

## DIFFERENCES IN VOWEL QUALITY IN TWO CATALAN DIALECTS. DATA FROM MDS.

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### ABSTRACT

Phonetic descriptions which concern themselves with dialectal distinctions have different goals: a) general descriptions of all the linguistic domain and b) more specific detail focusing on the differences between dialects, such as "lleidatà" and "barceloní". Following this second line of dialectal contrast, this paper aims at demonstrating acoustical differences of openness between the middle vowels of the anterior series of two Catalan dialects: "barceloní" (Eastern Catalan) and "lleidatà" (Western Catalan). The data have been statistically treated by means of MultiDimensional Scaling (MDS), and the configurations obtained allow us to observe significant differences between open and closed vowels in both dialects.

### 1. INTRODUCTION

All languages present phonic features which are detected differently according to dialectal differences, so that 1) they can be easily distinguished, 2) are evident in the production act but are difficult to perceive, or 3) are imperceptible. In the Catalan vowel system, some differences are very difficult to perceive but are clearly marked from an acoustic point of view. We will focus on two vowels that are a good example of this.

Catalan is a Romance language spoken by some seven million inhabitants of Spain, distributed over Catalonia, Valencia, part of Aragon and the Balearic Islands. It is also spoken in Andorra, Roussillon and L'Alguer. Catalan has two major dialectal regions: the Eastern diasystem (including the Eastern dialects: Central Catalan, Balearic, Roussillonese and Algerese) and the Western diasystem (containing the Western dialects and Valencian). On the one side, the vocalic differences between these two diasystems are based on the fact that in non-stressed position the Eastern dialects have three vowels and the Western ones, five; on the other side, in stressed position, there are differences between both diasystems in the openness of the vowels. Both Central Eastern Catalan and Western Catalan have two different middle vowels of the anterior series in stressed position: /e, ε/ (e.g.: [seu]=his/her/their vs. [scu]=cathedral). However, the realizations /e/ and /ε/ in both dialects are different acoustically, even though this difference is not easily perceived. As a consequence, different phonic distributions occur.

The middle vowels of Eastern and Western Catalan have been reported to have different vocalic openness. Using perceptual judgements basically, several authors coincided in affirming that the stressed middle vowels of Eastern Catalan were more open than Western Catalan ones (cf. Badia, 1973; Veny, 1983; Recasens, 1986a, 1991). Following this conception, the purpose of this paper is presenting a contrastive analysis of the acoustic differences between utterances by speakers of Central Eastern Catalan, on the one hand, and North-Western Catalan, on the other. Besides, we intend to validate these dialectal contributions using a statistical technique known as MultiDimensional Scaling (MDS).

### 2. MULTIDIMENSIONAL SCALING (MDS)

This technique is based on the assumption that, for a group of elements, a matrix of experimental proximities can be obtained from which a t-dimensional space is created (where t is equal to the number of dimensions) and the elements are represented in such a way as to ensure that the



In the graph the vowels organize themselves according to openness and dialect: the top part corresponds to the utterances from North-Western Catalan (Lleida); and the bottom, to the Central Eastern dialect from Barcelona; on the right, the open vowels; and, on the left, the closed ones. It is evidence that each dimension represents a clearly differentiated space that coincides with the phonetic parameters investigated. Only one exception to the openness parameter can be found, corresponding to an open vowel within the closed vowels space; there are two exceptions to the parameter "dialect" corresponding to two vowels from the Central Eastern Catalan. In a previous study with the two vowel qualities of the middle vowels the results were very similar; in it, the dimensions of vowel quality and openness were perfectly differentiated without any intersection of the spaces and only one case was an exception as for dialect (Carrera-Sabaté et alii, 1999).

Assuming that both phonetically and statistically the openness distinction is reflected perfectly in our data without intersections, in a second analysis of the data we have divided the parameter in order to get deeper into the aspect we were most interested in: the dialectal distinction of the anterior middle vowels. As a result, we have decided to use MDS again in two dimensions: dialect and a new parameter we have denominated consonantal context adjacent to the vowel studied, since adjacent consonants are known to affect vocalic formants. These results appear on the following graphics in figure 2:

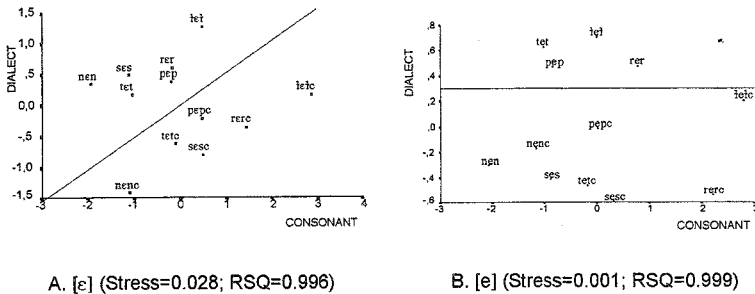


Figure 2

Among open vowels there is regularity of distribution associated to dialect. Only two logatomes with vowel [e] (*ses* and *nen*) from Central Eastern Catalan do not follow the expected tendency.

Apart from this, the utterances from each dialect show distance differences. The vowels of the Western dialect occupy a wider space than the Eastern ones. This fact suggests that [e] and [ɛ] in the Western dialect expand themselves over a larger area than in the Eastern dialect.

If we look into the data carefully, we find out that there is a spatial distribution among the logatomes according to vowel quality and adjacent consonant. In this way, the x axis can be correlated with vowel F2. This is why a straightforward connection can be established between a lower F2 of the studied vowels (caused by the adjacent consonant) and the position of the logatomes on the right hand-side of the graph ( $r=0.99$ ;  $p<0.01$ ). Apart from this, [n] causes formant alterations visible in the adjacent vowels, as Recasens (1991) exposes and, as a consequence, the logatomes with [n] appear on the left hand-side of the graphs systematically.

Finally, connecting these observations with the differences shown by the analysis of the logatomes in both dialects it can be concluded that Western speakers utter anterior vowels [e] and [ɛ] in all contexts ([p], [t], [n], [s], [r] and [ʃ]) with a lower F2 than speakers of the Eastern dialect, as can be inferred from the following table and the graphs in figure 3:

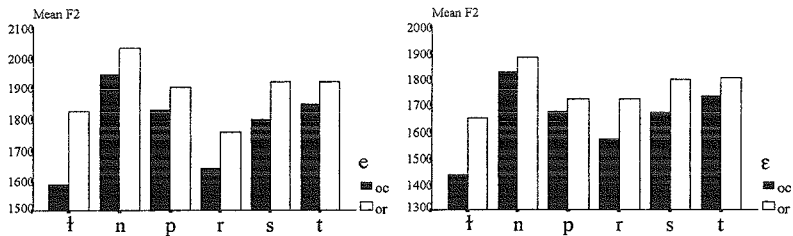


Figure 3

		VOWEL								
		ε				e				
		Max.	Min.	$\bar{x}$	s.d.	Max.	Min.	$\bar{x}$	s.d.	
East.	p	F1	587,00	518,00	554,44	25,17	432,00	362,00	400,67	29,92
		F2	1780,00	1676,00	1718,22	36,84	2022,00	1814,00	1898,89	87,73
	t	F1	604,00	483,00	542,89	42,38	466,00	362,00	408,33	41,60
		F2	1901,00	1711,00	1799,11	61,42	2005,00	1866,00	1918,22	46,52
	n	F1	674,00	501,00	593,11	61,08	466,00	311,00	393,22	63,19
		F2	1970,00	1797,00	1881,67	60,75	2160,00	1901,00	2031,56	92,95
	s	F1	622,00	449,00	543,00	65,98	414,00	345,00	375,67	30,87
		F2	1884,00	1659,00	1793,22	83,68	2126,00	1780,00	1918,22	123,92
	r	F1	691,00	501,00	604,44	71,31	466,00	397,00	443,22	22,74
		F2	1797,00	1659,00	1720,44	47,46	1884,00	1607,00	1755,11	78,42
t	F1	725,00	501,00	604,33	75,28	483,00	414,00	448,88	20,56	
	F2	1745,00	1521,00	1647,33	61,54	1918,00	1711,00	1823,00	80,38	
West.	p	F1	639,00	570,00	606,33	23,61	466,00	380,00	433,56	27,88
		F2	1935,00	1538,00	1674,22	129,36	1987,00	1693,00	1829,67	109,45
	t	F1	604,00	553,00	575,67	17,00	466,00	345,00	418,00	36,47
		F2	1970,00	1555,00	1731,67	147,66	2074,00	1659,00	1847,00	155,85
	n	F1	691,00	449,00	560,22	88,21	466,00	328,00	389,22	48,97
		F2	2264,00	1659,00	1827,78	203,74	2108,00	1780,00	1945,00	112,97
	s	F1	604,00	501,00	554,56	35,94	466,00	380,00	414,44	28,64
		F2	2074,00	1486,00	1672,22	193,03	2039,00	1590,00	1799,11	168,37
	r	F1	656,00	553,00	583,33	31,84	483,00	397,00	443,11	27,22
		F2	1814,00	1434,00	1574,11	153,92	1918,00	1348,00	1641,56	209,95
	t	F1	639,00	570,00	610,11	22,93	501,00	380,00	454,10	39,07
		F2	1676,00	1330,00	1438,00	126,02	1832,00	1330,00	1589,60	181,67

Table 1

		VOWEL							
		ε				e			
		Máx.	Min.	$\bar{x}$	s.d.	Máx.	Min.	$\bar{x}$	s.d.
Eastern	F1	725,00	449,00	573,70	63,07	483,00	311,00	410,96	44,63
	F2	1970,00	1521,00	1760,00	94,76	2160,00	1607,00	1892,11	120,90
Western	F1	691,00	449,00	581,70	46,69	501,00	328,00	425,93	40,20
	F2	2264,00	1330,00	1653,00	197,39	2108,00	1330,00	1771,95	197,72

Table 2

Graphic number 3 and tables 1 and 2 show that the highest values appear when the vowel is adjacent to an alveolar nasal and the lowest ones, when it is adjacent to velarised laterals and trills. This results are coincident with those by Recasens (1986b) and Carrera-Sabaté et alii (1999). This fact is particularly evident in the results for the North-Western dialect (in the Eastern one the values for vowels adjacent to bilabial stops are also lower). This finding is not unexpected, since graphic 2 showed that the frequencial values for the speakers from Lleida expand themselves in a wider space than those for speakers from Barcelona. For instance, mean values for the F2 of [e] in Lleida's dialect go from 1,438 Hz when it was adjacent to [ʃ] to 1,827 Hz when it was adjacent to [n], while the average value in all consonantal contexts is 1,653 Hz. For Barcelona dialect, the average values were: 1,647 Hz (adjacent to [ʃ]) and 1,881 Hz (adjacent to [n]), being the general average 1,760 Hz.

## 5. CONCLUSIONS

The results from the acoustic data from our experiment show that there is a well-established openness distinction in the middle anterior vowels between the North-Western dialect from the area of Lleida and that of Barcelona, belonging to the Central Eastern dialect. Furthermore, it is clear that Western vowels present a lower F2 than the Eastern ones systematically. As a result, we can affirm that middle vowels are more open in North-Western Catalan than in Central Eastern Catalan.

As a corollary, we wish to point out that, even though perceptually the interdialectal distinction between the middle vowels is not always obvious, since it is not categorical but gradual between dialects (Recasens, 1992; Fernández-Planas et alii, in press), it is a well-established distinction from an acoustic point of view.

Another conclusion that deserves being remarked is that MultiDimensional Scaling (MDS) has proved to be an efficient tool for our aims. Even though it is a complex technique, it has a great advantage: analysis and understanding are quickly achieved, since the target groups are well delimited and this is visually evident.

## NOTES

1. In a previous study we found out that the posterior middle vowels of Catalan ([o, ɔ]) did not follow the same pattern as the anterior ones, so we have decided to focus on the latter in this paper
2. Previous analyses demonstrated F3 did not supply relevant information for our purposes. Consequently, we did not use these data for our study.

3. «Or» refers to the Català oriental (Eastern Catalan) and «oc» to de Català nor-occidental (Western Catalan).

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