

Spanish and Catalan in Majorca: Are There Contact-Induced Changes in the Catalan Vowel System?

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1. Introduction

The vowel systems of Catalan and Spanish are considerably different. Spanish has a simple five-vowel symmetrical system, which is the most common number of vowel phonemes cross-linguistically (Hualde, 2005). As shown in Table 1, the vowels contrast along two dimensions: along the height dimension, there are two high vowels (/i/ and /u/), two mid vowels (/e/ and /o/), and one low vowel (/a/); and along the frontness/backness dimension, there are two front vowels (/i/ and /e/), one central vowel (/a/), and two back vowels (/u/ and /o/). In contrast, Catalan has a seven-vowel symmetrical system with an additional contrast in height, distinguishing higher-mid vowels /e/ and /o/ from lower-mid vowels /ɛ/ and /ɔ/ in stressed syllables, as shown in Table 2. Moreover, the variety of Catalan spoken in Majorca has the additional vowel phoneme /ə/, which may appear both in stressed and unstressed position (Recasens, 1991).

Table 1. The vowel inventory of Spanish

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	
	Nonround		Round

Table 2. The vowel inventory of Catalan (NB: /ə/ is phonemic in Majorcan Catalan)

	Front	Central	Back
High	i		u
Higher-mid	e	(ə)	o
Lower-mid		ɛ	ɔ
Low		a	
	Nonround		Round

In terms of the acoustic properties of vowels, the first two formants (F_1 and F_2) provide information that can be used to uniquely identify the vowels in Spanish versus Catalan (Hualde, 2005). Table 3 below provides the average formant values of the Spanish vowels, based on analyzed data from sixteen male speakers (Quilis and Esgueva, 1983). Table 4 presents the acoustic properties of Majorcan Catalan vowels, based on the average F_1 and F_2 frequencies of five speakers (Recasens and Espinosa, 2006).

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Table 3. Spanish vowels. Average values in Hz for F₁ and F₂ (Quilis and Esgueva, 1983)

	F ₁	F ₂
/i/	264.5	2317.5
/e/	435.8	1995.01
/a/	657.28	1215
/o/	474.5	888.4
/u/	293.5	669.08

Table 4. MC vowels. Average values in Hz for F₁ and F₂ (Recasens and Espinosa, 2006)

	F ₁	F ₂
/i/	328	2151
/e/	489	1905
/ɛ/	659	1739
/a/	739	1464
/ɔ/	708	1178
/o/	547	1000
/u/	394	899
/ə/	563	1393

Of interest in the present paper is the potential influence that these vocalic systems might exert on each other in the context of contact. It is not infrequent for vocalic systems to be affected in situations of language contact. For example, in her acoustic study of Quichua-Spanish contact in Ecuador, Guion (2003) concludes that acquiring the five-vowel system of Spanish affects the production of native Quichua vowels /i/, /a/, and /u/. Specifically, the Spanish-Quichua bilinguals produced higher Quichua vowels than monolingual Quichua speakers in the same community. Bullock and Gerfen (2004) present experimental evidence that the vowel system of Frenchville French, a variety of French spoken in Pennsylvania, is undergoing a process of phonetic convergence with English motivated by the auditory and acoustic similarity between the mid vowels in English and /ø/ and /œ/ in French.

Several studies have examined the contact-induced phonological changes that may be manifest among Spanish-Catalan bilinguals. Recasens (1991) reports that urban varieties of Catalan may be merging the four mid vowels (/e/, /ɛ/, /o/, and /ɔ/) into two (/e/ and /o/), and replacing schwa with /a/. Herrick (2006) provides acoustic data that confirms the loss of height contrast between mid vowels in speakers from Barcelona; however, this finding might be complicated by his use of speakers who had moved to the US where they would have had sustained exposure to Spanish and English. In a subsequent experiment, Herrick shows that the height contrast is maintained in other Catalan-speaking regions, namely Bages and Girona (in Catalonia), Ciutadella (in Minorca), and Palma and Lloseta (in Majorca).

Lleó et al. (2007, 2008, 2009) examine the effects of social context, comparing districts in which Spanish is dominant, and observe that the degree of merging in Barcelona is especially noted in the groups of bilinguals who live in a district with a large Spanish-speaking population, and that the older the subjects are, the more target-like their production is.

The findings of the research referenced above invite further study to examine the effect of language dominance. The present paper addresses the influence of dominance in language contact situations by considering a variety of the Balearic dialect, Majorcan Catalan, and by comparing the effects of contact observed in the Catalan vowel systems of Spanish-dominant and Catalan-dominant bilinguals. The remainder of this paper is organized as follows: In section 2, I present a brief overview of the contact situation between Catalan and Spanish in Majorca. Section 3 describes the research questions and hypotheses. Section 4 details the design and procedure of the experiment. Section 5 includes the results from the acoustic analysis. Finally, section 6 summarizes and presents conclusions.

2. The case of Majorca

The island of Majorca, which is the largest of the Balearic Islands, is located at approximately 200 km from the eastern coast of the Iberian Peninsula in the Mediterranean Sea. Together with Minorca, Ibiza, Formentera, and some of the surrounding islets, it comprises one of the 17 autonomous regions of Spain. According to the 2001 census, 79.9% (702,122) of the population of the Balearic Islands is

concentrated in Majorca.¹ The population strata of Majorca by place of birth shows that 62.9% (442,193) were born in the Balearic Islands, 26.8% (188,279) were born in other autonomous regions of Spain, and 10.3% (71,650) were born abroad (INE, 2001).

The linguistic situation in Majorca (as in the rest of the Balearic Islands) presents differences in the amount of Catalan used, which correlates with the speaker's place of origin and place of residence. Census data (INE, 2001) shows that Catalan has not extended to all the linguistic spheres in the Balearic Islands; the Spanish-dominant group, and especially the immigrant group composed of speakers born outside of Spain, have the lowest percentages of Catalan use, which has also been supported by recent linguistic work (Blas-Arroyo, 2007; Melià, 2002). In addition, the data collected by the Government of the Balearic Islands also shows that the use of Spanish or Catalan varies depending on the specific island and that Catalan is present and is used at varying degrees in urban versus rural areas. Thus, the highest use of Spanish and lowest use of Catalan in the Balearic Islands is in Ibiza, while the highest use of Catalan is in Minorca and inland Majorca. As for Majorca, the lowest use of Catalan is in the city of Palma and in the coastal towns, which are well-known tourist destinations.

When discussing the bilingualism of Majorca it is important to highlight the enactment of the Law of Linguistic Normalization (*Llei de normalització lingüística*) in 1986, which has led to the spread of Catalan to domains that were formerly exclusive to Spanish. Other language policies favoring Catalan have followed, such as the requirement for certain levels of competence in Catalan in order to hold positions in the Civil Service and the public education system. Catalan has most markedly increased its presence in the education system, with the introduction of a required Catalan language class in addition to Catalan becoming the language of instruction. However, dialectal variation between the standard Central Catalan variety and the local Majorcan variety is noticeable.

Majorcan Catalan is a dialect of Catalan spoken by over 600,000 speakers in Majorca, according to sociolinguistic data collected by the *Direcció general de política lingüística* in 2003, sponsored by the Government of the Balearic Islands. This dialect of 'Eastern Catalan' differs from Standard Catalan in that the phonetics and phonology of the Majorcan Catalan include more conservative features from Old Catalan as well as features from other Romance languages with which the variety was in early contact, such as Occitan and Italian (Recasens, 1998). Standard Catalan and Majorcan Catalan both emerge in different contexts of use in Majorca, with the formal registers of the Catalan media and the educational system representing Standard Catalan, and the vernacular of everyday life presenting Majorcan Catalan.

As a variety of Catalan that has recently increased in prestige and spread in contexts of use with a stronger presence in the linguistic landscape, Majorca is an ideal case of bilingualism with a stable language contact situation. This study presents an account of the effect of Catalan-Spanish language contact on vowel inventories in Majorcan Catalan to make a comparison to earlier studies on such effects in Barcelona.

3. The experiment

3.1. Research questions and hypotheses

The main goal of the present experiment is to explore the role of language dominance in the production of the mid-open (/ɛ/, /ɔ/) and mid-closed vowels (/e/, /o/) produced by Catalan-Spanish bilinguals in Majorca to determine whether Majorcan Catalan speakers are losing the distinction between tense and lax mid vowels. In other words, this experiment explores the qualitative differences in the production of the Catalan mid vowels by Spanish-dominant and Catalan-dominant bilinguals to determine whether the distinction between tense and lax mid vowels is being lost in what can be interpreted as a case of convergence, or if, on the other hand, the Majorcan Catalan vocalic system is resisting simplification. Language dominance will also be considered to determine if it plays a role in the distinction. Therefore, the research questions are the following:

- Are the vowels /ɛ/ and /ɔ/ merging towards /e/ and /o/ in Majorcan Catalan?

¹ Source: Balearic Institute of Statistics (INE) Department of Economy, Commerce and Industry, Government of the Balearic Islands.

- Are there differences in production between the Spanish- and Catalan-dominant groups? Is language dominance a significant factor?
- Is the variance in the formant values of each language dominant group (Spanish, Catalan) the same?

As stated above, Spanish and Catalan share five segments in their vowel systems (/a/, /e/, /i/, /o/, and /u/) but only Majorcan Catalan possesses /ɛ/, /ɔ/, and /ə/. According to Lleó et al. (2008) the vocalic system of Catalan exhibits a higher degree of complexity in comparison to the Spanish vowel system, and as a result of language contact there will be a tendency towards simplification. Evidence from previous studies in Central Catalan suggests that the four mid vowels in Catalan, /e/, /o/, /ɛ/, and /ɔ/, are being reduced to two, /e/ and /o/, and that the schwa is being replaced by /a/. Furthermore, assuming the influence of the subset system of Spanish, the hypothesis is that the front mid vowels /ɛ/ and /e/ and the back mid vowels /ɔ/ and /o/ will merge in the Spanish-dominant group but not for the Catalan-dominant group. However, the question lies in whether there will be a significant difference between how Catalan- versus Spanish-dominant groups produce /ɛ/ and /ɔ/ and whether there is merging of the phonemes /ɛ/ with /e/ and /ɔ/ with /o/ in both, any, or neither of the participant groups. In addition, the Spanish-dominant bilinguals might be more likely to produce Catalan /ɛ/ and /ɔ/ with formants approximating Catalan /e/ and /o/ (replicating what Lleó et al. (2007, 2008) found in Barcelona), while Catalan-dominant bilinguals would be expected to maintain this Catalan-specific contrast with less variance. Whether the Spanish-dominant group's production of these mid lax vowels is closer to the vowels /ɛ/ and /ɔ/ or to /e/ and /o/ will depend on the degree of convergence produced by this contact situation.

To analyze these bilingual groups' behaviors in production, the speech of four Spanish-dominant bilinguals and four Catalan-dominant bilinguals were recorded and an acoustic analysis was performed to measure the data. The acoustic analysis consisted of the comparison of the formant values of open /ɛ/ and /ɔ/ words with the values of their closed counterparts in Catalan, namely /e/ and /o/. The formant values of these vowels were also compared between both groups.

4. Method

4.1. Participants

Eight (8) Catalan-Spanish bilingual residents of Majorca participated in the present study. They were all female and their mean age at the time of testing was 29.8 (range 18-62 years). All participants were born, raised, and educated on the island of Majorca and had extensive exposure to both languages on a daily basis. These participants spoke Catalan and/or Spanish in the household and were not native in any other language. The participants were divided into two groups, Spanish-dominant or Catalan-dominant, according to their responses to a background questionnaire that included items on language history, language of education, language use across domains, and language preferences across activities. A bilingual speaker was classified as Spanish-dominant if he/she mainly spoke Spanish at home, considered Spanish his/her native language, and favored the use of Spanish in his/her daily life. A classification as Catalan-dominant applied when Catalan was answered in response to these questions. Sample items appear below.

- (1) a. Lengua en que te comunicas con tu madre/padre/hermanos; si más de una lengua ¿en cuál os comunicáis principalmente?
'Language in which you communicate with your mother/father/siblings; if more than one language, in which do you principally communicate with them?'
- b. Lengua en que recibiste la mayoría de la instrucción en la escuela primaria/secundaria/universidad
'Language in which you received most of the instruction in primary school/high school/university'
- c. Lengua en que te sientes más cómodo/a expresándote oralmente/de forma escrita
'Language in which you feel most comfortable expressing yourself orally/in writing'

- d. ¿Qué lengua consideras tu lengua nativa? ¿Catalán o castellano?
‘Which language do you consider to be your native language? Catalan or Spanish?’
- e. Si puedes elegir ver una película en castellano o catalán, ¿cuál prefieres?
‘If you can choose to see a film in Spanish or Catalan, which do you prefer?’

4.2. Procedure

Following completion of the questionnaire, participants performed a series of translation tasks in which they were asked to silently read sentences written in Spanish and orally translate into Catalan. The stimuli consisted of five practice sentences and fifty-two (52) Spanish sentences designed to elicit the Catalan equivalent containing the target vowels /e/, /ɛ/, /o/, and /ɔ/. The vowels subject to analysis were all stressed vowels, in four contexts: a labial context (es **p[ɔ]bre** ca està brut, ‘the poor dog is dirty’), a dentoalveolar context (compr un **ordinad[o]r**, ‘(I) buy a computer’), a palatal context (I per **aix[ɔ]** obr es **caix[o]**, ‘because of this (I) open the drawer’) and a /l,r/ context (compr un poc d’ **arr[ɔ]s**, ‘(I) buy some rice). An example of the stimuli and its target form is the following:

- (2) a. Spanish (stimulus)
Juan no encuentra la carpeta y por eso abro el cajón y le doy una carpeta nueva
‘Joan cannot find the folder and because of this (I) open the drawer and (I) give him a new folder’
- b. Catalan (target)
En Joan no tr[ɔ]ba sa carpeta i per aix[ɔ] obr es caix[o] i li don una carpeta n[ɔ]va

4.3. Normalization

The recordings were analyzed using *Praat* (Boersma, 2001) and the formant frequencies (F_1 , F_2 , and F_3) of the four vowels /e/, /ɛ/, /o/, and /ɔ/ were measured for the eight participants of the Spanish- and Catalan-dominant groups. In order to make the formant values of each participant directly comparable with those of other participants, inter-speaker differences due to vocal tract size were eliminated by means of normalization. The normalization procedure adopted was Labov ANAE (speaker extrinsic) of Labov’s method using the Vowels² R package, version 1.0-3 (Kendall, Tyler and Erik R. Thomas, 2009). Labov’s method follows the formulas laid out by Labov et al. (2006): “A logarithmic grand mean, G , is calculated from the geometric mean of the natural log of the F_1 and F_2 values of all vowels for all speakers. A logarithmic mean value, S , is then calculated for each speaker by taking the natural log of the F_1 and F_2 values for all of that speaker’s vowels. The anti-log of the difference, $G - S$, is taken for F , the scaling factor for that speaker. Each individual’s formant values are then multiplied by the scaling factor F to obtain her or his normalized values” (Labov, Ash and Boberg, 2006: 39-40).

5. Results

The vowel formant data for each language dominance group (Spanish and Catalan) were plotted in different F_1 ~ F_2 dot plot formats, as shown in Figure 1.

² ‘Vowels’ is an R package for the manipulation, normalization, and plotting of phonetic and sociophonetic vowel formant data. The package instantiates a number of normalization routines (e.g., Bark difference, Nearey, Lobanov) for acoustic vowel data and provides a specialized plotting function to generate vowel plots.

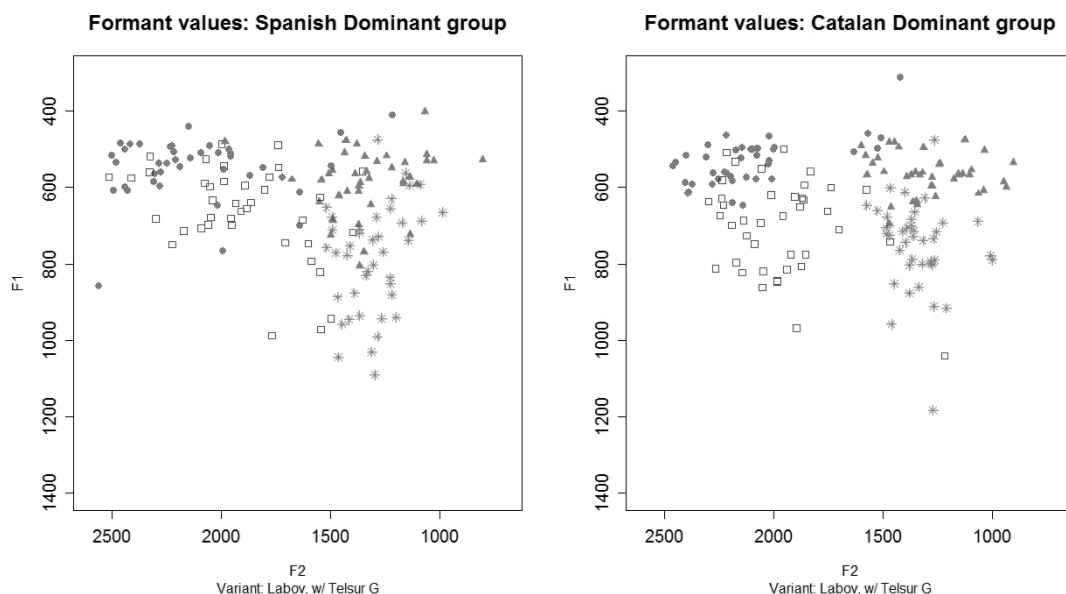


Figure 1. Vowel formant values for the production of /e/, /ɛ/, /o/, and /ɔ/ by the Spanish-dominant and Catalan-dominant groups.

After extracting and measuring the formants for each target vowel, the F_1 and F_2 normalized formant values of /ɛ/ and /ɔ/ were compared to the values of their closed counterparts /e/ and /o/ across both groups of speakers. A one-paired t-test was conducted for the mean difference value of the tense versus lax mid vowel in each group. The results show that there are significant differences in height F_1 between /e/ and /ɛ/, and /o/ compared to /ɔ/ in the Catalan-dominant group ($p=.0009$ for /e/-/ɛ/, and $p=.0001$ for /o/-/ɔ/) and in the Spanish-dominant group ($p=.027$ for /e/-/ɛ/, and $p=.0041$ for /o/-/ɔ/).

Table 6 and Table 7 list the mean normalized formant frequencies (F_1 , F_2) of the four phonemically contrastive Catalan mid vowels /e/, /ɛ/, /o/, and /ɔ/ for the Catalan-dominant and the Spanish-dominant groups. The tables also list the results of t-test analyses of the extent of variation in formant values for F_1 and F_2 of front and back mid-vowels within each group.

Table 5. Catalan-dominant-group: Distinction between /ɛ/ and /e/, and between /ɔ/ and /o/ in MC. Results of a Welch Two Sample t-test of mean F_1 and F_2 positions in vowels for Catalan-dominant group

	F_1		F_2	
	/e/	/ɛ/	/e/	/ɛ/
Mean (Hz)	543	715	2149	2011
Std dev. (Hz)	36.5	42.8	78.5	138
D.f	6		6	
Significance	P< .0009		P<0.13	

	F_1		F_2	
	/o/	/ɔ/	/o/	/ɔ/
Mean (Hz)	575	767	1312	1364
Std dev. (Hz)	16.6	20.4	41.1	64
D.f	6		6	
Significance	P<.0001		P<0.22	

Table 6. Spanish-dominant-group: Distinction between /ɛ/ and /e/, and between /ɔ/ and /o/ in MC. Results of a Welch Two Sample t-test of mean F₁ and F₂ positions in vowels for Spanish-dominant group

	F ₁		F ₂	
	/e/	/ɛ/	/e/	/ɛ/
Mean (Hz)	556	675	2134	1915
Std dev. (Hz)	32.9	75	196	179
D.f	6		6	
Significance	P<0.027		P<0.15	

	F ₁		F ₂	
	/o/	/ɔ/	/o/	/ɔ/
Mean (Hz)	587	793	1349	1320
Std dev. (Hz)	33.7	84.6	17	68
D.f	6		6	
Significance	P<0.0041		P<0.44	

These results provide evidence that Catalan-dominant participants are producing significantly different tense and lax mid-vowels, thus maintaining this Catalan-specific contrast. However, contrary to initial predictions, the Spanish-dominant participants are maintaining this contrast as well, i.e., they are not merging towards the tense mid vowels /e/ and /o/. For visualization purposes, Figure 2 plots the distribution of Majorcan Catalan vowel space in terms of the mean vowel formants for all speakers (circle), for Spanish-dominant speakers (squares), and for Catalan-dominant speakers (triangles).

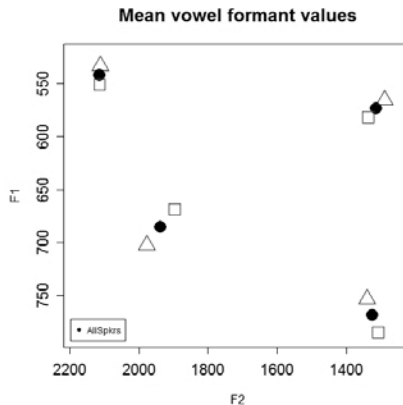


Figure 2. Mean vowel formant values for the production of /e/, /ɛ/, /o/, and /ɔ/ by all participants (circles), Spanish-dominant group (squares), and Catalan-dominant group (triangles).

The following tables present the Labov ANAE normalized formant means (F₁ and F₂) for the four mid-vowels in Majorcan Catalan divided across each individual speaker in the Catalan- and Spanish-dominant groups.

Table 7. Catalan-dominant group: Labov ANAE normalized formant means

Vowel	Formant	Participants				Mean [Hz]
		CAT1 [Hz]	CAT2 [Hz]	CAT3 [Hz]	CAT4 [Hz]	
/e/	F ₁	576.5	569.5	524.7	500.1	542.7
	F ₂	2259.2	2082.9	2104.8	2150.7	2149.4
/ɛ/	F ₁	676.9	766.5	733.5	682.7	714.9
	F ₂	2051.5	1863.7	1946.3	2183	2011.1
/o/	F ₁	592.7	584	555.3	568.2	575
	F ₂	1285	1274.2	1363.9	1326.7	1312.4
/ɔ/	F ₁	737.2	769.3	778.3	782.2	766.7
	F ₂	1275.9	1358.4	1408.1	1414.5	1364.2

Table 8. Spanish-dominant group: Labov ANAE normalized formant means

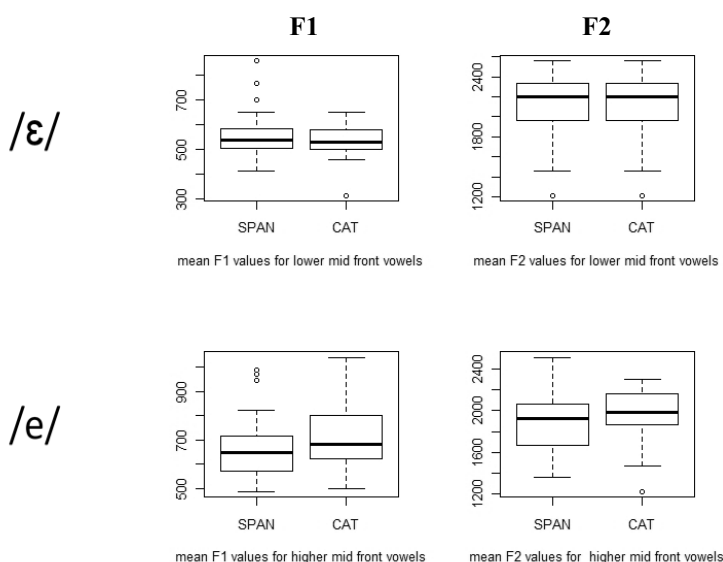
Vowel	Formant	Participants				Mean [Hz]
		SPAN1 [Hz]	SPAN2 [Hz]	SPAN3 [Hz]	SPAN4 [Hz]	
/e/	F ₁	552.7	603.7	538.7	530.1	556.3
	F ₂	2406	2005.8	1978.6	2147.7	2134.5
/ɛ/	F ₁	680.1	580.3	763.7	677.1	675.3
	F ₂	2008.6	2107.2	1704.2	1840.6	1915.1
/o/	F ₁	556.5	631.5	566.4	595.2	587.4
	F ₂	1338.8	1354.5	1371.6	1334	1349.7
/ɔ/	F ₁	709.1	778.4	910.6	772.8	792.7
	F ₂	1312.5	1252.9	1301.9	1414.8	1320.5

The comparison of the mean normalized measurements of F₁ and F₂ for /e/, /ɛ/, /o/, and /ɔ/ for the Catalan- and Spanish-dominant groups suggest that Spanish-dominant bilinguals and Catalan-dominant bilinguals slightly differ in their production of the Catalan vowels /ɛ/ and /ɔ/. However, these differences were not significant upon performance of a Welch Two Sample t-test, as can be seen in Table 10.

Table 9. Mean Labov ANAE normalized F₁ and F₂ frequencies of vowels produced by Catalan- and Spanish-dominant participants. Column 5 lists a Welch Two Sample t-test comparison between vowels produced by Catalan- and Spanish-dominant speakers for each formant

Vowel	Formants	Cat. dom	Span. Dom	t-test p-value
/e/	F ₁	542.7	556.3	0.60
	F ₂	2149.4	2134.5	0.89
/ɛ/	F ₁	714.9	675.3	0.39
	F ₂	2011.1	1915.1	0.43
/o/	F ₁	575.0	587.4	0.54
	F ₂	1312.4	1349.7	0.14
/ɔ/	F ₁	766.7	792.7	0.57
	F ₂	1364.2	1320.5	0.39

As shown, t-tests comparing the production of Catalan- versus Spanish-dominant groups indicate that these differences are not significant ($p > 0.05$). However, a closer look at the distributions of the two language dominance groups seemed to indicate a slight difference in the degree of dispersion in the data. To illustrate this dispersion, boxplots provide useful graphical summaries of distributions displaying differences between the Spanish- and the Catalan-dominant groups (Figure 3).



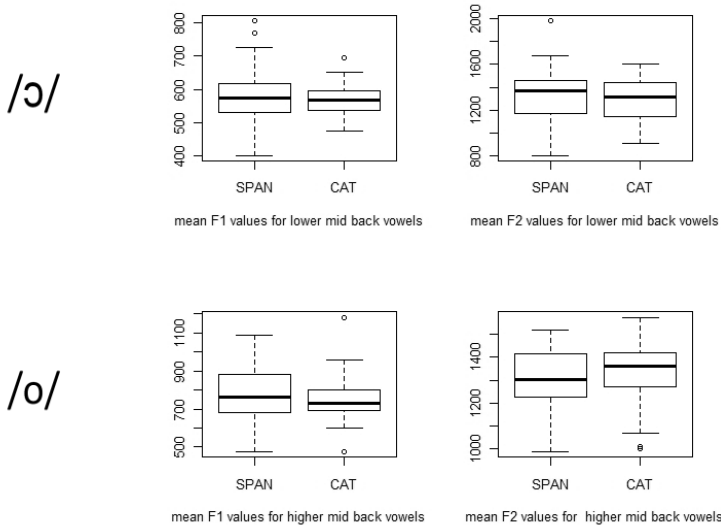


Figure 3. Boxplots comparing F_1 and F_2 normalized formant values of /ɛ/, /e/, /ɔ/, and /o/ between the Spanish- and Catalan-dominant groups (SPAN and CAT).

Some slight differences can be observed in the degree of dispersion (spread) and skewness in the data; therefore a variance test was carried out to determine whether the variances were different in the Spanish-dominant and the Catalan-dominant groups. However, the variance test demonstrated that the two variances for the formant values of the vowels produced are not significantly different for the Spanish- and Catalan-dominant groups, except for the F_1 for /e/ ($p=0.05$) and F_1 /o/ ($p=0.003$).

6. Discussion and conclusions

The results of the present study have shown that Catalan-Spanish bilinguals in Majorca are not merging the phonemes /ɛ/ and /ɔ/ (segments present in Catalan but not in Spanish) with /e/ and /o/, respectively, when speaking Majorcan Catalan. Statistical analyses found significant differences in the vowel production of /ɛ/ and /e/, and between /ɔ/ and /o/ by both Catalan-dominant and Spanish-dominant groups, i.e., all bilinguals are resisting simplification. This result replicates the findings reported in Herrick (2006), in which Catalan- and Spanish-dominant bilinguals of non-Barcelona Catalan (representing five regional dialects) maintained a height contrast among the mid vowels. However, the findings diverge from those of Lleó et al. (2007, 2008, 2009), who report that the Catalan spoken in Barcelona is merging the four mid vowels (/ɛ/, /e/, /ɔ/, and /o/) into two (/e/ and /o/). This merger, which is attributed to the influence of Spanish, exists at different degrees depending on the speakers' age and on place of residence; merging is argued to take place within the groups of the Catalan-speaking population in Barcelona that have been most exposed to Spanish from birth and reside in mainly Spanish-speaking neighborhoods. The present study cannot reach the same conclusions for contact-induced changes in the vowel system of Majorcan Catalan, since the contrast between the tense and lax mid-vowel is retained by both the Catalan- and the Spanish-dominant groups. Of particular note, the Spanish-dominant participants maintained this Catalan-specific contrast for the tense and lax mid-vowels. These divergent findings call for the need to examine regional and social variation together with residential patterns.

These regional and social differences in production might be manifested in perception as well; thus, further research in perception to complement studies in production would be desirable. Pallier et al. (2001) conclude that Spanish-dominant bilinguals in Barcelona process Catalan-specific minimal pairs as homophones. Therefore, these Spanish-dominant bilinguals who grew up in Catalonia, even though they had attained a high degree of proficiency in Catalan, were argued not to be able to internalize the Catalan-specific contrasts. The present study, on the other hand, has shown that the Spanish-dominant speakers in Majorca may not be “deaf” to Catalan vowel contrasts since they maintained the contrast between lax and tense mid vowels.

In addition to a perception study, the results of this study suggest a wide range of possibilities for future research. The preliminary results call for an examination of the interaction of language dominance with other social factors in predicting phonetic patterns. Variation can likely be explained at least in part by the differential use of Catalan versus Spanish, but a larger sample with more participants will allow a detailed analysis of the factors that determine these differences in Majorcan Catalan. Finally, like any other experiment involving translation, the task might affect performance and vowel quality, specifically, an increase in phonetic fundamental frequencies or a shift in formant center frequencies for F₁ and F₂ due to the Lombard effect. To correct this, future analyses from an elicitation task avoiding translation exercises would provide more evidence supporting the claims presented in this paper.

This study has provided evidence that Catalan speakers in Majorca do not display the contact effects observed in Barcelona; that is, there is no evidence of Catalan speakers in Majorca merging /ɛ/ and /ɔ/ towards /e/ and /o/. Future work is needed to probe whether this difference between speakers in Barcelona and Majorca is the result of divergence in the dialects' vowels or if it reflects the different sociolinguistic profile of Majorca versus Barcelona, and such a study could examine the role of sociolinguistic factors in determining identity issues and how they help to explain language usage.

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