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**A SURVEY OF LARYNGEALS *VERSUS* VELARS ONSETS & CODAE AND OF
LARYNGEAL COMPLEXITY IN TSELTAL (ALTO)**

1. Introduction: basic facts about Tselstal Sound Patterns and dialects

This research reports on three years gathering and processing of data within the framework of the ALTO project (“Atlas Lingüístico del Tselstal Occidental”), which aims at providing a first hand survey of dialectal variation in Tselstal, a Western Mayan language of the highlands of Chiapas, in Southern Mexico.

It will deal with methodological questions which arise while transcribing and analyzing first hand data for a linguistic atlas. In a previous study on Tselstal (Léonard, Gendrot & Polian, 2010), we were interested in the properties of laryngeal complexity, e.g. as regards the alternation between /h/ and /x/ in different contexts in 16 localities of Tselstal. In a further study covering the same dialect network of Tselstal (Léonard, Gendrot & Polian, 2011), we focused on the so called “rearticulated” or “interrupted vowels” and their different realizations allowing us to cluster Tselstal varieties according to the similarity of the phonological patterns under scrutiny (e.g. V’V *versus* V: and VV). In other words, token exemplarity was considered more important than dialect classification by itself (such as, e.g. in Hopkins, [1970]-1990, Campbell, 1987), in order to provide insights on the structure of the s. c. “complex nuclei” (i.e. categories such as VV, V:, V’, V’V, Vh, VhV, see Brown & Wichmann, 2004 and data in Kaufman & Justeson, 2003; Kaufman, 1972; see Silverman, 1997 for similar phenomena in a neighboring phylum), from a typological standpoint.

We found out that empirical linguists in our situation were actually handling two kinds of variability:

(i) variability between speakers of the same locality or within one speaker himself. Indeed intra-speaker variability in speech is an expected phenomenon that listeners usually take for granted, but that may prove embarrassing, if one endeavors to skip off this variability as not relevant for the topographic survey of who speaks what and where, in order to fill spots on a linguistic map.

Though, we were convinced that variability relies on quanta, as Labovian co-variationism has convincingly demonstrated, and that there should be a way to account for it.

(ii) variability found between the different localities, overstressed by dialectologists, since they tend to consider localities as genetically different according to specific realizations, which deserve isoglosses and clear-cut boundaries or bundles of isoglosses on linguistic maps. According to this viewpoint, quanta should be banished, and variation should be doomed to unobviousness. Though, quanta do not only blur those lines and frontiers (i.e. the isoglosses): they give them sense, beyond the isoglossic frame. Obviously these two kinds of variability – inner and outer variability – have to be distinguished, but both should be observed as *quanta*.

Previously, linguists were annotating data phonetically, relying on impressionistic transcription. Further analysis tried afterwards to make the phonemes match what the linguist had heard to the phonetic symbols provided by whatever Phonetic Alphabet in use in the empirical domain under scrutiny. Nowadays, the objectivity of this procedure can be seriously questioned, as phoneticians and phonologists make use of quality recording devices that allow accurate spectral analysis, providing a wide range of statistical evidence on acoustical patterns (Praat, by Boersma & Weenink, 2009), hinting at alternative forms of what had too often been too easily taken for granted. However, this doesn't rule out the problems of separating inner and outer variability in a geolinguistic space (or a diasystemic topology), and brings out new methodological issues, mainly based on how to handle any quantum of variation.

Table 1. Consonant and Vowel Inventory of Tseltal

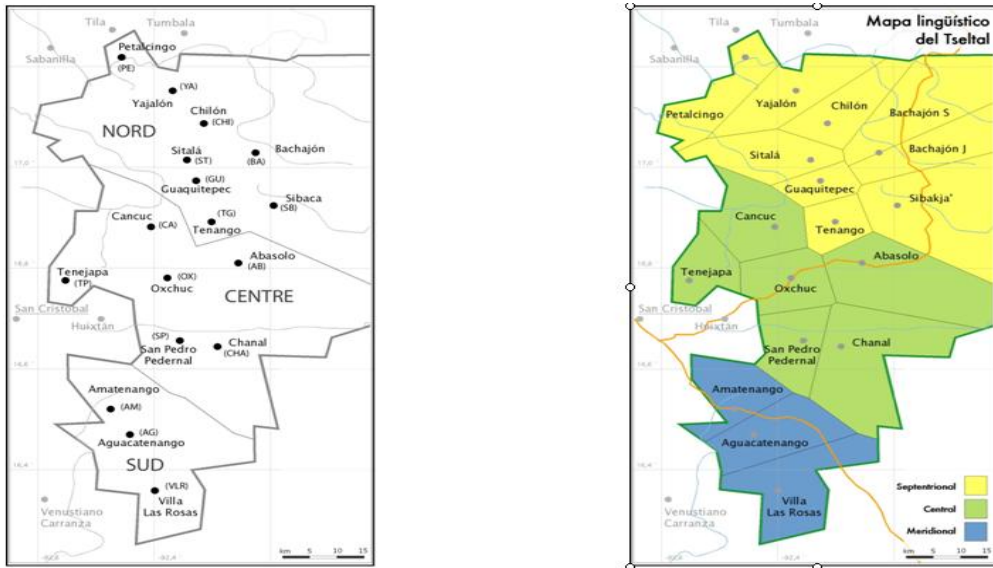
Consonants

Labial	Coronal			High	Dorsal	Glottal
<i>p</i>	<i>t</i>	<i>ts</i>	-	<i>č</i>	<i>k</i>	-
<i>b</i>						
(<i>p'</i>)	<i>t'</i>	<i>ts'</i>	-	<i>č'</i>	<i>k'</i>	-
-	<i>s</i>			<i>š</i>	<i>x</i>	<i>h</i>
<i>m</i>	<i>n</i>			-	-	
	<i>l</i>			-	-	
<i>w/v</i>				<i>y</i>		

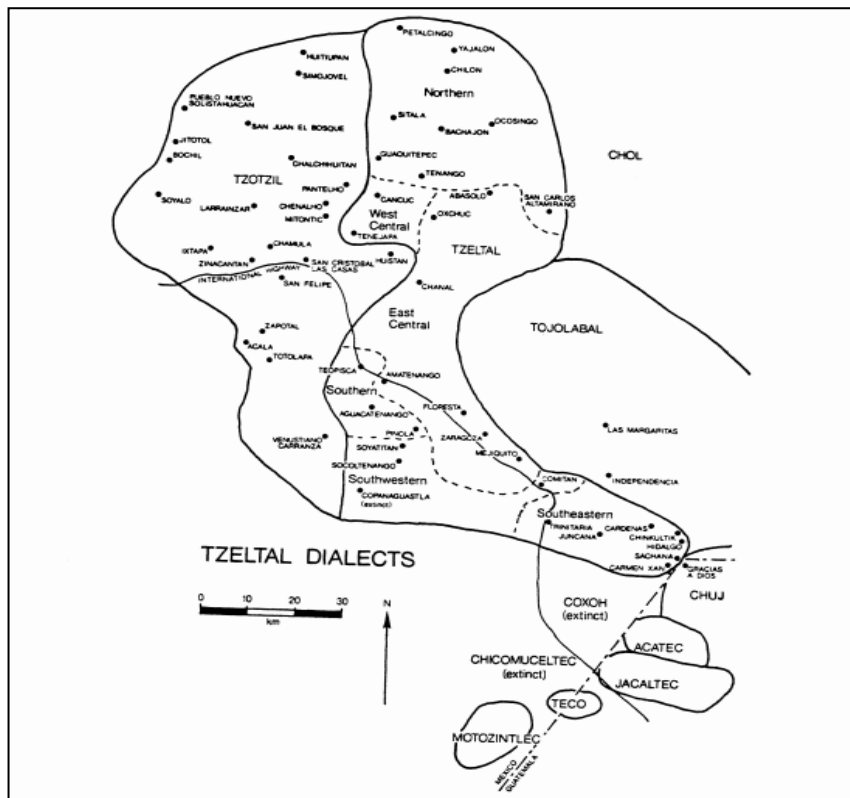
Vowels

Front	Back			
<i>i</i>	<i>u</i>	V	=>	V
<i>e</i>	<i>o</i>			V' <i>checked</i> (> V)
	<i>a</i>			V'V <i>interrupted</i> [constricted] (> V:)
				VhV <i>interrupted</i> [spread] (> V:)

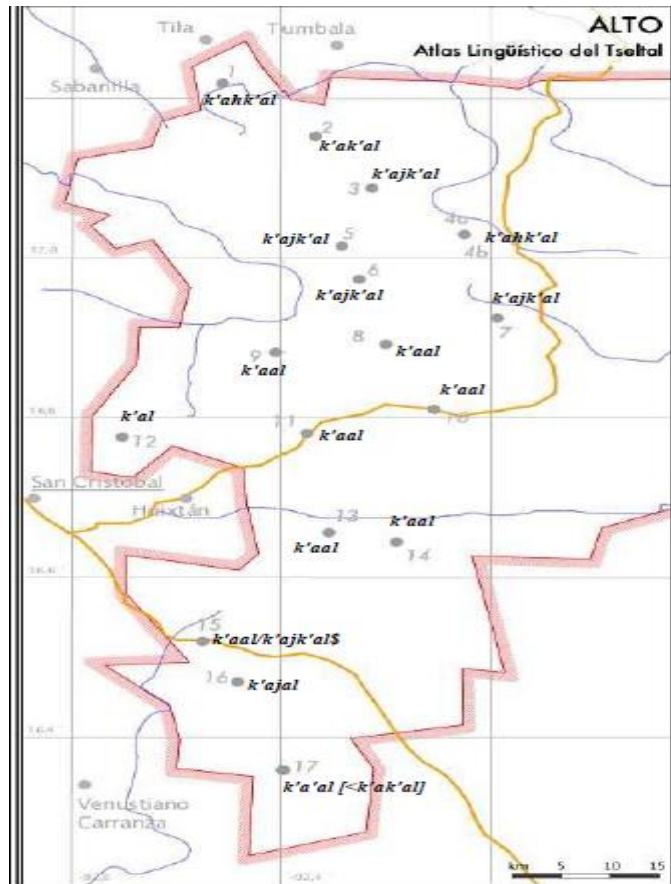
Map 1. Localities surveyed in the ALTO Project (2008-)



Map 2. Dialect areas, Greater Tzeltalan, according to Lyle Campbell (1987)



Map 3. Lexical maps: item $k'ajkal$ = “fire”, “fuego”



Atlas Lingüístico del Tzeltal Occidental

Localidades

1. Petalcingo
2. Yajalón
3. Chilón
4. Bachajón
5. Sitalá
6. Guaquitepec
7. Sibacá
8. Tenango
9. Cancuc
10. Abasolo
11. Oxchuc
12. Tenejapa
13. San Pedro Pedernal
14. Chanal
15. Amatenango
16. Aguacatenango
17. Villa Las Rosas

2. The Velar-Laryngeal Correlation: contexts and patterns

Table 2. Typology, according to context specification and phonological processes

Items	Phonemes	Tokens	Glose ¹	
'house'	/h/	<i>nah</i> <i>j-nah-tik</i> <i>te nah-e</i> <i>naH-etik</i>	house 1POS- house-PL DET house-CL house-PL	'house' 'our house' 'the house' 'houses'
'search'	/h/	<i>leh-el</i> <i>ya j-leh</i> <i>ya j-leh-tik</i> <i>ya j-leh-at</i> <i>ya s-leh-on</i>	search-INF INC 1ERG-search INC 1ERG- search-PL INC 1ERG- search-2ABS INC 3ERG- search-1ABS	'search' 'I search' 'we search' 'I look for you' 'he/she looks for me'
'meet'	/h/	<i>tah-el</i> <i>ya j-tah</i> <i>ya j-tah-tik</i> <i>ya s-tah-at</i> <i>ya s-tah-on</i>	meet-INF INC 1ERG- meet INC 1ERG- meet-PL INC 1ERG- meet-2ABS INC 3ERG- meet-1ABS	'meet' 'I meet' 'we meet' 'I meet you' 'you meet me'
'pine'	/x/	<i>taj</i> <i>j-taj-tik</i> <i>te taj-e</i>	pine tree 1POS- pine-PL DET pine-CL	'pine' 'our pine' 'the pine'

¹ Gloses: ABS: ABSOLUTE personal markers; CL: clitic; ERG: ERGATIVE personal markers; INAL: inalienable; INF: infinitive; PERF: perfect; PL: plural; POS: possessive.

		<i>taj-etik</i>	pine-PL	‘pines’
‘beat’	/x/	<i>maj-el</i> <i>ya j-maj</i> <i>ya j-maj-tik</i> <i>ya s-maj-at</i> <i>ya s-maj-on</i>	beat-INF INC 1ERG-beat INC 1ERG-pegar-PL INC 1ERG-pegar-2ABS INC 3ERG-pegar-1ABS	‘beat’ ‘I beat’ ‘we beat’ ‘I beat you’ ‘you beat me’
‘descend’	/h/	<i>koh-el</i> <i>ya x-koh</i> <i>ya x-koh-ix</i> <i>ya x-koh-at</i> <i>ya x-koh-otik</i> <i>koh-tes-el</i>	descend-INF INC INC-descend INC INC-descend-already INC INC-descend-2ABS INC INC-descend-1ABS.PL descend-CAUS-INF	‘descend’ ‘(he/she) descends’ ‘(he/she) descends already’ ‘you descend’ ‘we descend’ ‘make descend’
‘gourd (small)’	/h/	<i>tsuh</i> <i>j-tzuh-tik</i> <i>s-tzuh-il may</i> <i>te tsuh-e</i>	gourd 1POS-gourd-PL 3POS-gourd-INAL tobacco DET gourd-CL	‘gourd’ ‘our gourd’ ‘gourd for tobacco’ ‘the gourd’
‘pay’	/x/	<i>toj-el</i> <i>ya j-toj</i> <i>ya j-toj-tik</i> <i>ya j-toj-at</i> <i>ya s-toj-on</i>	pay-INF INC 1ERG-pay INC 1ERG-pay-PL INC 1ERG-pay-2ABS INC 3ERG-pay-1ABS	‘pay’ ‘I pay’ ‘we pay’ ‘I pay you’ ‘he/she pays me’
Suffix <i>-oj</i> PERFECT’	/x/	<i>k-ich'-oj</i> <i>k-ich'-oj-ix</i> <i>k-ich'-oj-tik</i> <i>k-ich'-oj-to</i>	1ERG-get-PERF 1ERG-get-PERF-already 1ERG-get-PERF-PL 1ERG-get-PERF-yet/still	‘get’ ‘I’ve already got’ ‘we have got’ ‘I still have got’

Table 3. Typology, according to context specification and phonological processes

Locality	Type	Class	V_#	V_C	V_V	Contexts & processes
Bachajón	OPOS.	A	±	+	+	PAUSA, CODA & PREV
Petalcingo	OPOS.	A	±	+	+	PAUSA, CODA & PREV
Yajalón	CONTR.GLIDE. & NEUTR.H	B, F	±	-	±	CODA & PREV
Sitalá	CONTR.VAR.LIB. NEUTR.H & NEUTR.J	E, F, G	± ±	± +	(+) +	PAUSA, CODA (& PREV)
Guaquitepec	CONTR.INT. & NEUTR.H	C, F	- ±	± ±	+ ±	CODA & PREV
Sibacá	CONTR.INT. CONTR.CODAE	C, F	- (+)	+ +	+ -	CODA & PREV (PAUSA &) CODA
Tenango	CONTR.CODAE, & NEUTR.H	D, F	±	+	-	PAUSA & CODA
Cancuc	CONTR.CODAE & NEUTR.H	D, F	±	+	-	PAUSA & CODA
Tenejapa	CONTR.CODAE, & NEUTR.H	D, F	±	+	-	PAUSA & CODA
Abasolo	CONTR.VAR.LIB. & NEUTR.H	E, F	± (+)	+ +	(+) (+)	PAUSA, CODA (& PREV) (PAUSA), CODA (& PREV)
Oxchuc	CONTR.VAR.LIB. NEUTR.H	E, F	± (+)	± -	- -	PAUSA, CODA

Chanal	NEUTR.H	F	± -	- -	- -	PAUSA
San Pedro	NEUTR.H	F	(+) +	- -	- -	(PAUSA) PAUSA
Amatenango	CONTR.CODAE	D, F	± ±	± +	- -	PAUSA & CODA
Aguacatenango	CONTR.CODA & NEUTR.J	D, F	-	+	-	CODA
Villa las Rosas	CONTR.CODA & NEUTR.J	D, G, (F)	± ±	+ +	+ +	Ubiquity/Saturation

N.B: + = the segment is realized as a contoïd; - = deletion of the contoïd ;
± polymorfism (contoïd and/or deletion); () = trend observed through minority report of free variants; OPOS. = opposition; CONTR.GLIDE. = contrasts with glide y for /h/;
CONTR.VAR.LIB. = generalized free variation of contrasts; CONTR.INT. = contrasts within word forms (CODA, PREV); CONTR. EXT. = contrasts in right margin of word forms (PAUSA);
NEUTR.H = neutralization on behalf of the laryngeal; NEUTR.J = neutralization on behalf of the velar contoïd.

Table 4. Acoustic hints

Contexts PAUSA, CODA & PREV.	Duration	Centre of Gravity	Relative Intensity rms.	Skewness
	Long	High	High	High
Petalcingo /h/	-	-	+	+
Petalcingo /x/	+	+	-	-
Sitalá /h/	-	-		
Sitalá /x/	+		-	
Cancuc /h/	-	-		
Cancuc /x/	+	+	-	-
Abasolo /h/	-			
Abasolo /x/	+		-	
Tenejapa /h/				
Tenejapa /x/			-	-
Oxchuc /h/		-	-	+
Oxchuc /x/		-	-	-
San Pedro /h/	-	-		+
San Pedro /x/	+	+	-	-
Amatenango /h/			+	-
Amatenango /x/			-	+
Villa las Rosas /h/	+	+	+	+
Villa las Rosas /x/	+	+	+	+

Chart 1. Results: Petalcingo

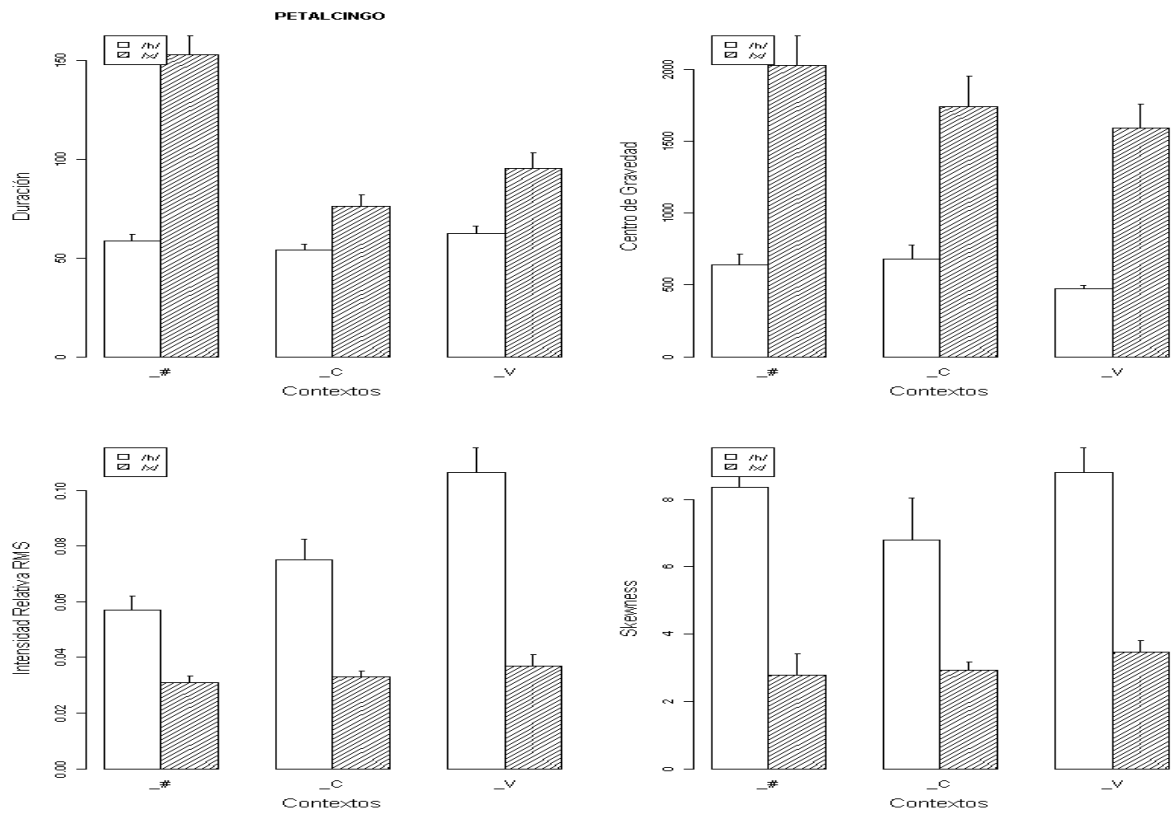


Chart 2. Results: Oxchuc

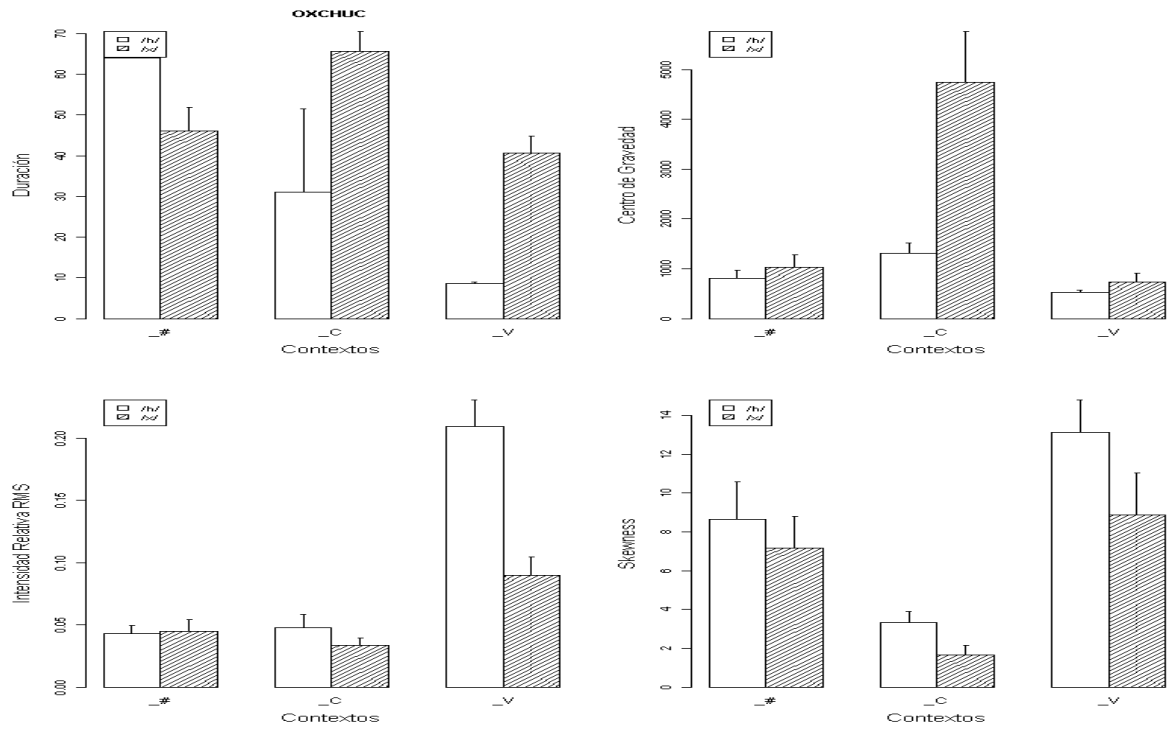
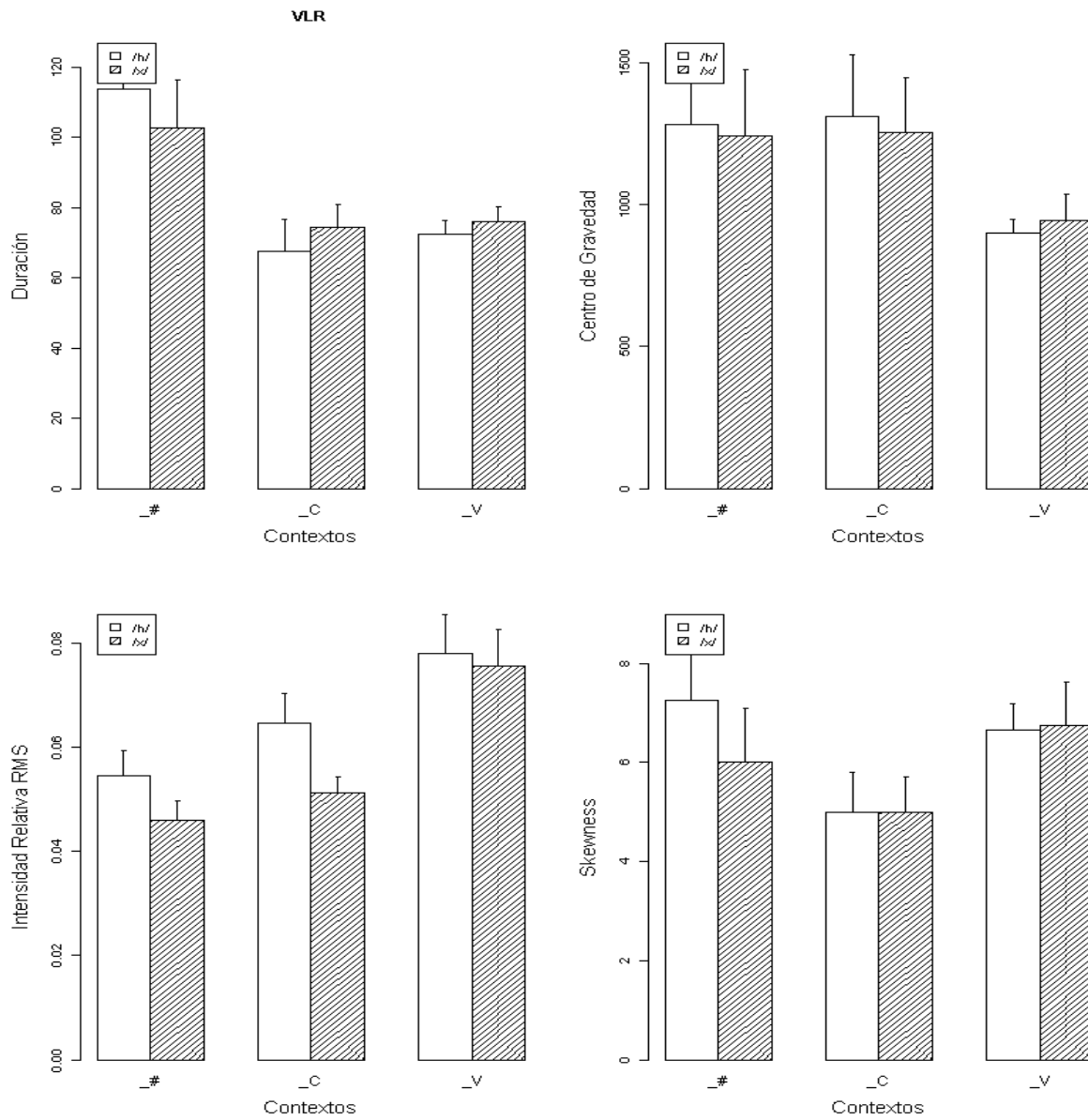


Chart 3. Results: Villa las Rosas



3. Rearticulated/Interrupted Vowels

(1) Interrupted Vowels of the [spread] type within a lexical root

a.	<i>xaHab</i>	‘pit’	
b.	<i>neHen</i>	‘mirror, glass’	
c.	<i>xiHin</i>	‘rancid’	
d.	<i>j-’uHul</i>	‘healer	AGT- healer

(2) Interrupted Vowels of the [spread] type between a root and a derivative suffix

a.	<i>beH-el</i>	‘walk’	walk-SUF
b.	<i>beH-en</i>	‘to walk’	walk-INTR
c.	<i>ts’eH-el</i>	‘bent’	bend-STAT
d.	<i>xeH-en</i>	‘to vomit’	vomit-INTR
e.	<i>biH-il</i>	‘name’	name-SUF
f.	<i>tuH-un</i>	‘be useful’	useful-INTR

g.	<i>ch'uH-un</i>	'to beleive'	God-TRANS
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(3) Interrupted Vowels of the [spread] type between a root and an inflectional suffix

a.	<i>ya s-taH-at</i>	'he/she finds you'	INAC 3ERG-find-2ABS
b.	<i>baH-at</i>	'you went'	go-2ABS
c.	<i>yaH-al</i>	'spicy'	spice-EPI
d.	<i>leH-el</i>	'search'	search-INF
e.	<i>koH-on</i>	'I descended'	descend-1ABS
f.	<i>boH-on</i>	'I went'	go-1ABS
g.	<i>moH-on</i>	'I climbed'	climb-1ABS

(4) Interrupted Vowels of the [constricted] type within a lexical root

a.	<i>u'un</i>	nom relationnel ('de, pour, par, etc.')
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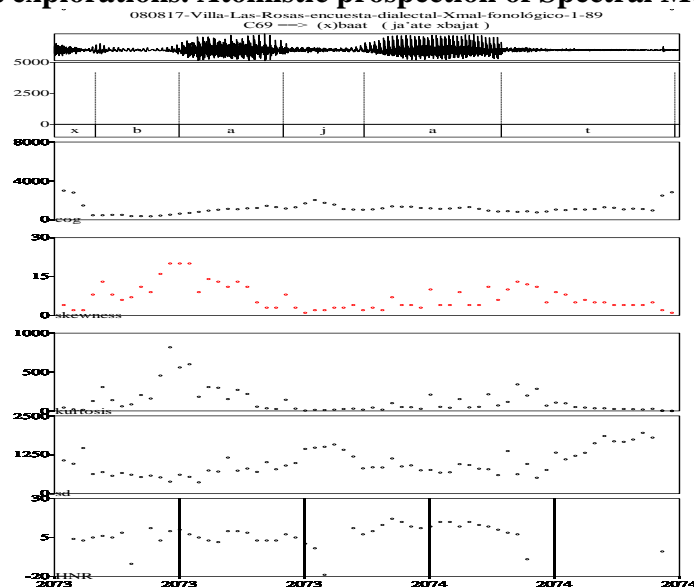
(5) Interrupted Vowels of the [constricted] type between a root and a derivational suffix

a.	<i>ja'-al</i>	'rain'	water-SUF
b.	<i>tsa'-an</i>	'defecate'	faeces-INTR
c.	<i>tse'-ej</i>	'laugh (n.)'	laugh-NOM
d.	<i>je'-el</i>	'open'	open-STAT
e.	<i>me'-el</i>	'old woman'	mother-SUF
f.	<i>tse'-en</i>	'laugh (v.)'	laugh-INTR
g.	<i>x-chi'-il</i>	'its sweetness' (of food)	3POS-sweet-NOM
h.	<i>chi'-in</i>	'sweet potato'	sweet-SUF

(6) Interrupted Vowels of the [constricted] type between a root and an inflectional suffix

a.	<i>y-a'-al</i>	'its water'	3POS-eau-PM
b.	<i>we'-el</i>	'eat'	manger-INF
c.	<i>s-ti'-il</i>	'its fringe/border'	3POS-mouth-PM
d.	<i>ja'-at</i>	'you'	FOC-2ABS
e.	<i>jo'-on</i>	'me'	FOC-1ABS
f.	<i>jo'-otik</i>	'we'	FOC-1ABS.PL

Chart 4. First explorations. Atomistic prospection of Spectral Moments for VHV



(7) Selecting varieties according to relevant features (rather than according to dialect areas)

SPREAD GLOTTIS	CONSTRICTED GLOTTIS
VhV (from the PE & BA varieties, Northern Tselal)	V'V (from PE TG AB, miscellanea)
V: (from CHA & AG, central Tselal)	V~V (from GU CA SP, central Tselal)
VV (from CA TG & AM, miscellanea)	VV (from CHA)

(8) A Typological Matrix of Tselal Dialects, serving as a *compass* for measure sampling

Voyelle basse		PE	BA	CA	TG	CHA	AM	AG
[+GF]								
V'V	INTERRUPTED	+	+		+		(+)	+
V~V	CREAKY		+	+		+	+	+
vv						+		
[+GO]								
VhV	SPREAD VhV	+	+					
V:	LONG					+		+
VV	GEMINATE			+	+		+	

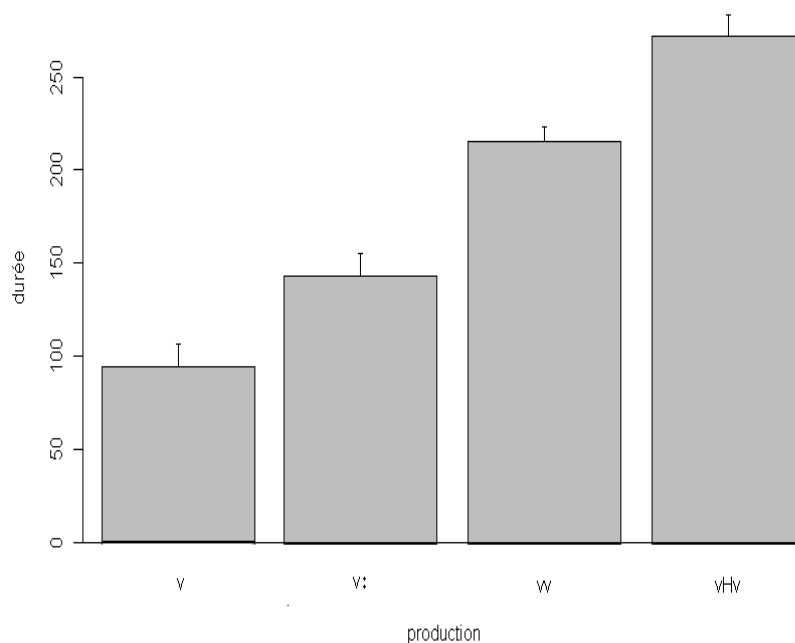


Chart 5. Duration of VhV Complex Nuclei – spread – as compared to Short Nuclei (low vowels, data from ALTO)

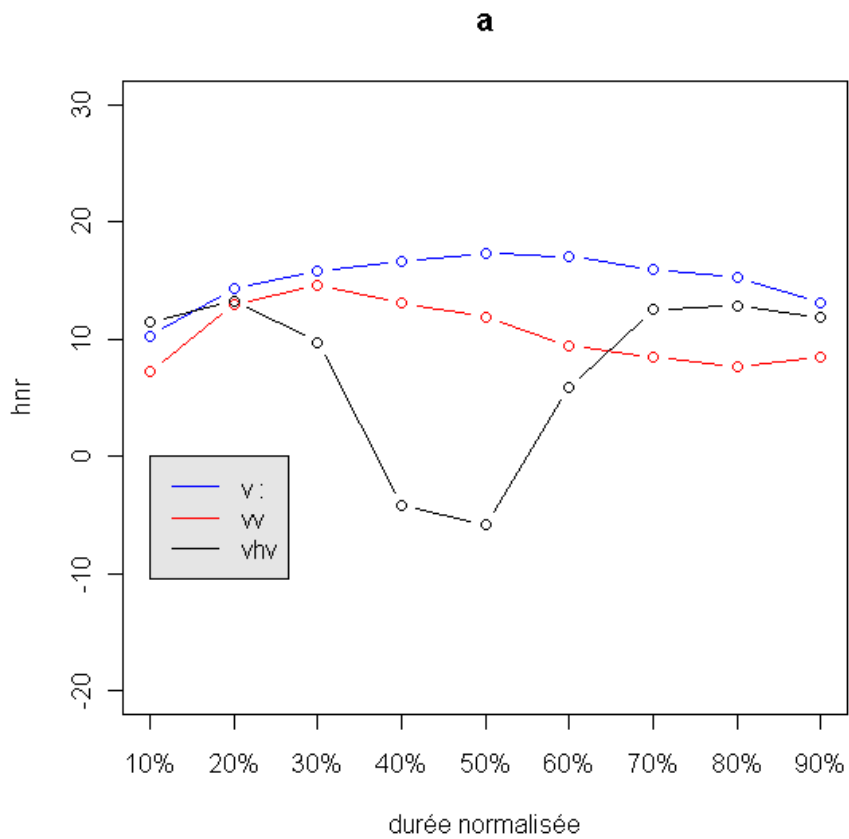


Chart 6. Harmony on Noise Ratio for VhV – spread – Complex Nuclei (low vowels, data from ALTO)

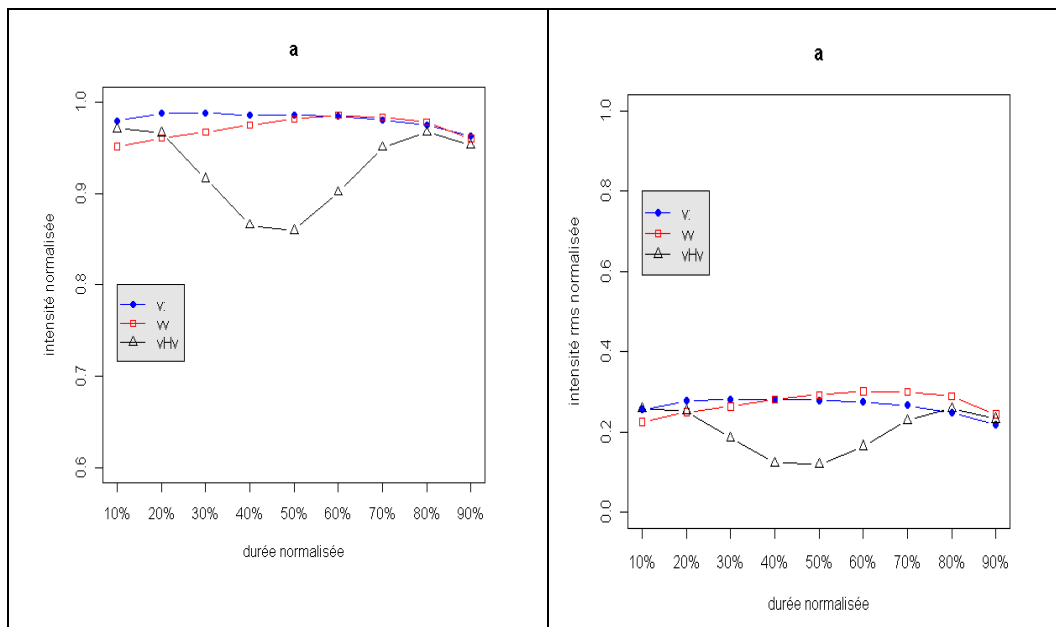


Chart 7. Intensity for VhV – spread – Complex Nuclei (low vowels, data from ALTO)

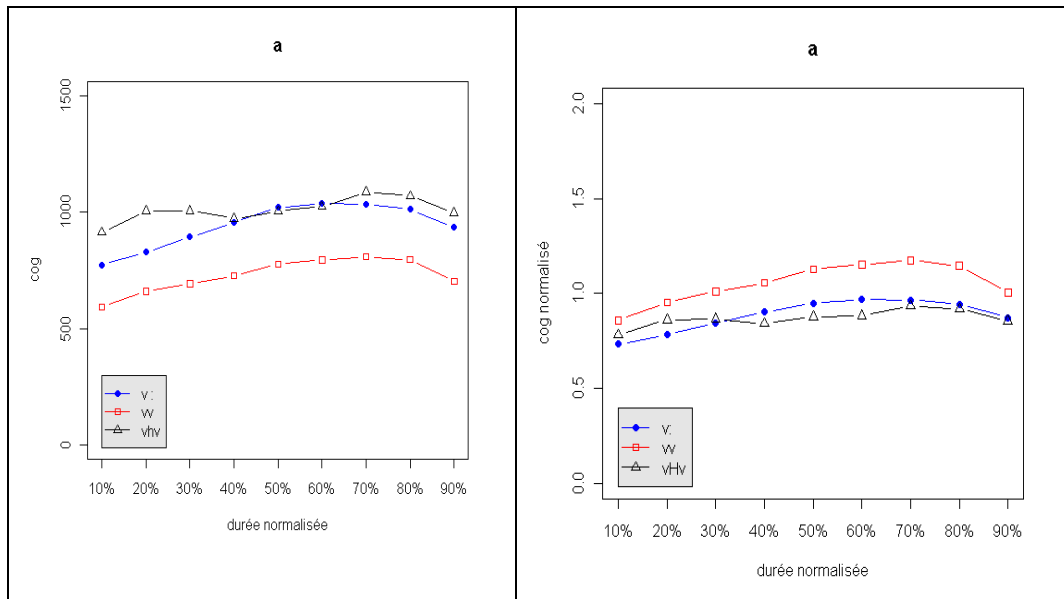


Chart 8. Center of Gravity for VhV – spread – Complex Nuclei (low vowels, data from ALTO)

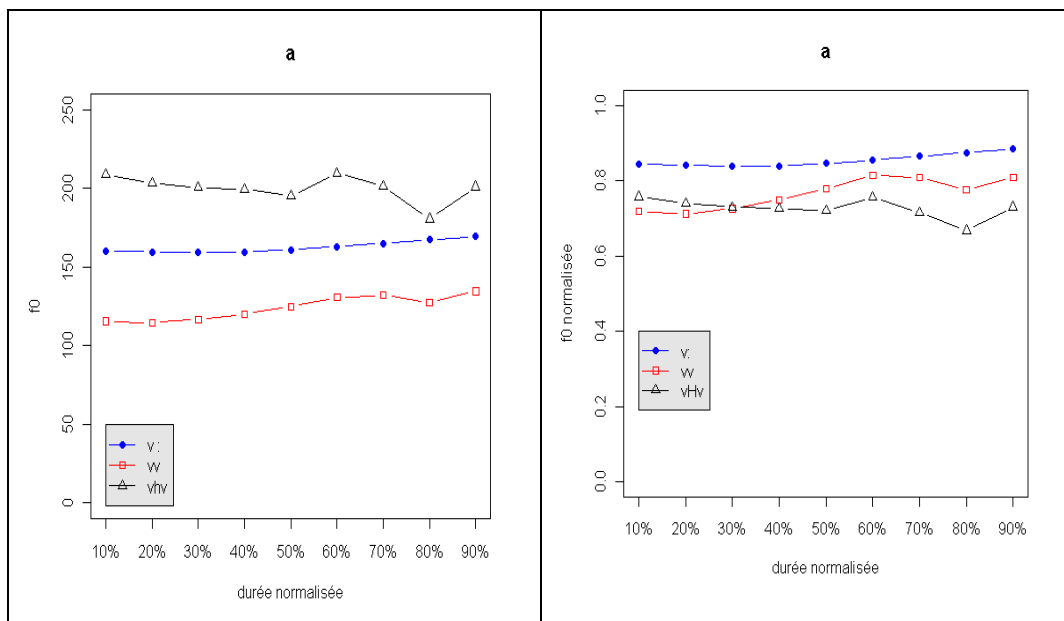


Chart 9. F0 for VhV – spread – Complex Nuclei (low vowels, data from ALTO)

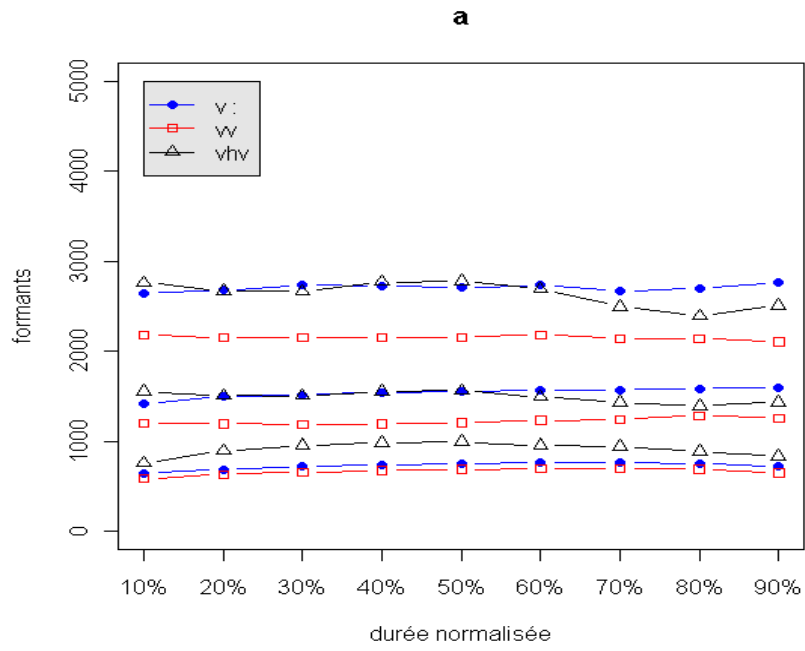


Figure 10. Formants VhV Complex Nuclei – spread – (low vowels, data from ALTO)

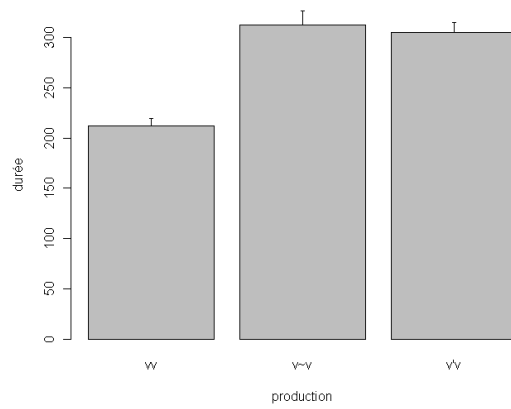


Chart 11. Duration of V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

a

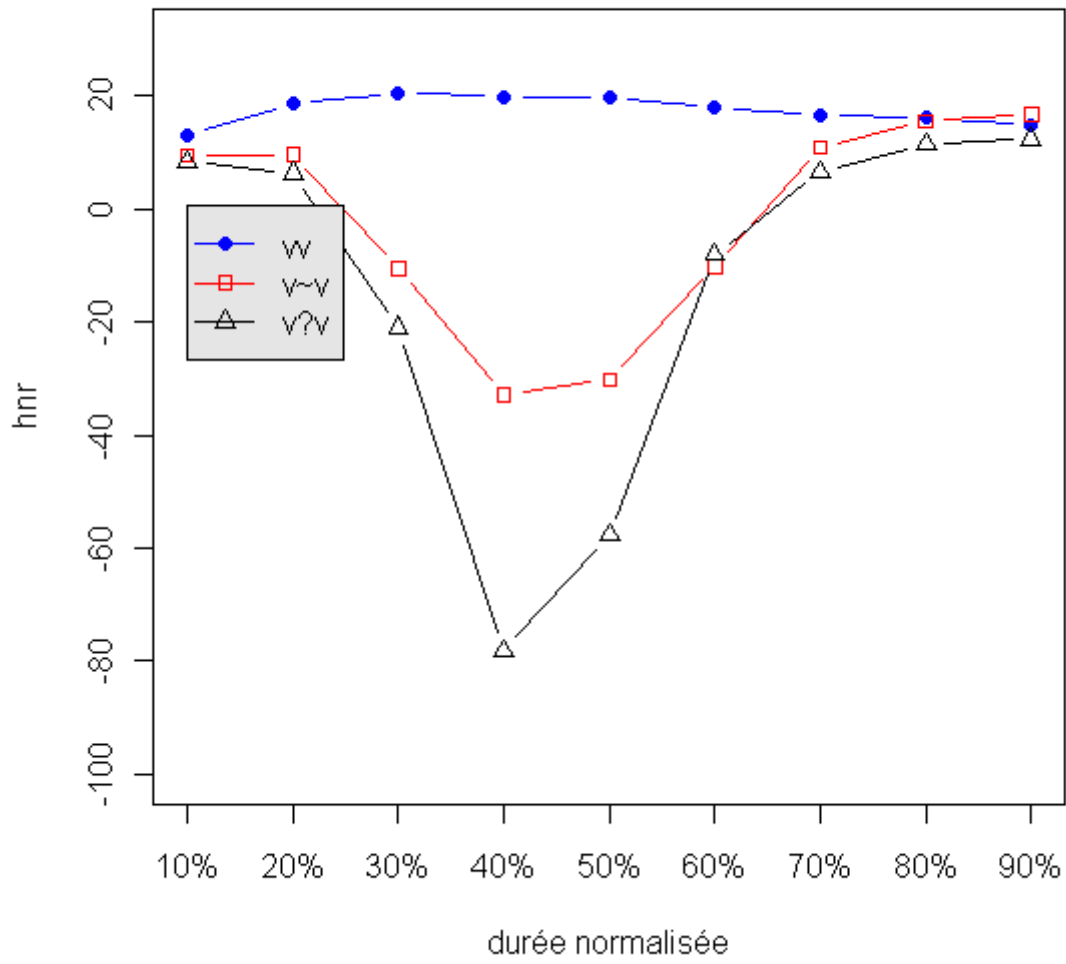


Chart 12. Harmony on Noise Ratio for V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

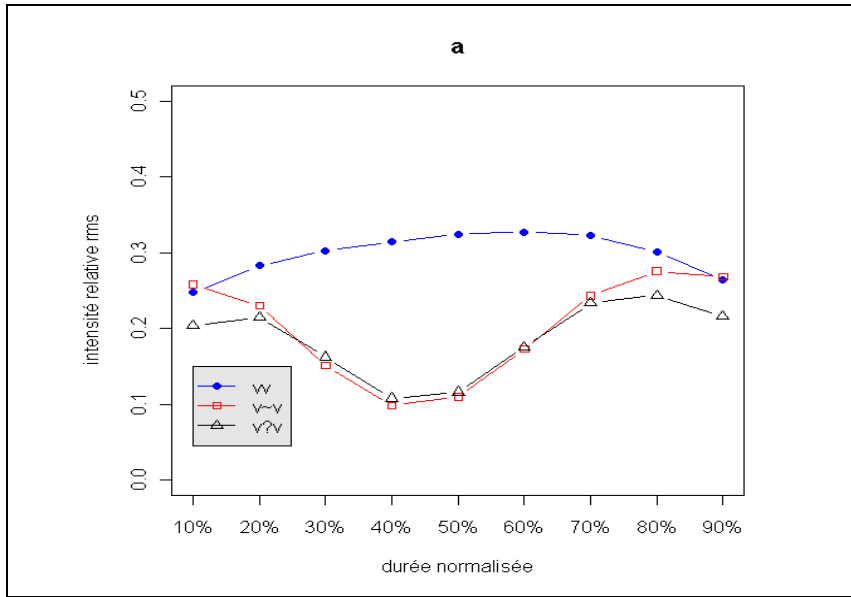


Chart 13. Intensity of V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

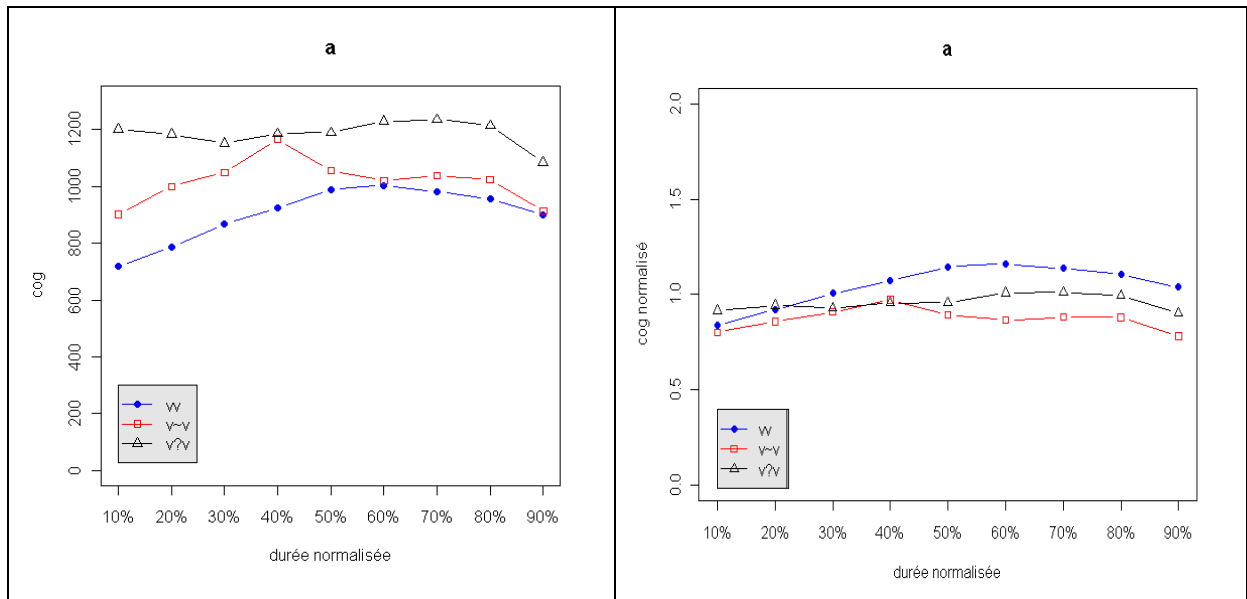


Chart 14. Center of Gravity of V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

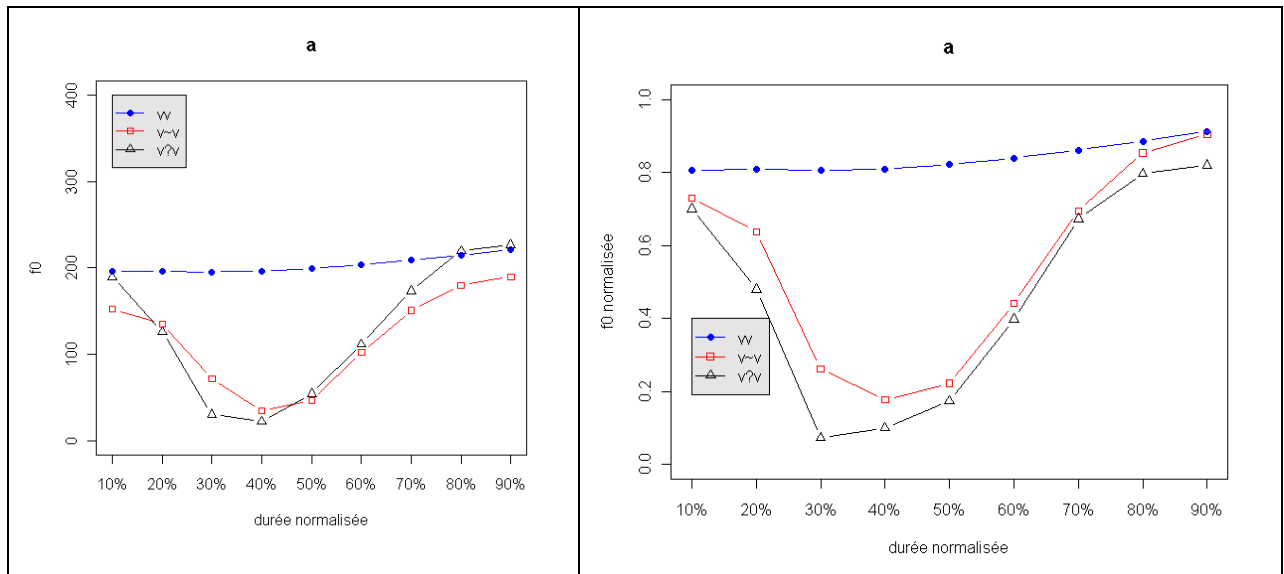


Chart 15. F0 for V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

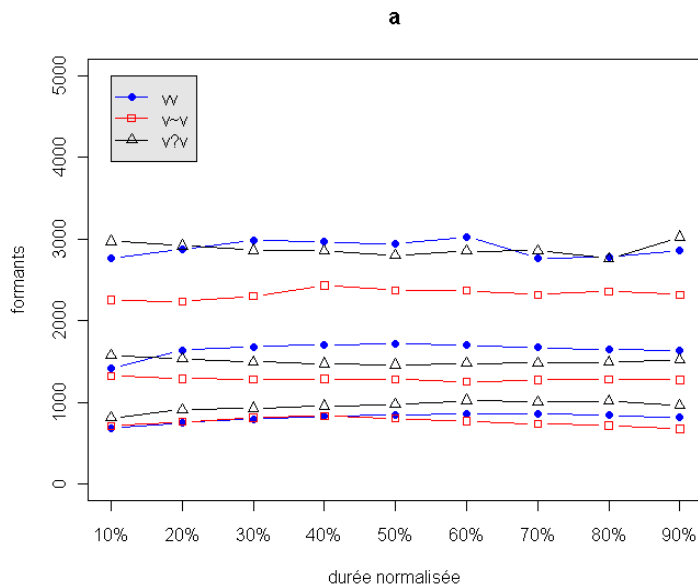


Chart 16. F1-3 V'V Complex Nuclei – constricted – (low vowels, data from ALTO)

Durée de la voyelle haute palatale i <i>VhV</i>	Durée de la voyelle haute vélaire u <i>VhV</i>
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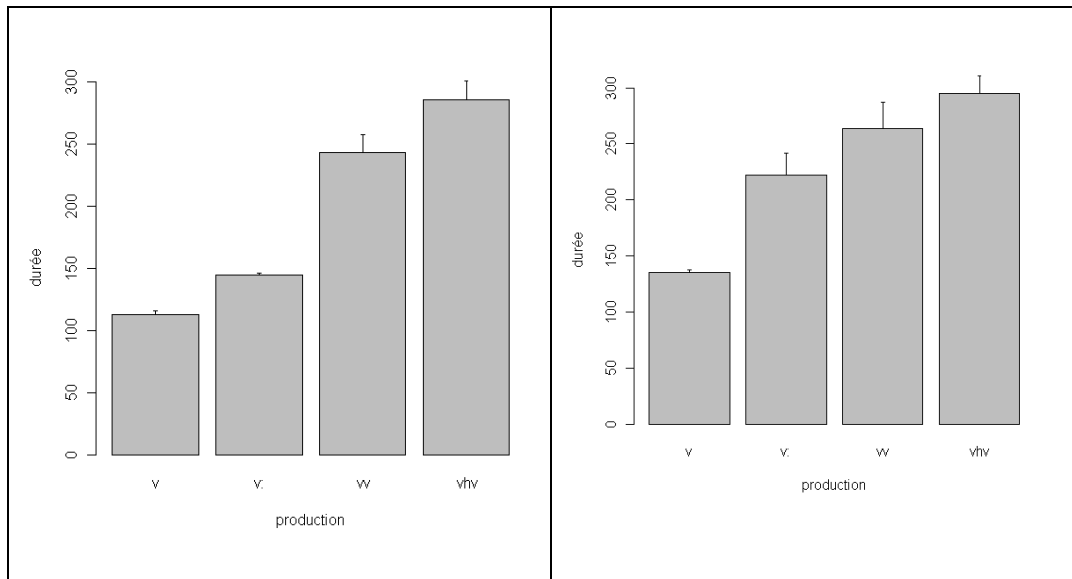


Chart 17. Duration of VhV Complex Nuclei – spread – (high vowels, data from ALTO)

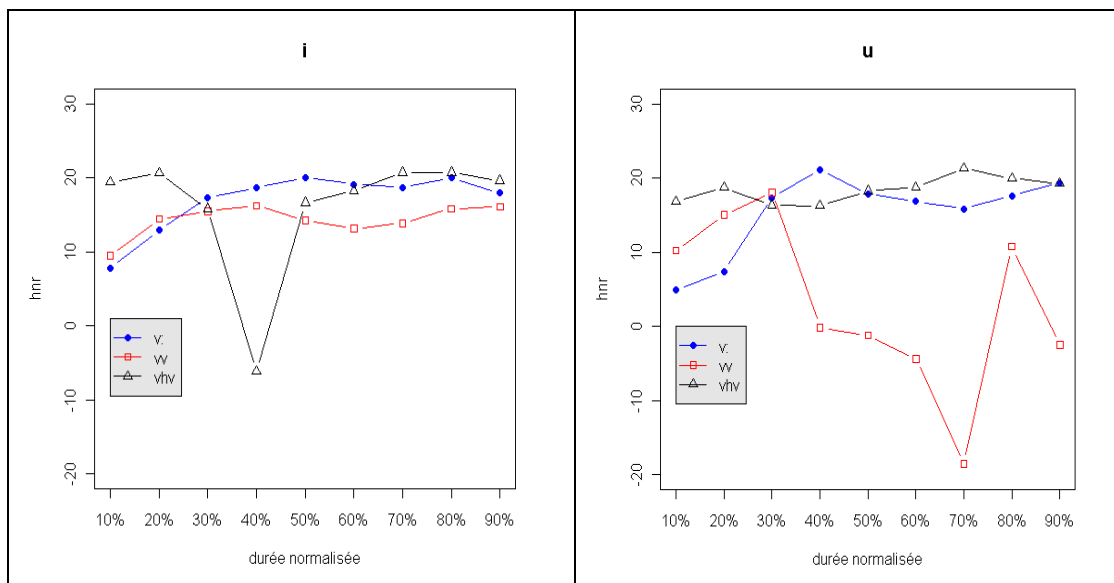


Chart 18. Harmony on Noise Ratio for VhV Complex Nuclei – spread – (high vowels, data from ALTO)

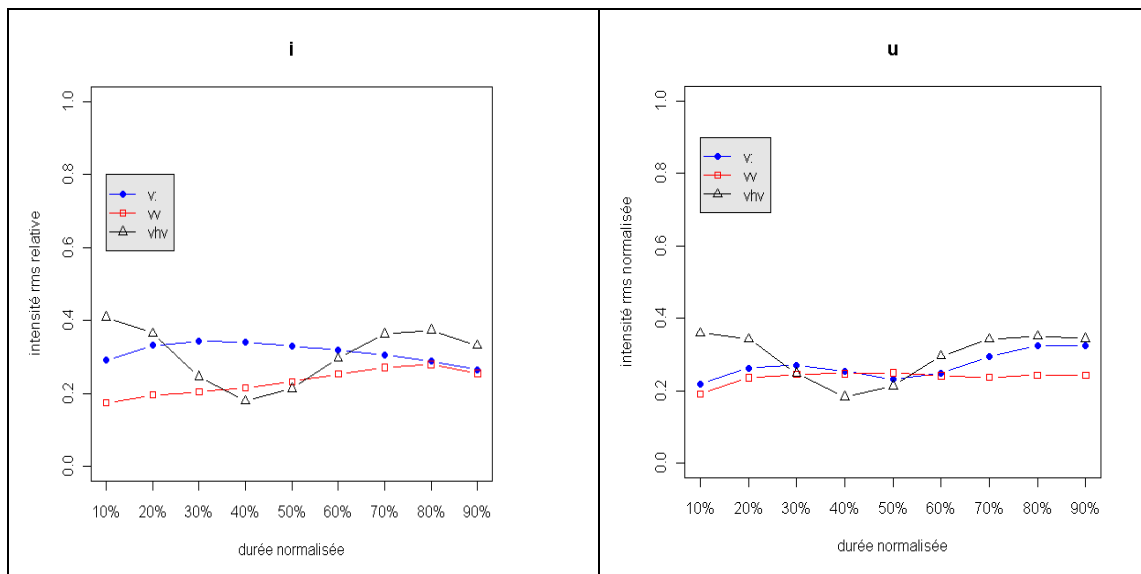


Chart 19. Intensity of VhV Complex Nuclei – spread – (high vowels, data from ALTO)

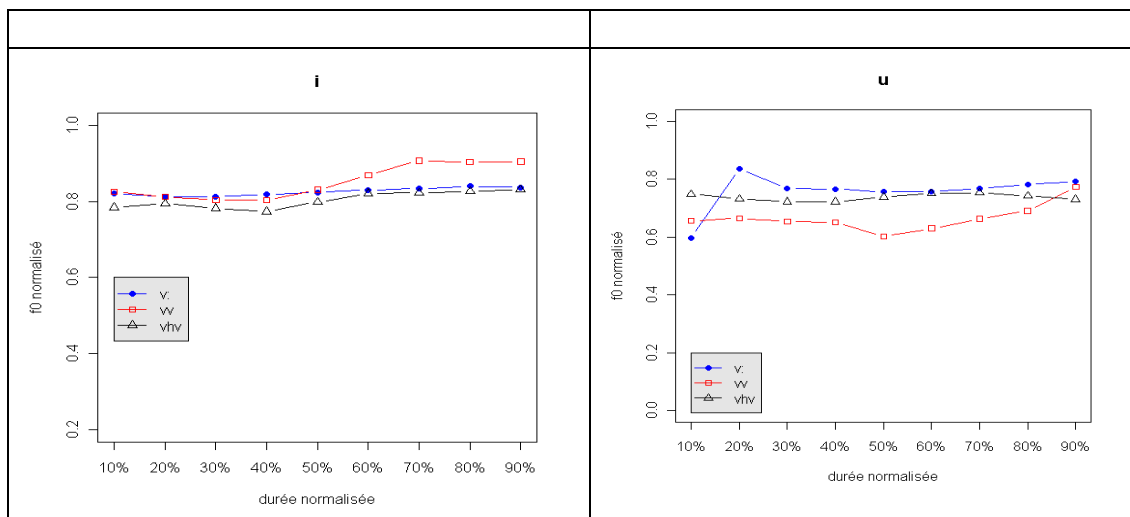


Chart 20. F0 for VhV Complex Nuclei – spread – (high vowels, data from ALTO)

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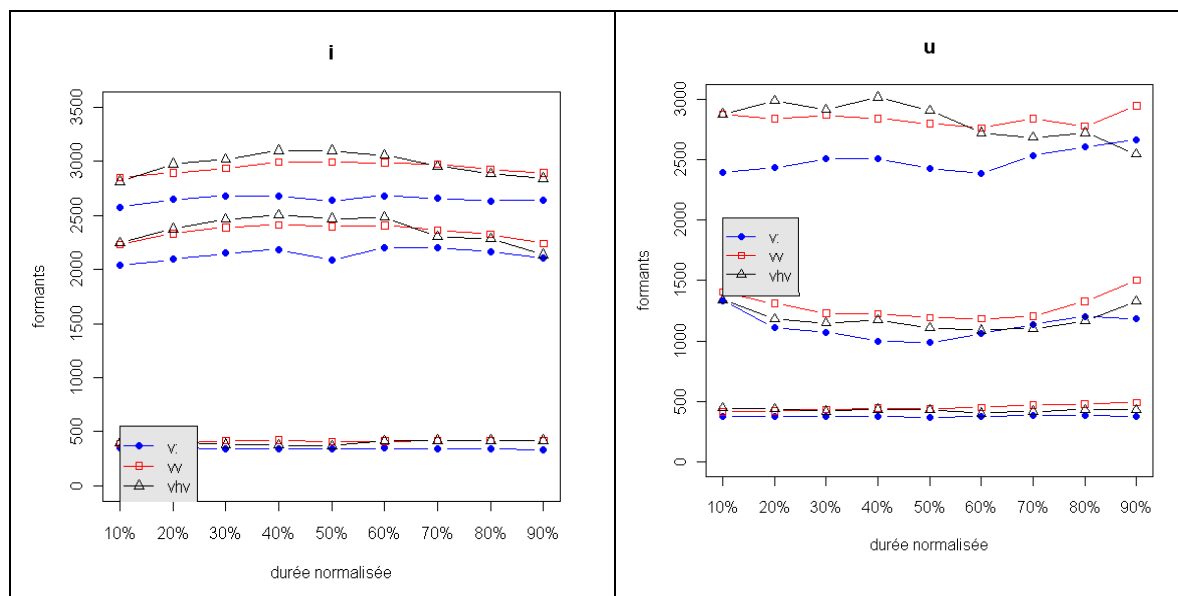


Chart 21. F1-F3 VhV Complex Nuclei – spread – (high vowels, data from ALTO)

Conclusion

Phoneticians make use of several acoustic measurements such as the first three formants for the description of vowel systems, the localization and distribution of energy for the categorization of fricatives or stops (Shadle & al. 1996), the harmonic-to-noise ratio in the realization of voicing of friction, acoustic duration and Root-Mean-Square intensity in selecting between phonemic categories. All these acoustic measurements do not provide binary (nor discrete) values, but continuous values instead, with standard deviation that should be separated in as many categories as needed for the language one observes. We will discuss the need of such instrumental methods, in order to obtain a reliable measurement and a better understanding of the variability present in speech. Instead of a quantum of solace, we'll deal with quanta of laryngeals, duration and sonority. It might be, though, that quanta may provide, at the best, some solace to the dialectologist desperate to reach his holly Grail: accurate notation.

References

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