

Rhythm across European Portuguese varieties

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General background

Rhythmic distinctions among languages: proposed to result from a series of phonological and phonetic properties, such as **syllable structure**, **vowel reduction** and the **correlates of stress** (e.g., Dasher & Bolinger 1982, Dauer 1983).

Debate on the organization of languages into **rhythmic classes** or along a **rhythmic continuum**:

- long standing agreement about the rhythm type of some languages (English and Dutch as stress-timed, Spanish and Italian as syllable-timed, Japanese and Tamil as mora-timed);
- other languages have been considered to be mixed or intermediate languages (e.g., Catalan, Brazilian Portuguese, Polish) (Nespor 1990);
- acoustic results from different kinds of measures of rhythm (%V- Δ C, Varcos, PVIs) do not always distinguish between languages arguably belonging to different classes (Arvaniti 2012, Grabe & Low 2002).

Perceptual experiments with adults (Ramus & Mehler 1999, Ramus et al. 2003), and **infants** (Mehler et al. 1996, Nazzi et al. 1998, 2000) have convincingly shown that languages are discriminated on the basis of rhythm according to the rhythmic classes.

- among the measures of rhythm that have been proposed, %V and Δ C (Ramus et al. 1999) seem to be those that better predict listeners' discrimination between languages (Nespor et al. 2011).

Rhythm in European Portuguese (EP)

An analysis along the lines of Ramus et al. (1999) has been applied to several languages and language varieties, including **Standard European Portuguese (SEP)** and **Brazilian Portuguese (BP)** (Frota & Vigário 2001):

- the authors used %V and Δ C and suggested normalized measures of the variability of intervals (Δ %V and Δ %C)

Main conclusions:

- %V and Δ %C successfully distinguished between SEP and BP, in accord with the known phonological properties that set the two varieties apart (vowel reduction in SEP vs. vowel epenthesis in BP)
- cross-language comparison with the 8 languages studied by Ramus et al. (1999): SEP clusters with stress-timed languages in the Δ C dimension and with syllable-timed languages in the %V dimension; BP clusters with syllable-timed languages in the Δ C dimension and with mora-timed languages in the %V dimension → **mixed nature of Portuguese rhythm**

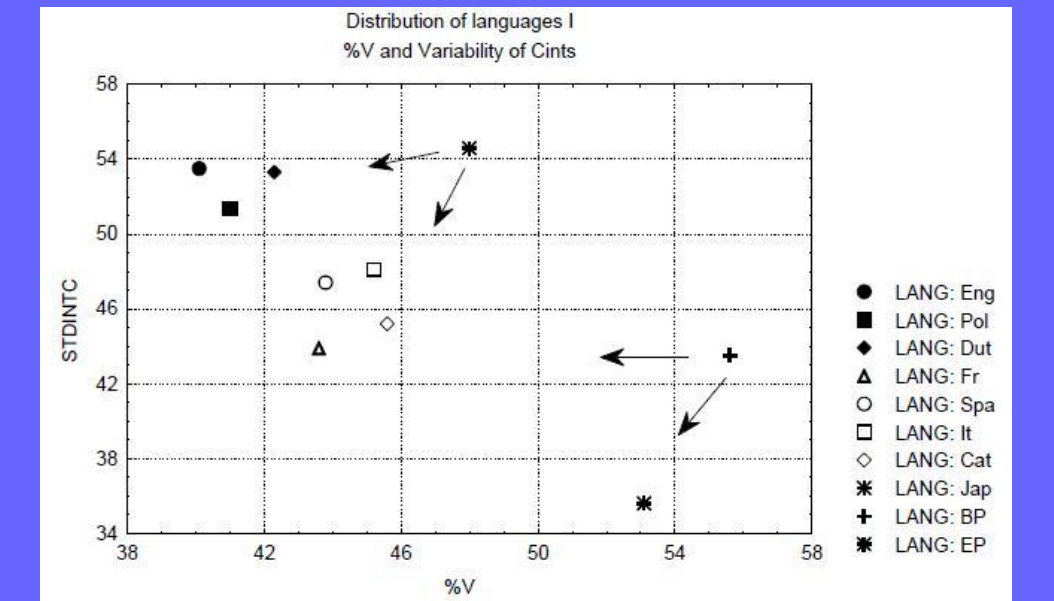


Figure 1 – Distribution of languages over the %V- Δ C dimensions (av. values by language). Data for the 8 other languages from Ramus et al. 1999. Figure and data for SEP and BP from Frota & Vigário 2001.

Main Goals: (i) to give a preliminary analysis of the rhythmic properties of two southern varieties of EP – Alentejo (Ale) and Algarve (Alg) –, previously shown to differ from SEP in their intonational contours, phrasing patterns and pitch accent distribution (Cruz & Frota, accepted, Frota et al., accepted); (ii) to observe if the use of different corpora leads to different rhythmic properties from the use of a common corpus; (iii) to contribute to the *Interactive Atlas of the Prosody of Portuguese* (InAPoP) Project.

Methodology

Varieties: 2 Interior Center and Southern varieties (Cintra 1971) of EP – Ale (Alentejo) and Alg (Algarve).

Speakers: 3 female speakers per variety, aged between 20-45 years-old, all recorded *in loco*.

Analysis: Vocalic and consonantal intervals were marked in *Praat* (Boersma & Weenink 2007), on the basis of both auditory and acoustic cues, following standard criteria of segmentation (Turk et al. 2006, Frota & Vigário 2001) (Figure 2). Measures of rhythm (%V, Δ C) were then automatically extracted with *Correlatore 2.1* (Mairano 2009) and manually cross-checked. Δ %C was also computed. In this preliminary stage, data from 1 speaker per variety were inspected.

Experiment 1: global comparison

- the corpus of Ramus et al. (1999), translated and adapted by Frota & Vigário (2001) was used
- 54 sentences were read twice in random order (54x2x6). In this preliminary analysis, a total of 108 sentences were analyzed per variety (108x2)
- sentences have different lengths (in no. of syllables): from 15 to 21 syllables (8 sentences per length condition)
- %V, Δ C and Δ %C were calculated for each variety and compared with **global results for SEP and BP** (Frota & Vigário 2001). These results were obtained with 3 different corpora:

MAVig – EP corpus analysed with the purpose of establishing the prosodic and intonational structure of the data (Vigário 1998)

20F – a comparative EP/BP corpus, developed within the Project *Rhythmic Patterns, Parameter Setting, and Language Change* (Fapesp, Brazil)

Rm – a comparative EP/BP corpus corresponding to the translation of the multi-language corpus used in Ramus et al. (1999)

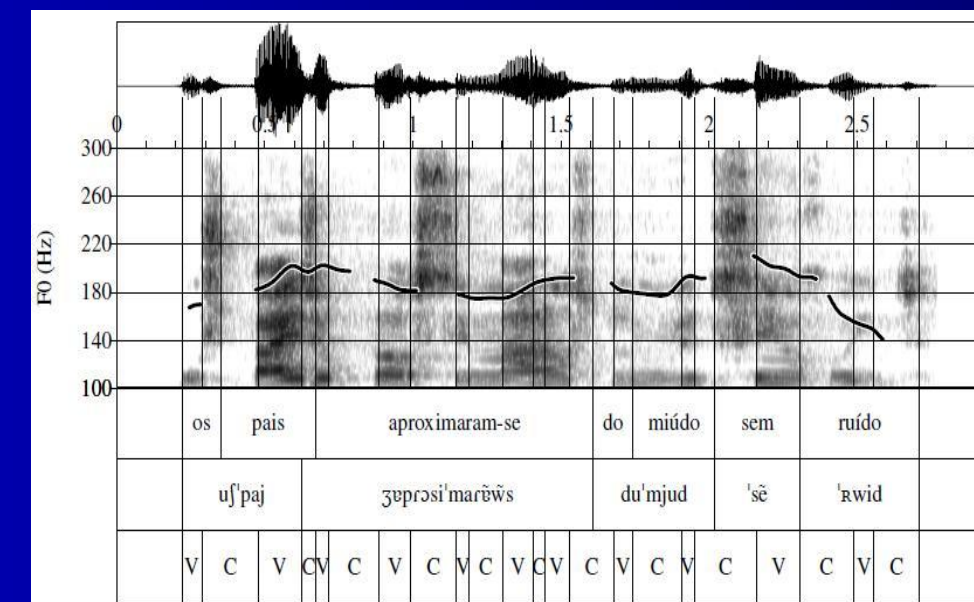


Figure 2 – Segmentation of vocalic and consonantal intervals, following the criteria from Turk et al. (2006) and Frota & Vigário (2001). Os pais aproximaram-se do miúdo sem ruído. 'The parents approach the kid silently.'

Experiment 2: selective comparison

- in order to allow for a more reliable comparison across EP varieties, **only the Rm corpus** from Frota & Vigário (2001) was here considered
- 40 of the 54 sentences were selected for analysis (40x2). In this preliminary analysis, a total of 80 sentences per variety (80x2) were considered in this selective comparison
- sentences with 20 and 21 syllables were excluded from this analysis
- %V, Δ C and Δ %C were recalculated for each variety and compared with **results for SEP and BP** obtained **only with the Rm corpus** (Frota & Vigário 2001).

Preliminary Results

Global Comparison

	%V	Δ %C	Δ C
Alg	37,3	4,10	73,9
Ale	44,0	3,6	64,2
SEP	48,0	2,4	54,6
BP	55,6	1,6	43,5

Table 1 – Three averaged acoustic measures : across Portuguese varieties. Global results for SEP and BP from Frota & Vigário (2001).

Across Portuguese varieties

- both Ale and Alg present higher scores of Δ %C than SEP and lower scores of %V
- the same is observed when compared with BP: Ale and Alg present higher scores of Δ %C and lower scores of %V

Within Southern varieties

- Alg presents a higher score of Δ %C than Ale and a lower score of %V

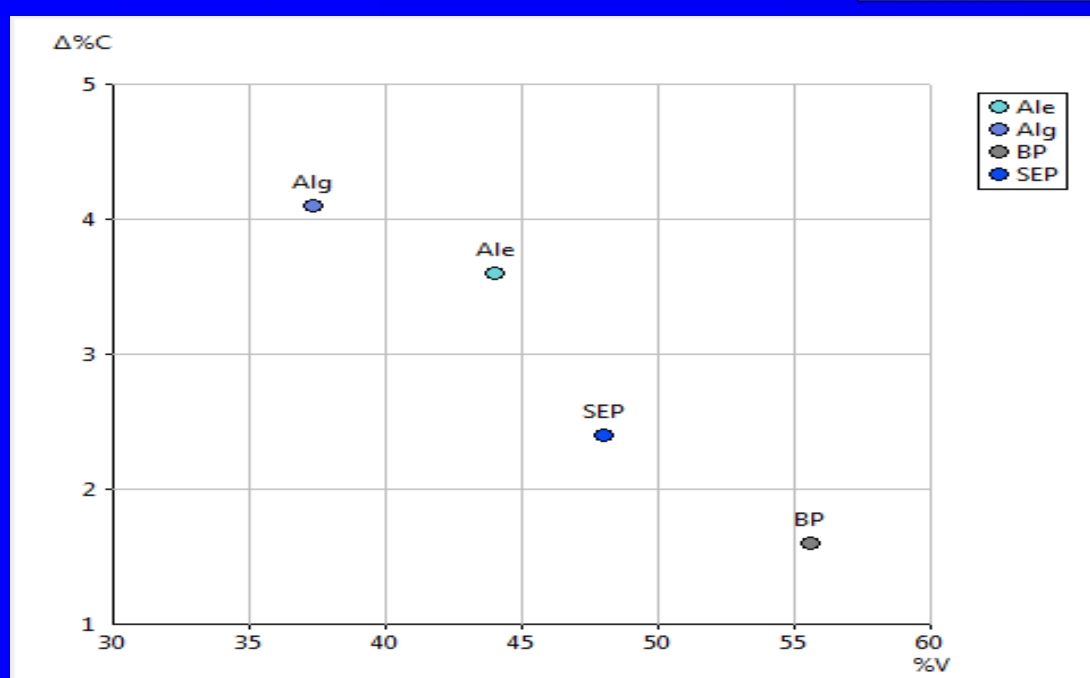


Figure 3 – Δ %C vs. %V for Portuguese varieties. Data for SEP and BP from Frota & Vigário (2001).

Both southern varieties are **stress-timed in the Δ %C dimension**, with **Ale** within the range of %V shown by **syllable-timed** languages, just like SEP, but **Alg** with %V pointing to **stress-timing**

Ale: seems to display a **mixed rhythm**, like SEP
Alg: clearly **stress-timed**

Tendency towards **stress-timing** as we move from Lisbon (SEP) to the South.

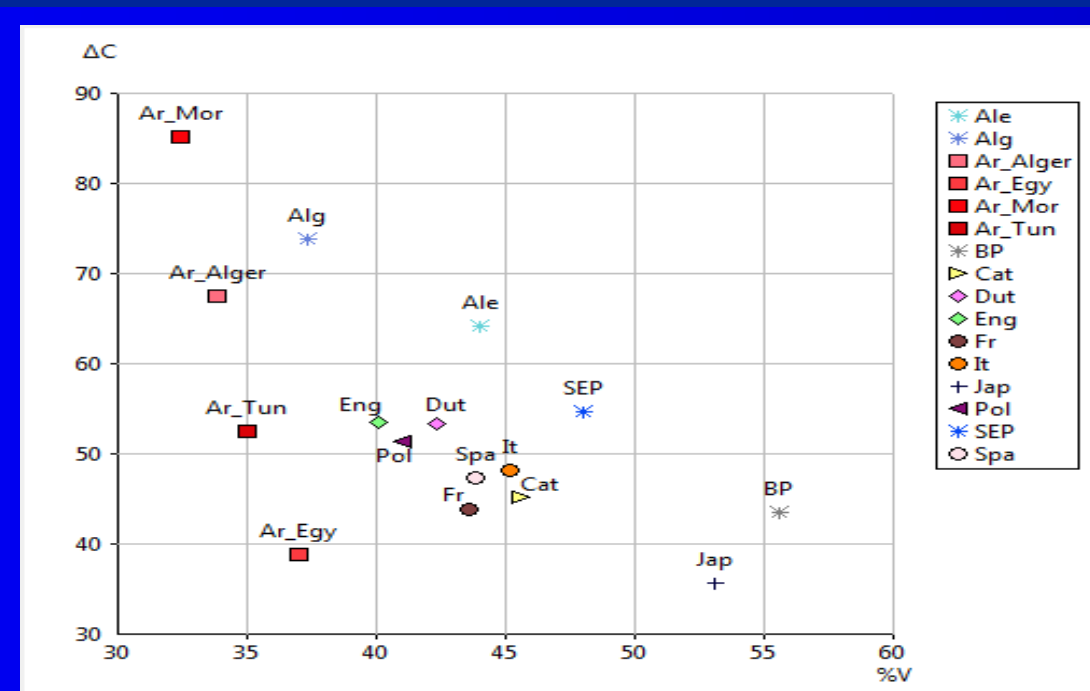


Figure 4 – Δ C vs. %V for Portuguese varieties. Selective comparison between SEP/BP (corpus Rm from Frota & Vigário, 2001) and Southern varieties.

Selective Comparison

	%V	Δ %C	Δ C
Alg	36,9	3,9	71,8
Ale	44,2	3,6	64,2
SEP	43,8	2,3	54,7
BP	53,2	1,7	55,7

Table 2 – Three averaged acoustic measures : across Portuguese varieties. Results for SEP and BP from Frota & Vigário (2001) (the Rm corpus).

Global vs. Selective ?

Few differences:

- %V in SEP is lower, which makes it closer to Ale in the %V dimension
- Δ %C in Alg is lower in the selective results than in the global ones, which makes it closer to Ale in the Δ %C dimension

Comparison across Portuguese varieties do not seem to be affected by the use of different/varying corpora (**BUT**).

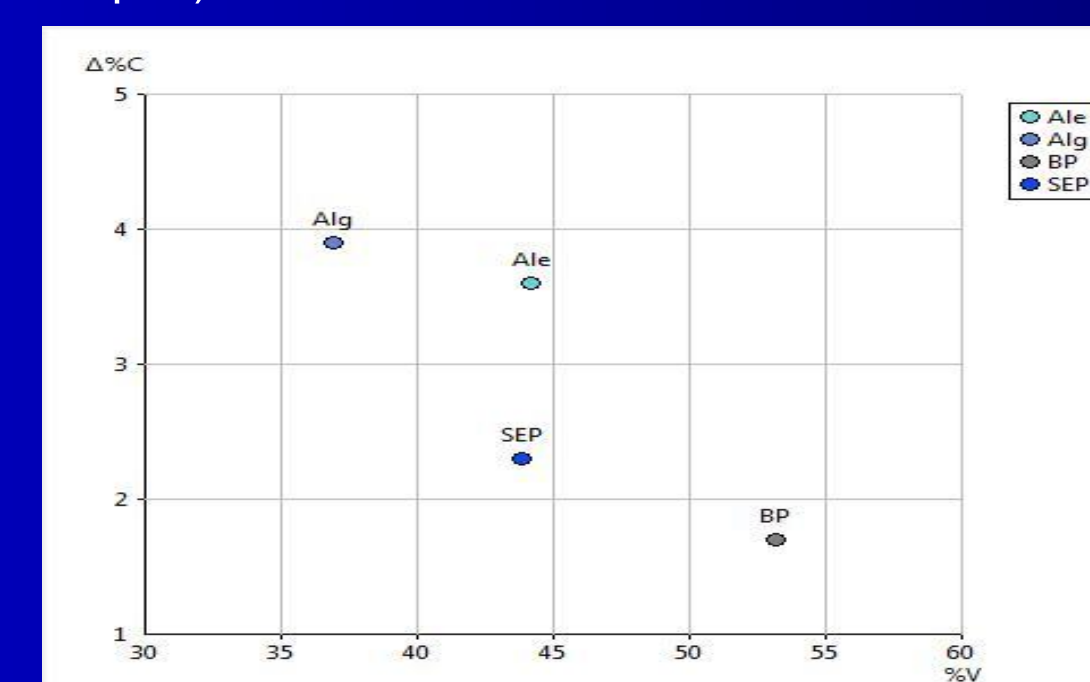


Figure 5 – Δ %C vs. %V for Portuguese varieties. Selective comparison between SEP/BP (corpus Rm from Frota & Vigário, 2001) and Southern varieties.

The organization of Portuguese varieties in **rhythmic classes** is more clear when the same basic corpus is used.

The rhythmic properties remain the same:

- the **Δ %C** dimension allows to classify Ale and Alg as stress-timed varieties
- the **%V** dimension allows to distinguish within southern varieties – stress-timing in Alg, but syllable-timing in Ale, as in SEP.

Further work is needed:

- expand the analysis within and across varieties and add other corpora (as Frota & Vigário 2001 did)
- use other acoustic measures (Varcos and PVIs) and compare the results
- complement the analysis of production data with perception experiments
- add to the debate on the organization of languages and varieties into rhythmic classes or along a rhythm continuum.

For discussion (sum up)

- 2 regions belonging to the **same variety** (Interior Center and South) may display **different rhythmic properties**: **Ale** seems to present a **mixed rhythm**, like **SEP**; **Alg** is clearly **stress-timing**.
- In the **%V** dimension, Ale (and SEP) is more **syllable-timed**, whereas in the **Δ %C** Ale presents **stress-timing** properties.
- These results seem to be related with previous observations on the hypothetical correlation between phrasing and pitch accent distribution, with Alg being closer to Western Arabic (Cruz & Frota accepted). Further research is needed.
- The use of different corpora impacts on the results. Statistical data are also necessary.

Selected references

- Arvaniti, A. 2012. The usefulness of metrics in the quantification of speech rhythm (prepublication version). *Journal of Phonetics* 40: 351-373.
- Dauer, R. 1983. Stress-timing and syllable-timing reanalyzed. *Journal of Phonetics* 11: 51-62.
- Frota, S. & M. Vigário. 2001. On the correlates of rhythmic distinctions: the European/Brazilian Portuguese case. *Probus* 13: 247-273.
- Gazhali, S., R. Hamdi & M. Barkat. 2002. Speech rhythm variation in Arabic dialects. *Speech Prosody* 2002, April 11-13, Aix-en-Provence, France, 331-334.
- Grabe, E. & E. L. Low. 2002. Durational variability in speech and the rhythm class hypothesis. In C. Gussenhoven & N. Warner (eds.) *Papers in Laboratory Phonology 7*, Berlin, Mouton de Gruyter, 515-546.
- Nazzi, T., J. Bertoni & J. Mehler. 1998. Language discrimination by newborns: Toward an understanding of the role of rhythm. *Journal of Experimental Psychology: Human Perception and Performance* 24, 756-766.
- Nespor, M. 1990. On the rhythm parameter in phonology. In I. Roca (ed.) *The logical problem of language acquisition*, Dordrecht: Foris, 157-175.
- Ramus, F., M. Nespor & J. Mehler. 1999. Correlates of linguistic rhythm in the speech signal. *Cognition* 73: 265-292.