



## INDIVIDUAL DIFFERENCES IN SPEAKER IDIOSYNCRASIES ON PHONETIC REGULARITIES OF BILINGUAL SUBJECTS

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### Abstract

Previous studies have researched the possibility of studying the speaker idiosyncrasies on phonetic regularities, by means of temporal parameters like the segmental duration. In Spain we have an official language for all State, Castilian or Spanish language, and various community languages; Catalan language is the language of Catalonia, but people of Catalonia is bilingual. Besides, people of different communities in general have different accent and emphasis for the same language, and different manners to say the same phonetic regularities, which are similar in the largest part of people of each community, like as the duration of vowels and consonants, but also there are particularities in the talk of each person. We analyse the phonetic regularities of the Spanish and Catalan languages and, after we describe the common manner of the phonetics regularities of the bilingual people in both languages. Finally we describe the idiosyncrasies of each person in both languages.

### Introduction

Previous studies of Bartkova [1], Broeders and Rietveld, [2], Campbell, [3], Campbell and Isard [4], Heuvel van den Rietveld and Cranen [5], Mendoza and Carballo, [6], Diego et al. [7] have researched the possibility of studying the speaker idiosyncrasies on phonetic regularities, by means of temporal parameters like the segmental duration. In Spain we have an official language for all State, Castilian or Spanish language, and various community languages: Catalan, Basque, Galician languages, and various dialects of them; Catalan language is the language of Catalonia, but a lot of inhabitants of Catalonia talk Spanish and Catalan languages: they are bilingual. On the other side, not only in Spain, but also in other countries people of different communities in general have different accent and emphasis for the same language, and different manners to say the same phonetic regularities, which are similar in the largest part of people of each community, like as the duration of vowels and consonants (Umeda, [8,9]; O'Shughnessy, [10,11]; Crystal

and House, [12,13]). But also there are particularities or individual differences in the talk of each person, of course. If we want to research these differences, we need that the measures of the variables were reliable, constant for each person, to know these particularities, but also these variables ought allow us to estimate interindividual and cluster differences. Our first problem is to know the phonetic regularities of the Spanish and Catalan languages. After we need to know the common manner of the phonetics regularities of the bilingual people in both languages. And finally we want to describe the idiosyncrasies of each person. It will be useful not only to research the particular speaker idiosyncrasies on phonetic regularities, but also to describe the community characteristics of monolingual and bilingual people. Next works will allow us to know how to assess the effect of the pathological personality on speech, to measure the pathological voices, and the progress of its treatment in different communities and people.

### Method

#### *Self-report measures*

Sex, Age, maternal language, level of knowledge of Spanish and Catalan languages

#### *Speech data set*

192 isolated nonsense disyllabic words of the /CVCV/- type.

#### *Independent variables*

Subject, sex, language, number of word.

### *Dependent variables*

Segmental duration of phoneme size. The analysed phonemes are: the vowels /a /, /i /, /u /, /e / and the consonants: /f /, /z /, /j /, /s /, /m /, /n /, /l /, and /r /, in initial position before vowel, and in half position between vowels.

Bilingual Subjects	Reading in Catalan Language	3 women	4 men
	Reading in Spanish Language	The same women	The same men
Monolingual Subjects	Reading in Spanish Language	1 women	1 men

Table 1.- Design

### *Participants*

They are 9 subjects, 7 of them are bilingual (Catalan and Spanish languages), 4 men and 2 women, and 2 are monolingual (Castilian language), 1 men and 1 women. Between the 7 bilingual they are dialectal differences: 2 are from Gerona, 1 from Andorra and 4 from Barcelona.

### *Procedure*

The 6 bilingual subjects read the 192 words twice: once in Spanish language and other time in Catalan language, 4 of them in this order, and the other 3 in the contrary order. The 2 monolingual subjects read the 192 words once in Spanish language. The recording has been made in the laboratory by means of a Digital Audio Tape SONY- TCD-D8.

### *Analysis*

The analysis has been carried out by means of program PcVox, and the WISHA target of the "Departamento de Ingeniería Electrónica de la Escuela Técnica Superior de Telecomunicacion." of the "Universidad Politécnica de Madrid" [14].

### *Aim and hypothesis*

We analyse the intra- and inter-speaker differences, with the repeated measures of every subject. Our hypothesis is that the segmental duration of the phonemes of every speaker that talks in Spanish or in Catalan languages is constant in the same specific context, but the segmental duration is different between different subjects for the same phonemes.

### *Statistic data*

SPSS 8.0 for Windows NT 4 of the SPSS Inc. Descriptives, MANOVA, ANOVA, T-Test, Reliability Procedure: Coefficient alpha and Split-half reliability

### *Results*

The statistical analysis is only carried out with the correctly read nonsense words. It is the reason that each subject has different number of phonemes and words. The 9 subjects present reading errors, for omission or substitution of phonemes or whole words. Sometimes they change a phoneme for other or they substitute a whole word for other, or they don't read it, or they read something totally different. Also there are errors in nonsense words, that have meaning in another language; for example, they convert the nonsense words to English phonetics, and then they transform it into word with meaning, or some nonsense words remember meaning words in Catalan or Castilian Languages, and then they increases the intensity of their voices and pitch.

On the other hand, we observe that some particularities of the personality of some subjects, as the shyness or the anxiety, affect the reading, and therefore to the emission of the phonemes. In other words, the possible perseverance in the duration of the phonetic segments, it can be altered by contextual denotative or connotative meaning, or by the individual differences in personality.

In the Table 2, we may observe the descriptive statistics of the analysed phonemes.

The reliability analysis of the repeated measures says us that the group of the 9 subjects present homogeneous dates: alpha coefficient between .75 and .95, but we only take the first 12 mensurations, due to the different numbers of words that each subject read. If we calculate the separate reliability for each one of the subjects, it varies among 0.75 and 0.95, because the previously mentioned problems.

The results of various ANOVA informs us that the means of the temporal segments of the different subjects (inter-speaker differences) with the whole of the Catalan and castilian phonemes, show differences statistically significant ( $p < 0.05$  to  $p < 0.000$ ). If we calculate the effect of

the variable “number of word” on the duration of the segments, the result is that the effect is not significant. It wants to tell that the differences among the subjects are not a consequence of the effect of the differences among the words. Finally we compare the duration of the phonetic segments of the Castilian language with those of the Catalan, although we can only make it with some phonemes, that have the same pertinent features in both languages, and that they have been analysed. These are: the vowels /a /, /i /, /u/, and the consonants: /F /, /Z /, /M /, /N /, /L /, and /R / in initial position before vowel, and in half position among vowels. The different means in Catalan and Castilian are compared by matched parallel phonemes. The t-test for paired samples says us that only some means has statistically significant differences. These are:

/a/	sig.	0.000
/i/	“	0.000
/f/	initial sig.	0.001
/z/	“	“ 0.079 (?)
/m/	“	“ 0.018
/n/	“	“ 0.104 (?)
/l/	“	“ 0,009
/r/	“	“ 0,001

There are not significative differences among the means of Catalan and Castilian vowel phoneme /u /, nor among the consonants when its position is among vowels /f /, /z /, /m /, /n /, /l /, /r /. The meaning is that the temporary segments of the vowels in general are significantly different, with the exception of /u / (the phoneme /e / is not compared, because it have different forms in

Catalan); but not the consonants, that have very similar means, when the phoneme is in intermediate position among vowels, although not in the initial position. When there are differences, in general the segments are more long in Catalan than in Castilian language.

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Variable	Mean	Std Dev	Minimum	Maximum	N	Label
N2	71,10	21,34	34,00	156,00	60	Consonant N between vowels
L2	77,14	30,04	30,00	174,00	35	Consonant L between vowels
CATL2	78,19	22,60	32,00	117,00	31	Consonant L between vowels
L1	80,05	30,60	30,00	137,00	20	Consonant L initial
M2	83,76	17,27	50,00	136,00	41	Consonant M between vowels
CATN2	84,37	41,15	19,00	204,00	54	Consonant N between vowels
CATM2	89,64	45,45	23,00	318,00	36	Consonant M between vowels
CATR2	93,63	26,48	47,00	151,00	38	Consonant R between vowels
N1	95,66	38,59	32,00	216,00	47	Consonant N initial
R2	96,40	28,54	44,00	161,00	42	Consonant R between vowels
M1	96,92	31,63	38,00	183,00	60	Consonant M initial
CATN1	108,55	49,91	29,00	257,00	40	Consonant N initial
CATJ1	109,59	33,51	49,00	190,00	32	Consonant J initial
CATZ2	110,10	40,53	46,00	160,00	10	Consonant Z between vowels
I	110,74	30,50	43,00	241,00	113	Vowel I en Castellano
R1	113,17	48,01	43,00	296,00	54	Consonant R initial
CATJ2	116,27	49,12	61,00	308,00	37	Consonant J between vowels
CATM1	116,34	60,31	25,00	276,00	59	Consonant M initial
U	117,97	93,85	44,00	1106,00	119	Vowel U en Castellano
CATU	120,85	29,59	21,00	214,00	110	Vowel U en Catalán
A	125,81	24,15	63,00	209,00	113	Vowel A en Castellano
CATL1	127,00	36,35	75,00	212,00	16	Consonant L initial
CATI	130,85	49,07	51,00	381,00	100	Vowel I en Catalán
F2	131,82	20,02	64,00	170,00	49	Consonant F between vowels
J2	135,76	23,93	86,00	199,00	45	Consonant J between vowels
CATR1	135,80	49,52	4,00	261,00	49	Consonant R initial
CATS2	135,90	70,38	55,00	513,00	48	Consonant S between vowels
S2	136,10	17,91	111,00	185,00	39	Consonant S between vowels
Z1	137,76	41,58	46,00	262,00	25	Consonant Z initial
Z2	139,04	23,34	106,00	202,00	28	Consonant Z between vowels
CATA	140,01	31,62	31,00	260,00	95	Vowel A en Catalán
S1	142,84	49,54	98,00	381,00	50	Consonant S initial
CATF2	144,08	38,06	96,00	291,00	48	Consonant F between vowels
J1	148,66	36,61	74,00	252,00	32	Consonant J initial
F1	151,77	70,08	66,00	524,00	44	Consonant F initial
E	167,19	54,19	38,00	440,00	325	Vowel E final en Cast
CATS1	168,48	69,88	96,00	514,00	50	Consonant S initial
CATF1	172,68	65,44	91,00	375,00	40	Consonant F initial
CATZ1	176,67	112,35	65,00	558,00	21	Consonant Z initial
CATE	196,39	65,80	83,00	531,00	277	Neutral vowel in Catalan

Table 2. - Descriptives

Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
A Vocal A in castilian				122,3924	24,612	2,769
	79	,266	,018			
CATA Vocal A in catalan				138,9620	30,444	3,425
Mean	SD	SE of Mean	t-value	df	2-tail	Sig
-16,5696	33,682	3,789	-4,37	78		,000
95% CI (-24,116; -9,024)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
I Vocal I in castilian				106,5517	28,526	3,058
	87	,074	,498			
CATI Vocal I in catalan				132,9655	51,630	5,535
Mean	SD	SE of Mean	t-value	df	2-tail	Sig
-26,4138	57,118	6,124	-4,31	86		,000
95% CI (-38,590; -14,238)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
U Vocal U in castilian				120,2308	106,969	11,213
	91	,036	,735			
CATU Vocal U in catalan				118,5385	29,939	3,138
Mean	SD	SE of Mean	t-value	df	2-tail	Sig
1,6923	110,037	11,535	,15	90		,884
95% CI (-21,229; 24,614)						
Number of	2-tail					
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
F1 Consonante F initial in castilian				134,4194	28,389	5,099
	31	,080	,670			
CATF1 Consonante F initial in Catalá				180,0645	64,787	11,636
Mean	SD	SE of Mean	t-value	df	2-tail	Sig
-45,6452	68,628	12,326	-3,70	30		,001
95% CI (-70,824; -20,466)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
F2 Consonante F among vowels in Cast				129,6667	19,480	3,391
	33	-,221	,217			
CATF2 Consonante F among vowels in				140,6667	34,182	5,950
Mean	SD	SE of Mean	t-value	df	2-tail	Sig
-11,0000	42,918	7,471	-1,47	32		,151
95% CI (-26,222; 4,222)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean

Z1	Consonante Z initial in castilian	132,6111	36,877	8,692			
		18	-,109	,666			
CATZ1	Consonante Z initial in Catalá	188,3889	117,131	27,608			
Mean	SD	SE of Mean		t-value	df	2-tail	Sig
-55,7778	126,590	29,838		-1,87	17	,079	
95% CI (-118,745; 7,189)							
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean	
Z2	Consonante Z among vowels in Cast	133,5556	13,830	4,610			
		9	-,211	,586			
CATZ2	Consonante Z among vowels in	113,8889	41,065	13,688			
Mean	SD	SE of Mean		t-value	df	2-tail	Sig
19,6667	46,014	15,338		1,28	8	,236	
95% CI (-15,712; 55,046)							
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean	
M1	Consonante M initial in Catellano	93,3333	31,632	4,715			
		45	,058	,704			
CATM1	Consonante M initial in Catalá	117,4444	59,604	8,885			
Mean	SD	SE of Mean		t-value	df	2-tail	Sig
-24,1111	65,829	9,813		-2,46	44	,018	
95% CI (-43,893; -4,329)							
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean	
M2	Consonante M among vowels in Cas	84,0714	17,936	3,390			
		28	,026	,895			
CATM2	Consonante M among vowels in	91,4286	48,889	9,239			
Mean	SD	SE of Mean		t-value	df	2-tail	Sig
-7,3571	51,633	9,758		-,75	27	,457	
95% CI (-27,383; 12,669)							
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean	
N1	Consonante N initial in castilian	93,8182	39,450	6,867			
		33	-,092	,610			
CATN1	Consonante N initial in catalan	113,7273	52,179	9,083			
Mean	SD	SE of Mean		t-value	df	2-tail	Sig
-19,9091	68,252	11,881		-1,68	32	,104	
95% CI (-44,116; 4,298)							
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean	
N2	Consonante N among vowels in Cast	72,1957	22,924	3,380			
		46	,272	,067			
CATN2	Consonante N among vowels in C	83,2174	40,002	5,898			

Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-11,0217	40,325	5,946	-1,85	45	,070	
95% CI (-23,000; ,956)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
L1 Consonante L initial in Castellan	10	-,563	,090	71,2000	23,179	7,330
CATL1 Consonante L initial in catalan				127,8000	37,623	11,898
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-56,6000	54,175	17,132	-3,30	9	,009	
95% CI (-95,365; -17,835)						
Number of Variable	2-tail pairs	Corr	Sig	Mean	SD	SE of Mean
L2 Consonante L among vowels in Cas	27	,205	,306	75,6667	26,666	5,132
CATL2 Consonante L among vowels in C				76,6296	23,551	4,532
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-,9630	31,757	6,112	-,16	26	,876	
95% CI (-13,529; 11,603)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
R1 Consonante R initial in castilian	41	,053	,743	101,6341	41,830	6,533
CATR1 Consonante R initial in catalan				137,7805	50,905	7,950
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-36,1463	64,156	10,020	-3,61	40	,001	
95% CI (-56,401; -15,891)						
Variable	pairs	Corr	Sig	Mean	SD	SE of Mean
R2 Consonante R among vowels in Cas	32	-,214	,239	92,8750	30,638	5,416
CATR2 Consonante R among vowels in C				94,4375	27,818	4,918
Mean	SD	SE of Mean	t-value	df	2-tail Sig	
-1,5625	45,584	8,058	-,19	31	,848	
95% CI (-18,001; 14,876)						

Table 3.- T-test differences between Castilian and Catalan phonemes