowels depends more on language-specific pronunciation base than a universal maximal contrast in the available space (Bradlow 1995).

The Speech Learning Model (SLM) suggests that obtaining L2 categories that are “new” compared to L1 is easier than obtaining those that are “similar” to L1 categories (Flege et al. 1997). In this

paper we compare the Estonian and Spanish vowel systems in the production of L1 and L2 speakers of the both languages. Spanish has 5 vowels /i, e, a, o, u/ that are symmetrically spread over the vowel space (Table 1). The Estonian vowel system (Table 2) on the contrary is more crowded, having 9 vowels /i, y, e, ø, æ, ɑ, o, ɤ, u/, that additionally interact with the quantity. Estonian has as rather complex three-way quantity system, which functions over a trochaic disyllabic foot. Together with the vowel duration, the vowel quality changes from more central in short (Q1) to more peripheral place of articulation in long (Q2) and overlong (Q3) quantity degrees. In unstressed syllables, the quantity pattern is reversed, the vowels being longer in Q1 and shorter in Q3, and while the unstressed vowels are reduced in general, similar quantity-related variation of vowel quality can be seen as in the stressed syllables (Eek & Meister 1998; Lippus et al. 2013). In Spanish the quantity is not relevant, the longer duration is a correlate of stress (Quilis & Fernández 1996).

Table 1. Spanish vowels system.

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	

Table 2. Estonian vowel system.

	Front	Central	Back
High	i, y		u
Mid	e, ø	ɤ	o
Low	æ		ɑ

In this paper we are analysing Spanish and Estonian vowels in both L1 and L2 production. We expect that:

- The Estonian L1 speakers are more sensitive to vowel duration and the Spanish L1 speakers produce the vowels with a greater variation in duration. At the same time we expect the Spanish stressed vowel duration correspond to Estonian long rather than short vowel duration.

- The vowels /i, e, u, o/ are the same in both languages and there is no difference in their place of articulation.
- Estonian L1 speakers produce Spanish /a/ more back than Spanish L1 speakers, while Spanish L1 speakers merge Estonian /ɑ/ and /æ/ into a central low vowel.
- Spanish L1 speakers merge Estonian /y, ø, ʏ/ into an ambiguous central vowel.
- As there is a smaller number of vowels in Spanish, a greater dispersion of vowel quality could be expected in Spanish L1 production than in Estonian L1 production.

2. Materials and Methods

The data was recorded from 12 speakers: six Estonian L1 Spanish L2 speakers and six Spanish L1 Estonian L2 speakers (three females and three males in both groups). The background information of the subjects in the Spanish L1 group is given in Table 3. They were aged from 16 to 42 and have learned Estonian from 5 months to 12 years while living in Estonia. One of the speakers attends to Estonian high school and uses Estonian in her everyday life. Other speakers use mainly Spanish because they are involved in the local Spanish community.

Table 3. Spanish L1 group.

Gender	M	M	M	F	F	F
Year of birth	1974	1988	1988	1997	1971	1978
Place of birth	Cataluña, Spain	Valencia , Spain	Sevilla, Spain	Cádiz, Spain	Cádiz, Spain	Cádiz, Spain
Other languages	English, French, Slovenian, Catalan	French	English, French	English, French, Italian	Italian	English, Italian
Estonian studies	2.5 years	1.5 years	0.5 years	12 years	2 years	2 years
Lived in Estonia	3.5 years	2 years	8 months	12 years	12 years	6 years

The subjects in the Estonian L1 group are described in Table 4. They were aged from 21 to 28 and all of them were students of University of Tartu. Most of them have studied Spanish at language courses, some have studied Spanish on their own. Their Spanish studying time ranges from 1.5 to 3.5 years. Four subjects have Spanish as their main subject at University of Tartu.

Table 4. Estonian L1 group.

Gender	M	M	M	F	F	F
Year of birth	1990	1990	1985	1991	1992	1992
Place of birth	Tallinn, Estonia	Tartu, Estonia	Tallinn, Estonia	Viljandi, Estonia	Tartu, Estonia	Paide, Estonia
Other languages	English, Russian, Italian	English, Russian, Polish, German	English, Russian, Finnish	English, Russian, German, Italian, Latin	English, German, French	English, Russian, French, Italian
Spanish studies	3.5 years	1.5 years	2 years	2 years	1.5 years	1.5 years

The data consists of the 12 speakers' production of the five Spanish and nine Estonian vowels. Each target vowel was placed in the stressed first syllable of words with CVCV structure, which was embedded in a carrier sentence. The test words were placed in the final position of the sentence to receive the focal stress. To eliminate the possible quantity-related variation in Estonian vowel quality, only long vocalic quantity words were selected. As discussed above, we decided for using Estonian long rather than short quantity because in Spanish the duration is a strong correlate of stress and we expected the duration of Spanish stressed vowels to be the most comparable to Estonian long vowels.

The experiment was carried out in a recording booth at the University of Tartu using the SpeechRecorder software. There were 10 sentences for each target vowel, thus each subject read $5 \times 10 + 9 \times 10 = 140$ sentences. The sentences were presented to the subjects in randomized order in two blocks for Spanish and Estonian. The target vowels were manually tagged in Praat (Boersma & Weenink 2014). The measurements of the duration, and the first and the second formants from the midpoint of the target vowel were extracted with a Praat script.

3. Results and Discussion

Figure 1 shows the vowel duration in Spanish and Estonian produced by the two groups. The hypothesis that the Spanish stressed vowel duration corresponds to the duration of Estonian long vowels can be rejected: both groups produced the Spanish vowels as short and Estonian vowels as long and there is no greater temporal variation in the Spanish L1 group. However, there is a significant interaction of the language and the mother tongue: in both languages the vowels produced by the L1 group are shorter than by the ones produced by the L2 group.

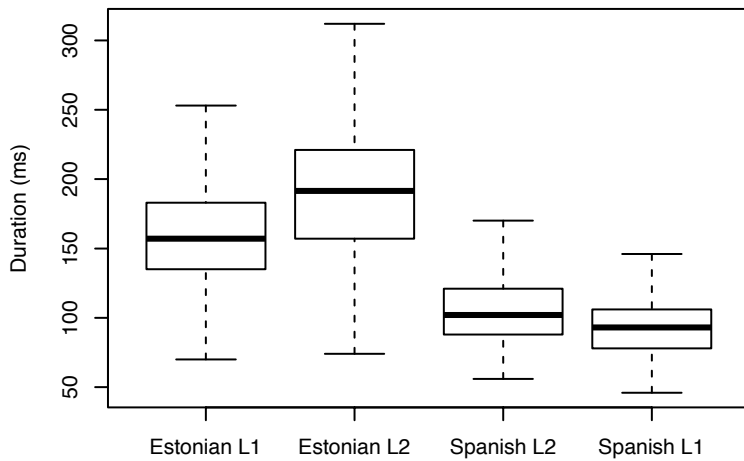


Figure 1. The vowel duration in Estonian and Spanish produced by the two groups.

In order to compare the vowels of the two languages produced by the two groups, the formant values were log-scaled normalized to z-scores for each speaker. Figure 2 plots the normalized values in F1-F2 space.

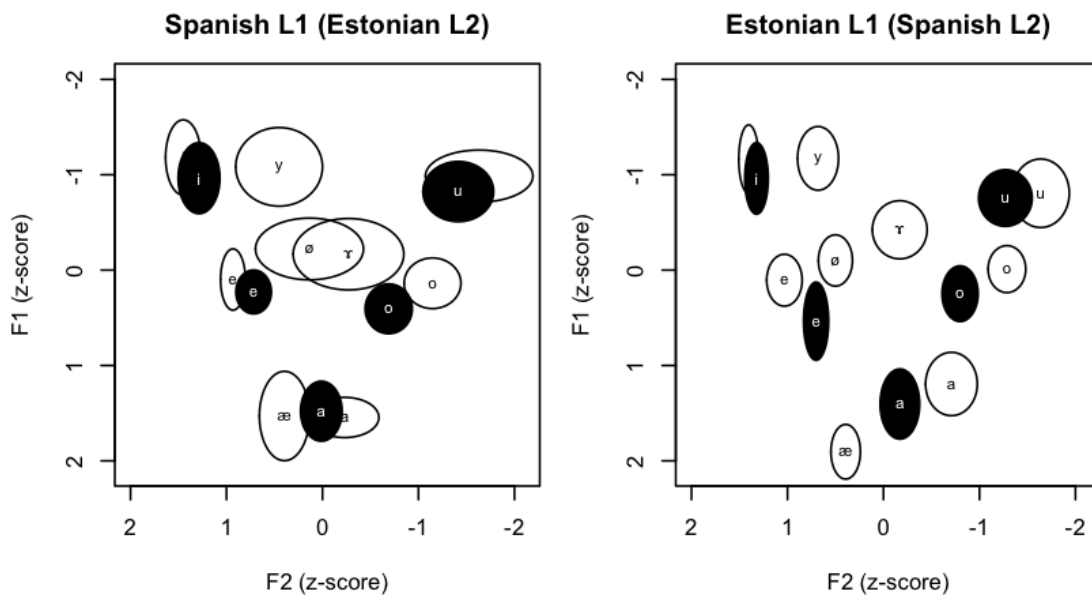


Figure 2. Spanish (black) and Estonian (white) vowels produced by the Spanish L1 group in the left and the Estonian L1 group in the right panel, the ellipses showing the standard deviation of the normalized formant values.

Figure 2 shows that the L1 vowels in both languages have approximately the same amount of within-category variation. The non-low vowels /i, e, u, o/ that fall in the same vowel category in

both languages are produced more peripheral in Estonian and more central in Spanish by both speaker groups. This difference between the two languages follows the same pattern in the production of both speaker groups and there seems to be no L1 bias or language learning effects. This difference can be an effect of the vowel duration, as both groups produced the Estonian vowels with a considerably longer duration than the Spanish vowels.

The Spanish vowels are produced in an equally spaced triangular pattern by both groups except that the low vowel /a/ is perfectly in the centre for the L1 group while the L2 group has produced it more back. However, it is difficult to say whether the more central position of Spanish /a/ compared to Estonian /a/ produced by Spanish L2 speakers is the result of language learning or is it just the effect of shorter duration that we could see in the case of the non-low vowels /i, e, u, o/.

In the L2 production of the Estonian vowel system, we can firstly see that the dispersion of the vowel quality is considerably larger for vowels /æ, ø, ɤ, y/. Spanish L1 speaker had to create new categories for Estonian vowels /ø, ɤ, y/. Those three vowels are relatively close to each other, making it difficult for L2 speakers to distinguish them. There is a vast overlap of /ø/ and /ɤ/, which are produced as an ambiguous mid-vowel by the Estonian L2 group. The vowel /a/ in Estonian L2 production is produced more front compared to the L1 group, and /æ/ is higher and more back. Thus Estonian L2 speakers merge Estonian vowels /a/ and /æ/ into Spanish vowel /a/.

It seems that the more complicated Estonian vowel system is more difficult for the Spanish L1 Estonian learners than the more sparsely occupied Spanish vowel system is for the Estonian L1 Spanish learners. However, this difference in the two L2 groups could be a result of the differences in learning time. In order to assess the successfulness of obtaining the L2 categories, the Euclidian distance of each L2 speakers vowels was calculated from the mean value of the L1 group. The distance of L2 from L1 vowels as a function of learning time is plotted in Figure 3.

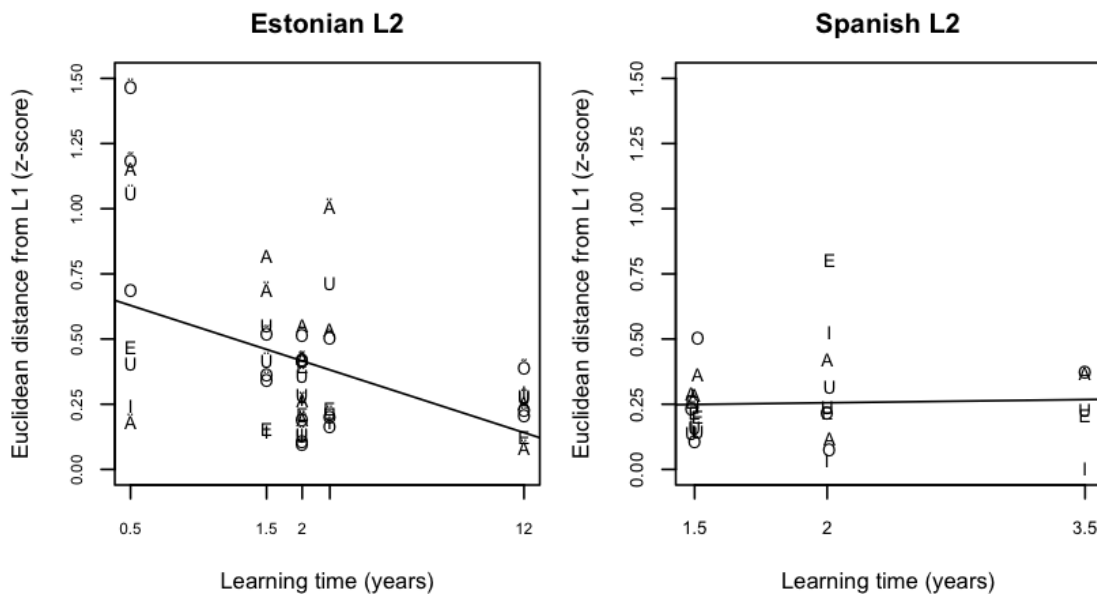


Figure 3. The Euclidean distance of the L2 speakers' vowels from the L1 mean value as a function of learning time and the fitted linear regression line.

Figure 3 shows that in the case of Estonian L2 group, there is a significant correlation between the Euclidian distance of the vowels from the L1 mean and the learning time ($r = -0.813$). This means that with a longer language learning time the vowels are produced closer to the L1 target values.

In case of Spanish L2 there is no significant correlation between the distance from L1 target vowels and learning time. Regrettably the timespan in Spanish L2 group was much more homogeneous than in Estonian L2 group and one might speculate that a wider range could possibly reveal an effect of learning time to the vowel category learning also in Spanish L2 group. On the other hand the Spanish L2 distances from the L1 target values are already rather low with considerably short learning time.

4. Conclusions

The results show that the four vowels /i, u, e, o/ are identical in both languages. As expected from the SLM, if there are two categories in one language that are close to but not the same with, as it is the case with Spanish /a/ and Estonian /æ/ and /ɑ/, the L2 speakers have difficulty obtaining the L2 category without confusing it with their L1. Estonian L1 speakers produce Spanish low vowel /a/ more back, close to their L1 corresponding vowel /ɑ/. Spanish L1 speakers merge Estonian low vowels /æ/ and /ɑ/ into Spanish /a/.

The three non-high vowels /ø, ɤ and y/ that do not occur in Spanish were produced with a greater dispersion by the L2 speakers. They are difficult for Estonian L2 speakers to discriminate and especially the mid-high vowels /ø/ and /ɤ/ were often produced as an ambiguous mid-vowel.

In conclusion we can say that learning has an important role in the acquisition of L2. The results suggest that the Spanish system with 5 vowel categories is more easily obtained by the Estonian L1 speakers whose native vowel system is more complicated, but the Spanish L1 group showed a strong effect of learning time: the longer they have learned Estonian the closer they reach to the Estonian target vowels.

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