

Universidade de Lisboa
Faculdade de Letras
Departamento de Linguística Geral e Românica



**Prosodic variation in
European Portuguese:
phrasing, intonation and
rhythm in
central-southern varieties**

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PhD in Linguistics
Portuguese Linguistics

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This research was developed within the PhD Project BD/61463/2009, funded by Fundação para a Ciência e a Tecnologia.

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

Aos meus pais

A minha avózinha, a minha segunda mãe

Abstract

Included within a research project aiming to provide a detailed description of prosodic variation in European Portuguese (EP), the present study analyzes phrasing, intonation and rhythm in central-southern varieties using data from different types of tasks (reading task, Discourse Completion Task, Map Task).

Following the Prosodic Phonology view of prosodic structure (e.g., Selkirk 1984, 1986, Nespor & Vogel 1986/2007) and the Autosegmental Metrical (AM) approach within the intonational phonology framework (e.g., Pierrehumbert 1980; Ladd 1996/2008), we examined the prosody of two regions of the south of Portugal (Alentejo – Ale –, and Algarve – Alg) relating to: (i) phrasing; (ii) tonal system and pragmatic meanings of tonal morphemes; (iii) pitch accent distribution, and (iv) rhythmic properties of each variety.

The analysis of prosodic phrasing reinforces the relevance of the Intonational Phrase in EP. Segmental phenomena such as Fricative Voicing and Paragoge (the later only in Ale) cue the IP level, and length in number of syllables and syntactic/prosodic branching of phrases impact on intonational phrasing. Intonationally, some general properties can be observed across varieties, such as: (i) similar nuclear contours across speech styles, (ii) the same pitch accent to convey focus in declaratives, (iii) post-focal subordination, and (iv) tonal boundary marking at the IP-level. However, some specificities were also found, namely: (i) a dense pitch accent distribution correlated with intonational phrasing choices in Ale, but not in Alg; (ii) a specific phrasal level in Ale, but not in Alg, that may show tonal edge-marking. The inspection of rhythmic properties showed that Ale presents a mixed rhythmic nature, whereas Alg is clearly stress-timed. Perceptual experiments with listeners from the Standard variety (SEP) showed that central-southern varieties are discriminated from SEP, even when F0 is not preserved in the signal. In contrast with SEP-Alg (different rhythmic properties), the discrimination SEP-Ale (same rhythmic properties) is unexpected. Speech rate is raised as a possible cue being interpreted by listeners, but left open for future research.

This work contributes to our knowledge of the prosodic and intonational system of Portuguese, as well as the prosody of other languages, namely in the Romance space. Furthermore, our findings impact on the phonological analysis of prosody and of prosodic variation. The current results may be used as resources for the teaching of European Portuguese as first or second language, for computational applications, forensics, speech therapy, *inter alia*.

Keywords: prosodic variation, prosodic phrasing, intonation, rhythm, speech styles.

Resumo da Dissertação

Enquadrada num projecto dedicado à variação prosódica no Português Europeu (PE), a presente investigação visa analisar o fraseamento, a entoação e o ritmo nas variedades centro-meridionais, a partir de dados de diferentes tipos de tarefa (leitura, *Discourse Completion Task*, *Map Task*).

Partindo da abordagem da Fonologia Prosódica à estrutura prosódica (Selkirk 1984, 1986, Nespor & Vogel 1986/2007) e do Modelo Métrico Autossegmental enquadrado na Fonologia Entoacional (Pierrehumbert 1980; Ladd 1996/2008), analisou-se a prosódia de duas regiões do Sul de Portugal (Alentejo – Ale; Algarve – Alg), considerando os seguintes aspectos: (i) fraseamento, (ii) sistema entoacional e significados pragmáticos dos morfemas tonais; (iii) distribuição de acentos tonais e (iv) propriedades rítmicas de cada variedade.

A análise do fraseamento prosódico confirma a importância do Sintagma Entoacional (IP) no PE. Fenómenos segmentais como o Vozeamento da Fricativa e a Paragoge (o último apenas no Ale) fornecem evidências para o nível de IP. A extensão frásica (em número de sílabas) e a complexidade sintáctica/prosódica têm impacto no fraseamento. Entoacionalmente, observam-se propriedades comuns a todas as variedades: (i) contornos nucleares semelhantes, independentemente do estilo discursivo, (ii) o mesmo acento tonal para o foco, nas declarativas, (iii) subordinação pós-foco, e (iv) marcação tonal da fronteira, obrigatória para o nível de IP. Contudo, também verificámos especificidades, tais como: (i) elevada densidade tonal correlacionada com os padrões de fraseamento entoacional no Ale, mas não no Alg, e (ii) marcação opcional do PhP, apenas no Ale. A análise do ritmo mostra que o Ale apresenta uma natureza mista, enquanto o Alg tem um ritmo acentual. Testes perceptivos com participantes da variedade *standard* (SEP) mostram que as variedades centro-meridionais são discriminadas do SEP, mesmo quando a entoação não é preservada no sinal acústico. Em contraste com SEP-Alg (propriedades rítmicas diferentes), a discriminação SEP-Ale (mesmas propriedades rítmicas) é inesperada. A velocidade discursiva é sugerida como possível pista usada para a discriminação, aspecto a explorar em trabalhos futuros.

Esta investigação contribui para o conhecimento do sistema prosódico e entoacional do Português, bem como para o conhecimento da prosódia de outras línguas, nomeadamente, no espaço Românico. Além de fornecerem informação adicional para os estudos de variação prosódica, os resultados alcançados constituem instrumentos relevantes para outras áreas do conhecimento, tais como o ensino do Português como L1 ou L2, terapia da fala, aplicações computacionais, *inter alia*.

Palavras-chave: variação prosódica, fraseamento, entoação, ritmo, estilo discursivo.

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List of Abbreviations and Symbols

EP	European Portuguese
BP	Brazilian Portuguese
SEP	Standard European Portuguese (Lisbon, Lisbon district)
NEP	Northern European Portuguese (Braga, Braga district)
Ale	Alentejo (Castro Verde, Beja district)
Alg	Algarve (Albufeira, Faro district)
Por	Porto (Oporto, Oporto district)
AM	Autosegmental Metrical framework
BI	Break Indices
ToBI	Tone Break Indices
SLH	Strict Layer Hypothesis
NP	Noun Phrase
PAD	Pitch Accent Distribution
Syl	Syllable
CL or BI 0	Clitic
PW or BI 1 or ω	Prosodic Word
CG	Clitic Group
PWG or BI 2	Prosodic Word Group
PhP or BI 3	Phonological Phrase
ip	Intermediate phrase
IP or BI 4	Intonational Phrase
IP ^{min}	Internal Intonational Phrase of a Compound IP
IP ^{max}	External Intonational Phrase of a Compound IP
U	Utterance
[...]PhP	Internal position of the PhP
[.._]PhP	Final position of the PhP
[.._]IP	Final position of the IP
[.._]IP [...]IP	Final position of an internal IP
S	Subject
V	Verb
O	Object
C	Consonant
V	Vowel
ep	Epenthesis
vs	Vowel split
vl	Vowel lengthening
Hz	Hertz
ms	Milliseconds
PR	Pitch Range
PA	Pitch Accent

InAPoP	Interactive Atlas of the Prosody of Portuguese
IARI	Interactive Atlas of the Romance Intonation
IViE	English Intonation in the British Isles
ALEPG	Linguistic and Ethnographic Atlas of Portugal and Galicia
CORDIAL-SIN	The Syntax-oriented Corpus of Portuguese Dialects
ALLP	Linguistic Atlas of the Portuguese Coast
ALEAç	Linguistic and Ethnographic Atlas of Azores
RLD	Romance Languages Database
y	Yes (presence)
n	No (absence)
%V	Duration of vocalic intervals
ΔV	Variability of the duration of vocalic intervals
ΔC	Variability of the duration of consonantal intervals
$\Delta\%V$	Standard deviation of %V
$\Delta\%C$	Standard deviation of %C
VarcoV	Standard deviation of vocalic intervals
VarcoC	Standard deviation of consonantal intervals
PVI	Pairwise Variability Indices
nPVI	Normalized Pairwise Variability Indices
rPVI	Raw Pairwise Variability Indices
CCI	Control and Compensation Index
SDT	Signal Detection Theory
RT	Reaction times
d'	d-prime
+F0	with F0 contour
-F0	without F0 contour
L1	Native Language
L2	Non-Native Language (Second Language)
[C:]	Written context of sentences in reading task
DCT	Discourse Completion Task
IPA	International Phonetic Alphabet
SAMPA	Speech Assessment Methods Phonetic Alphabet

Acknowledgements

Along this journey, I came across many people who contributed for my personal and academic identity. However, I will use my native language from now on, so I can express my true feelings, better.

À minha família, devo um profundo agradecimento pelo apoio constante e incondicional. Aos meus pais e à minha avó materna, a quem dedico este trabalho, e que me dão a mão sempre que preciso. Sei que estão sempre aqui e só isso é suficiente para me acalmar! À minha irmã, pelo carinho, pela partilha e, muito importante, pela paciência. Vocês são tudo o que tenho de melhor, o meu porto de abrigo!

À minha orientadora, Sónia Frota, por “me levar com ela” e por acreditar em mim. Obrigada pela precisão cirúrgica que tão bem a caracteriza e que emprega em tudo o que faz. Quando crescer, quero ser assim.

À Marina Vigário pelos comentários tão preciosos que foi tecendo ao longo deste e de outros trabalhos. Aprendo muito em poucos minutos de conversa.

Não posso deixar de reservar umas quantas linhas para ‘os meus dois rapazes’, o meu apoio nestes últimos tempos. Foram incansáveis no recrutamento de participantes para os meus testes perceptivos e na aplicação dos mesmos. Nuninho e Pedrocas, não sei que seria de mim sem vocês, sobretudo nestes últimos dias. Meus companheiros das recolhas de dados, das discussões prosódicas à mesa, das gargalhadas... Meus amigos, meus confidentes. A boa disposição que vos caracteriza, a solidariedade, a dedicação constante... nada exprime tudo o que recebi de vocês ao longo desta caminhada. Nunca me esquecerei das palavras de alento nestes últimos dias. Agarrei-me a elas e aqui estou eu! Um sincero obrigada por TUDO.

Ao Joe pela leitura integral da tese e pelas correcções importantíssimas. Esteve sempre ali, à espera, e a responder muito prontamente. Joe, it is done now! Many thanks for your eagle eye.

Su, muito obrigada pelas leituras e sugestões. Muito obrigada pelas palavras de apoio.

À Cátia, ao Nuno, à Raquel, companheiros desta e de outras caminhadas. Sei que estiveram, estão e estarão aqui, sempre. Nunca me esqueço disso.

À Aninhas pela amizade de anos, pela preocupação que nutre por todos os que a rodeiam. Obrigada por ouvires os meus desabafos, obrigada por seres quem és, na minha vida.

Do outro lado do Oceano, não posso esquecer pessoas que me são muito queridas: a Flávi, a Carol Serra (já de outras caminhadas), a Pri e a Carol Cangemi. À Jô, agora deste lado do Oceano, obrigada pelas mensagens de carinho e desculpa a minha recente ausência.

Aos meninos e meninas catalães, Maria del Mar, Joan, Rafèu, Vèro, que muito bem me receberam durante a minha formação em Barcelona. Ainda à Meghan. Muito obrigada por se cruzarem no meu caminho! Tenho aprendido muito convosco!

À Nádia, um dos membros mais recentes do lab, sempre disposta a ajudar.

A todos os meus informantes, que dispensaram três horas do seu precioso tempo para estarem comigo. A todos os que, de alguma forma, participaram no meu trabalho. Saliento o apoio fundamental da Cátia, bem como da Câmara Municipal de Albufeira. Em Castro Verde, tenho de reconhecer que a família Matos ficou no meu coração. À Paulinha, ao Luís pai e ao Luís filho, muito obrigada pela hospitalidade com que me receberam. Foram dias bem passados!

À Susete Bruno, a quem devo o último mapa deste trabalho! Muito obrigada pelo “bom dia” sempre tão bem disposto.

Por fim, mas não de menor importância, a ti, Diogo. Desculpa a rabugice! Foram tempos difíceis, eu sei...

«Recordo paisagens e, enquadrados nelas, homens e mulheres. Diversos como os cenários em que se situavam, contavam-me histórias, diversas também. Ao fim de dois ou três dias sentíamo-nos por vezes verdadeiros amigos, quase irmãos. Eu não tinha podido dar-lhes senão um pouco de atenção, de simpatia. Eles tinham-me dado uma lição magnífica, decisiva para o meu modo de sentir e de pensar a partir daquele momento.

[...] Se mais nada, no vasto terreno da linguística, conservasse um dia interesse para mim, creio que esta experiência seria só por si suficiente para me obrigar a reconhecer e afirmar que vale a pena o ramo de estudos para que a vida me conduziu.»

(in Luís F. Lindley Cintra, in ‘Sobre o interesse humano do estudo dos dialectos e falares regionais’, *Estudos de Dialectologia Portuguesa*, 2ª edição, 1995, pp. 7-15.)

1. Introduction

The present research is a contribution to a major ongoing project at the Phonetics Lab & Lisbon BabyLab (CLUL/FLUL), which aims to build an *Interactive Atlas of the Prosody of Portuguese (InAPoP)* – PTDC/CLE-LIN/119787/2010, funded by FCT – Fundação para a Ciência e a Tecnologia). The InAPoP web platform is available at <http://www.fl.ul.pt/LaboratorioFonetica/InAPoP/> (Frota & Cruz, coords., 2012-2014). This project greatly benefited from three other atlases, developed by Pilar Prieto and collaborators (University Pompeu Fabra, Barcelona) – *Atles interactiu de l'entonació del català* (Prieto, & Cabré, coords., 2007-2012), *Atlas interactivo de la entonación del español* (Prieto & Roseano, coords., 2009-2013), and *Atlàs interactiu de l'intonacion de l'occitan* (Prieto & Sichel-Bazin 2014). Partly based on similar methodologies as the other atlases, the *InAPoP* allows a close comparison across European and Brazilian Portuguese varieties, and also across Romance languages (Portuguese, Catalan, Spanish and Occitan, as well as French, Italian, Friulian, Sardinian and Romanian, which are included in the ongoing *IARI* project - *Interactive Atlas of Romance Intonation* (Prieto, Borràs-Comes & Roseano, coords., 2010-2014).

Within this context, we aim to provide a detailed prosodic analysis, which includes phrasing, intonation and rhythm, of the speech of two urban regions belonging to the central-southern variety of European Portuguese (EP), according to Cintra (1971). The two urban regions studied are located in Alentejo and Algarve. With the goal of comparing the prosody of the two central-southern regions with the prosodic and intonational systems already described for Standard European Portuguese (SEP) and Northern European Portuguese (NEP) varieties, the materials used in the prosodic analysis of SEP and NEP (Frota 2000; Frota & Vigário 2001; Vigário & Frota 2003; Frota & Vigário 2007) were reused and extended in order to allow a closer comparison between previous results and those obtained in the current study. This is the first in-depth study of the prosody of southern varieties of EP.

Our major goal is to observe similarities and differences in prosodic patterns across EP varieties, in different speech styles, focusing on central-southern varieties. In this sense, we explore the following prosodic aspects: (i) the prosodic organization and characterization of constituents above the Prosodic Word (PW); (ii) the ways *sandhi* and other segmental phenomena cue prosodic phrasing; (iii) the average size of the Intonational Phrase (IP); (iv) the pitch accent distribution in the Intonational Phrase (tonal density); (v) the tonal inventory and the pragmatic meanings of tonal morphemes (including focalization); (vi) nuclear

contours for each sentence type (declaratives, yes-no questions, wh-questions, requests and vocatives – greeting call and insistent call); and (vii) the rhythmic properties.

The present research is thus a contribution to the knowledge of the prosody of EP, and it also adds information to the understanding of the properties and limits of variation within and across languages, in general. The results will also be of interest for (i) prosodic typology; (ii) studies on syntax-prosody and morphology-prosody interfaces; (iii) language development (prosodic bootstrapping); (iv) language pathologies and disorders; (v) computational purposes, namely for synthesis and speech recognition systems; (vi) and teaching of EP as first or second language, among others.

In chapter 2, an overview of prior studies on prosodic variation is presented (section 2.1), and the background on variation in EP is provided (section 2.2). General methodological procedures that were taken into account in this research are mentioned (section 2.3), from the selection of the geographical points for analysis to the annotation criteria adopted.

Chapters 3, 4 and 5 are devoted to the analysis of each of the main prosodic aspects covered in this dissertation, respectively phrasing, intonation and rhythm. The first sections of each chapter provide a general background for the prosodic aspect under analysis, followed by a review of previous studies for EP. Then, the analysis of the data from the two central-southern varieties is described, followed by discussion and concluding remarks and some of the respective theoretical implications.

For the analysis of prosodic phrasing in the Interior Centre and South (Chapter 3), both segmental and suprasegmental evidence was inspected. In line with previous studies on prosodic phrasing in the Standard variety, we decided to explore fricative voicing as a cue for prosodic phrasing patterns (section 3.3.1), as well as the insertion of a paragogic vowel, known to be characteristic of the Interior Centre and South. At the suprasegmental level, syntactic and prosodic complexity and length in number of syllables were also inspected in order to see whether and how these aspects constrain prosodic phrasing (section 3.3.2).

The intonational analysis of the Interior Centre and South (Chapter 4) includes the inspection of (i) the main nuclear contours, (ii) tonal marking of prosodic edges, (iii) prosodic focus and the post-focal behavior in early focus cases, and (iv) pitch accent distribution (section 4.3.2). These prosodic aspects were examined in different speech styles and considering several sentence types.

Rhythmic properties of the central-southern varieties were inspected on the basis of production and perception experiments. First, an acoustic analysis on the basis of two different metrics is presented (section 5.4). Then, experiments with participants from the Standard variety perceiving manipulated sentences produced by speakers from the Interior

Centre and South are described (section 5.4.2). This preliminary study of rhythmic properties across varieties of EP adds to the discussion of the rhythmic organization of languages (and varieties) in classes or along a continuum.

Finally, in the conclusion (Chapter 6), we sum up the main results obtained for the analysis of phrasing, intonation and rhythm in the Interior Centre and South. The challenge involved in the cartographic representation of these prosodic aspects and the relevance of this kind of representation for research on prosodic variation are also reported. Furthermore, a parallel with the cartographic representation of segmental and syntactic aspects is considered, and areas of convergence/divergence are proposed. We also discuss hypothetical implications of our results for the knowledge of the European Portuguese prosodic grammar, in particular, and for prosodic typology in general.

2. Prosodic Variation

2.1. An overview

Studies on prosodic variation are considered as a relevant source of information to determine generalizations and specificities of prosodic systems. General tendencies observed across languages are interpreted as universals of language. Based on the model of prosodic phonology, Vogel (2009) proposes and discusses a series of potential universals, related with general properties of prosodic structure, the geometry of prosodic constituents, and prosodic structure phenomena. By establishing these universals, Vogel (2009) is thus assuming that these aspects do not vary across languages/varieties. However, the author does not discard the possibility of significant deviations relative to the proposed universals. Even though, the proposed universals are considered as general tendencies (widely observed across languages), thus opposed to absolute universals (Vogel 2009).

As a first step to establish a prosodic typology, Hirst & Di Cristo (1998), for example, assembled descriptions of the intonation systems of twenty languages. A few years later, based on the prosodic description of thirteen languages, all following the Autosegmental Metrical (AM) framework¹, together with data from eight other languages, Jun (2005) proposed a model of prosodic typology. The author shows, among other observations, that: (i) all languages have at least one prosodic unit above the word, and (ii) the number and type of rhythmic/prosodic units at the postlexical level are not predictable from the lexical rhythmic unit of the language, nor from the type of lexical prominence. For instance, in both English and Portuguese, lexical prominence is conveyed by stress. However, the foot is the lexical rhythmic unit in English, which differs from the lexical rhythmic unit of Portuguese – the syllable. Furthermore, these two languages have also different rhythmic/prosodic units at a postlexical level: the intermediate phrase and Intonational Phrase in English, but only the Intonational Phrase in Portuguese. In sum, according to Jun (2005), prosodic similarities and differences across languages are captured by two main aspects, which may define a prosodic typology: prominence and the rhythmic/prosodic pattern of an utterance.

According to Ladd (1996/2008), languages can differ intonationally in four possible dimensions: (i) semantic (differences in the meaning/use of phonologically identical tunes); (ii) systemic (differences in the inventory of phonologically distinct tunes, independently of semantic differences); (iii) realisational (different phonetic realizations of the same phonological tune); (iv) phonotactic (differences in tune-text association). For Hirst & Di

¹ For a detailed description of the AM framework, see Chapter 4, section 4.1.

Cristo (1998: 1-44), the variability in the intonation systems of different languages might reflect the variability across dialects of the same language. Thus, the authors hypothesize that in the intonation system of a given language, some parameters would be anchored in the system while other aspects would be more prone to vary across dialects.

Subsequent studies on prosodic variation have included the analysis of varieties of languages, with important consequences for the knowledge of prosodic grammar and for both intonational and rhythmic typologies. Studies on Swedish varieties developed by Bruce and collaborators (Bruce 1977, 2004, 2005, 2007; Bruce & Gårding 1978, Gårding 1982) and the IViE project for British English (Coleman & Kochanski 2003) are among the most relevant studies on prosodic variation across language varieties. As with other Scandinavian languages (Norwegian, Danish), Swedish is characterized by the opposition between two word accents (accent I and accent II). Seven different intonational varieties were found within the Project SweDia 2000 (Bruce 2004, 2005), characterized on the basis of some interrelations, such as between phrasing (less understood, and then interpreted as a kind of pitch course between the two accented types, signaling the coherence between these items) and focal accentuation. In this sense, Swedish speech from the South present a low *plateau*, while the Northern variety presents a high *plateau*. Interestingly, varieties with a low *plateau* (South and Far East) do not distinguish between focal and non-focal accent, in contrast with speakers from the varieties of West, Central, East and North (with a high *plateau*). The latter varieties are also characterized by a downstepping of post-focal accents, instead of deaccentuation (observed in the former). Within the IViE Project, nine urban varieties of English were analyzed. Cross-variety differences were found in the phonetic realization of pitch accents: Cambridge and Newcastle English compress, whereas English spoken in Belfast and Leeds is characterized by truncation. Considering intonational phonology, the production of nuclear accents was shown to vary along three dimensions: (i) variety, (ii) sentence type, and (iii) speaker. For example, declaratives are essentially produced with falling contours, whereas questions are subject to more variation (three or four patterns were observed per variety) (Grabe et al. 2000, Grabe 2004).

For several Romance languages, research has also been developed on this field. Besides the individual Atlases developed for Catalan varieties, Spanish varieties, and Occitan varieties (by Prieto and collaborators), a joint Atlas covering nine Romance languages (Catalan, French, Friulian, Italian, Occitan, Portuguese, Romanian, Sardinian, and Spanish) is under construction (*IARI* - Prieto, Borràs-Comes & Roseano, coords., 2010-2014). However, only intonation is explored within these Atlases. Other prosodic aspects such as phrasing and rhythm were not considered for these cross-language comparisons. Actually, phrasing is

barely described from a variational perspective. Even among Romance languages, phrasing is only explored, in a comparative fashion, in European Portuguese, Spanish, Catalan, and Italian (Elordieta et al. 2003; Elordieta, Frota & Vigário 2005; D’Imperio et al. 2005; Frota et al. 2007). Frota (2012a) summarizes the main cues for phrasing (such as phrasal phonological processes, rhythmic phenomena like stress clash resolution strategies, the realization of tonal targets) and illustrates some variation of these cues across languages.

More recently, the main intonational patterns of Peninsular and American varieties of Spanish were inspected in a cross-comparison perspective (Hualde & Prieto in press). Falling nuclear contours in declaratives are less common, which is quite different from the intonational pattern of declaratives of other Romance languages (e.g. Italian or Portuguese). Information seeking yes-no questions are produced with a falling-rising configuration in varieties spoken in Madrid or Mexico, but with a rising-falling contour in varieties spoken in the Caribbean or Buenos Aires. Pitch accent distribution in Spanish is known to be high (Hualde 2002), but it is style dependent: in careful speech, every content word tend to carry a pitch accent; in more casual speech, the rate of deaccentuation increases (Hualde & Prieto in press).

Aiming at developing research and applications on prosodic, intonational and rhythmic variation in Portuguese, the *Interactive Atlas of the Prosody of Portuguese (InAPoP)* project covers the analysis of phrasing, intonation and rhythm, and these three prosodic dimensions were thus considered in the present research.

Before presenting these three prosodic dimensions of variation in detail (Chapters 3, 4, and 5), we provide a general description of variation in European Portuguese (section 2.2) from a non-prosodic (section 2.2.1) and a prosodic perspective (section 2.2.2).

2.2. Variation in European Portuguese

2.2.1. Non-prosodic variation

Research on variation in EP was limited, until a decade ago, to segmental and lexical aspects. The proposal for the classification of Portuguese dialects (Cintra 1971), which was more recently adapted by Segura & Saramago (2001), describes a split between two major linguistic areas in Portugal, corresponding to northern varieties and central-southern varieties, illustrated in the map below (Figure 1). Northern varieties are essentially characterized by the presence of more conservative features than central-southern varieties. Northern varieties are separated into two regions: Transmontano and Alto-Minhoto (light blue - Figure 1 below),

and Baixo Minhoto, Duriense and Beirão (dark blue). The former is phonetically characterized by the maintenance of four sibilants – the fricative [s] and its sonorant [z], associated with the graphemes <c(e,i)>, <ç> and <z>, as well as their correspondent apical-alveolar realizations [ʃ] and [ʒ], associated with the graphemes <s> and <ss>. The latter is phonetically characterized by the reduction of the system of four sibilants to the two apical-alveolar realizations (Cintra 1971:102).



Figure 1– European Portuguese dialects, according to Cintra (1971), adapted by Segura & Saramago (2001). The black solid line splits the northern varieties (in light and dark blue) from the central-southern ones (in brown and white). The red thinner lines signal regions with peculiar linguistics features.

Central-southern varieties are also separated into two regions: Littoral-Centre and Interior Centre and South (brown and white - Figure 1 above). These two regions mainly differ from each other in one segmental feature: the reduction of the diphthong /ej/ to [e] in the latter. Lisbon, although included in this region, has a phonological behavior similar to the Littoral-Centre because it maintains the diphthong /ej/, produced as [ɐj] (Cintra 1971:102; Vigário & Frota 2003).

More recently, other studies have been developed. Aguiar (2008) and Aguiar & Vigário (2010) observe phonological phenomena, and phonological units (segments, syllables and stress) in the region known as *Terra Quente Transmontana*, in the Northeast of the country. Rodrigues (2003) compares the Standard variety (Lisbon) with a specific region from the North (Braga), from a segmental perspective. Both these regions were also analyzed by Vigário & Frota (2003) and Frota & Vigário (2007), but from a suprasegmental point of view, namely the authors observed the main phrasing patterns and nuclear configurations of

declaratives and interrogatives in a cross-comparison fashion (see sections 3.3 and 4.2, respectively, for further details).

In line with Cintra's research, several Atlases focusing on lexicography have been developed since 1970: ALEPG (Saramago coord., 1992-), ALLP (Vitorino coord., 1985-), ALEAç (Saramago coord., 1994-). These materials were then transcribed and annotated for syntactic purposes, and released as a syntax-oriented *corpus* – CORDIAL-SIN (Martins et al. 2000-). The knowledge of both morphological and syntactic variation in EP have benefited from the use of these resources, namely, Carrilho, Magro & Pereira (2004) developed a morphologic and syntactic annotation of dialectal *corpora*; Carrilho (2005) observed the expletive 'ele' in Portuguese dialects; Lobo (2001, 2003) analyzed adverbial clauses. Based on previous studies describing a geographical distribution of some non-standard syntactic structures (Martins 2003, Pereira 2003, Magro 2007, Lobo 2008, *inter alia*), Carrilho & Pereira (2011) propose isoglosses for each non-standard syntactic structure. The authors conclude that the geographical distribution of these syntactic structures matches the dialectal areas determined on the basis of phonetic and phonological phenomena (Cintra 1971, Segura & Saramago 2001). For example, gerunds mainly occur in the Interior Centre and South, which corresponds to the geographic area under analysis in the present research.

2.2.2. Prosodic variation

In this section, we describe the contribution of prosody to the knowledge of variation in EP.

Viana (1987) is known to be the first study to look at intonation in Standard EP, providing a phonological description with phonetic details as evidence. Frota (1993) is the first approach to phonological constituents above the Prosodic Word, providing segmental, durational and intonational evidence for phrasing in EP. This research was developed in Frota (1995), which gives a detailed analysis of sandhi phenomena as a cue for prosodic constituency. The author's proposals are discussed in subsequent studies (Falé 1995, Vigário 1995). Frota (1998/2000) provides a detailed analysis of prosodic phrasing and intonation on the basis of the comparison between broad and narrow focus utterances. The author further applies the AM model to the study of EP intonation, focusing on tonal association, target alignment and scaling (Frota 2002a, 2002b, 2003). Importantly, all these studies were based on the Standard variety of EP (Lisbon). The first discussion of dialectal variation in EP intonation appears in Vigário & Frota (2003), thus being a fairly recent topic of research.

Vigário & Frota (2003) and Frota & Vigário (2007) have compared the Standard variety of EP (SEP) to the Northern variety (NEP), spoken in the region of Braga. These authors have

studied prosodic phrasing, pitch accents and nuclear contour types and pitch accent distribution in these two EP varieties. Since these prosodic aspects are also examined in the central-southern varieties described in this thesis, in the following paragraphs only general information is provided. Thus, introductory sections of chapters 3, 4 and 5 are mandatory for detailed information about previous research on prosodic phrasing, intonation and rhythm across Portuguese varieties.

Vigário & Frota (2003) show that SEP and NEP contrast with respect to prosodic phrasing. In SEP declaratives usually correspond to a single Intonational Phrase (IP), except for long subjects (more than 8 syllables long), which correspond to an IP apart from the verb and the object, both grouped together in the same IP – (S)(VO). In NEP, subject, verb and object are usually grouped into two IPs (S)(VO), independently of the subject's length (Frota & Vigário 2007).

Intonationally, the declarative is produced in SEP with a falling nuclear contour (H+L*), while in NEP the nuclear Prosodic Word is produced with a low pitch, followed by a low boundary tone (L* L%). This contour is also used in this variety to produce a wh-question. In SEP, the same nuclear configuration (H+L* L%) can also be found in both declaratives and wh-questions. Yes-no questions are produced in SEP with the nuclear configuration H+L* LH%. By contrast, in NEP, yes-no questions are realized with a low nuclear syllable (L*), followed by a complex falling boundary tone (HL%). As a general observation, Vigário & Frota (2003) show that NEP mainly presents less complex pitch accents types than SEP.

To summarize, by comparing these two varieties, the authors conclude that they differ from each other in the four aspects mentioned by Ladd (1996/2008) as domains of intonational variation across languages: (i) systemic – SEP and NEP show different nuclear accents in declaratives and wh-questions (H+L* in SEP vs L* in NEP), and different nuclear contours in yes-no questions (H+L* LH% in SEP vs L* HL% in NEP); (ii) realizational – the alignment of the nuclear L target is later in NEP; (iii) distributional – SEP is characterized by a sparse pitch accent distribution inside the Intonational Phrase (IP), whereas NEP shows a higher tonal density; (iv) semantic – the contour H+L* L% may express a yes-no question in NEP and a declarative in SEP.

Studies of rhythmic variation within Portuguese have only examined SEP and Brazilian Portuguese (BP, from São Paulo) in a comparative fashion. Frota & Vigário (2001) have analyzed the rhythm in EP (SEP) and BP, by using the following acoustic measures: %V (duration of vocalic intervals within the IP), ΔC (variability of the duration of consonantal intervals within the IP), and the suggested normalized measures of the variability of intervals

($\Delta\%V$ and $\Delta\%C$). Following Dasher & Bolinger (1982) and Dauer (1983), Frota & Vigário (2001) also explore the relation between these acoustic measures and the phonological properties of each Portuguese variety. They concluded that $\%V$ and $\Delta\%C$ successfully distinguished between SEP and BP, in accordance with the known phonological properties that set the two varieties apart: vowel reduction in SEP and vowel epenthesis in BP. A cross-language comparison with the eight languages studied by Ramus, Nespors & Mehler (1999) showed that SEP clusters with stress-timed languages in the ΔC dimension and with syllable-timed languages in the $\%V$ dimension, while BP clusters with syllable-timed languages in the ΔC dimension and is closer to mora-timed languages in the $\%V$ dimension (see Chapter 5, section 5.3, for further details). Perception experiments were also run, showing that adult participants were able to discriminate EP from BP (Experiment 1) on the basis of filtered sentences, but only when intonation is preserved. When contrasted with Dutch (Experiment 2), EP and BP are no longer discriminated (Frota, Vigário & Martins 2002a, b).

Since phrasing, intonation and rhythm are unexplored in central-southern varieties, and considering our goal of adding knowledge to the current understanding of properties and limits of variation within and across languages, we decided to analyze central-southern varieties on the basis of similar *corpora* and methods previously used for Standard and Northern varieties. The general methodology applied in the current research is described in the following section.

2.3. General methodology

This chapter concludes with a description of the general methodology used in the thesis, including the selection of the sample (section 2.3.1), the tasks associated to different speech styles (2.3.2), and general procedures applied to the data collection (2.3.3). The main annotation criteria are presented in section 2.3.4. Further details on each *corpus* and particular procedures used for the analysis of each of the three prosodic aspects studied (phrasing intonation and rhythm) are given in chapters 3 to 5.

2.3.1. Sample

Considering the current scenario of studies on prosodic variation in Portuguese we described above, and given that no varieties from the South had been studied, we decided to analyze two regions from the Interior Centre and South group. Although belonging to the same global variety (central-southern variety - Cintra 1971, Segura & Saramago 2001), the two selected geographical points are located at the extreme south in order to ensure the maximal distance from Lisbon. In this sense, and also considering the geographical coverage

of *InAPoP*², we selected two urban areas³ – Castro Verde (Figure 2), from Beja district (Ale), and Albufeira (Figure 3), from Faro district (Alg). The choice of urban areas also matches the criteria determined for all the Romance intonation atlases.

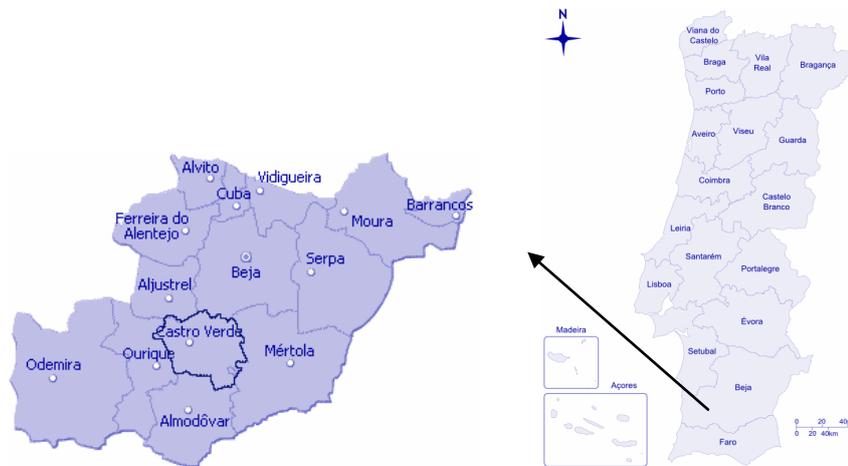


Figure 2 – Detail of the Beja district. The selected region for analysis is surrounded by a dark blue line.

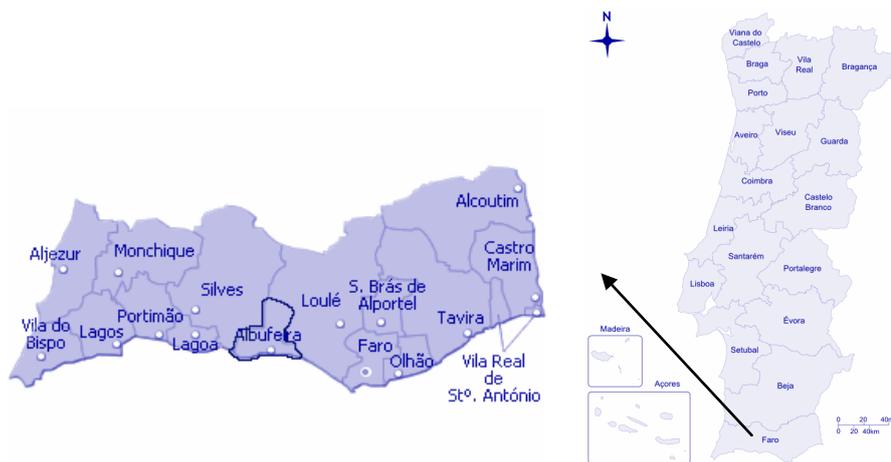


Figure 3 – Detail of the Faro district. The selected region for analysis is surrounded by a dark blue line.

² The *InAPoP* Project covers two geographical points per district: one urban area and one rural area. The choice of the exact points to be covered was not arbitrary. Based on a comparison between the ALEPG and CORDIAL-SIN Atlases, the common geographical points to the lexicographic Atlas and the syntactic Atlas were considered for the selection of the points to be covered from a prosodic point of view within *InAPoP*. After that, a classification of these points as being urban or rural was judiciously made on the basis of statistical data available at INE (see Footnote 3). Finally, for the districts barely covered, we decided to add a third point. This is the case for Beja and Faro districts, initially covered in their extreme latitudinal areas. For the geographical distribution to become more homogeneous, one urban area was added to each district, in its centre-south.

³ The classification of geographical points as urban or rural was established on the basis of statistical data available at the National Institut for Statistics (INE).

We have also collected data from SEP (Lisbon), in order to allow for a full cross-comparison analysis between the two regions from central-southern varieties and the standard variety.

In each region, we collected speech data from 6 female speakers, organized into two age groups, according to the *InAPoP* criteria (Frota & Cruz, coords., 2012-2014): 20-45 and 60 or more years of age. Speakers from the youngest age group may have a variable level of education (from high-school to university) while the eldest should be alphabetized, in order to perform the reading task. When speakers are not illiterate but they do not have good performance (i.e. they are not fluent) in the reading task, only the Interview is considered for analysis (see section 2.3.2 below). All participants are native speakers of the variety spoken in each region.

Each participant must give her consent to the processing of personal data, her voice and image included. In this sense, all participants must complete and sign both a personal information form and a consent form, giving their permission to make their data available for scientific purposes.

2.3.2. Tasks

Within the *InAPoP* project, four types of task were considered: Interview, Map Task, Discourse Completion Task, and Reading. In the following sections, the main procedures involved in data collection for each task are described (see also Frota & Cruz, coords., 2012-2014, under Methodology).

2.3.2.1. Interview

In the Interview, participants had to talk about themselves (their infancy/youth, their occupation, their family, traditional aspects of the local where they live, etc.). The researcher should have a minor participation during the 10 minutes of conversation (*circa* 1600 words per Interview). This task is particularly useful to obtain spontaneous data; however, it is not controlled enough to allow for a comparison of all prosodic aspects across speech styles and/or across varieties.

2.3.2.2. Map Task

The Map Task is a cooperation task performed by two subjects – the follower and the giver. Both participants have a map of an imaginary town, with buildings, gardens and other elements, corresponding to specific named places. The giver's map has a route marked on it and the follower's map is slightly different from the giver's: it does not have the route and it

may contain mismatches regarding both the location of specific places and its names/labels (see Appendix III).

Portuguese maps were adapted from those used by Prieto and colleagues in all atlases under Prieto's coordination (Prieto & Cabré, coords., 2007-2012; Prieto & Roseano, coords., 2009-2013; Prieto & Sichel-Bazin 2014; Prieto, Borràs-Comes & Roseano, coords., 2010-2014).

The main goal of this task is to lead to the production of particular interrogative patterns (confirmation yes-no questions, counterexpectational questions, etc.) and of utterances with narrow/contrastive focus. We also have controlled the labels of places, in terms of segmental contexts, in order to complement the set for the South included in the Reading task and to test whether, besides the prosodic context, the type of speech context (spontaneous in the Map Task) might influence the occurrence of these segmental phenomena.

During the recording procedure, participants are separated by an object to avoid visual contact. They are instructed to exclusively use voice commands. Thus, the follower has to ask for instructions from the giver in order to draw exactly the same route on his map. At the end, this participant should sum up the drawn path and the giver should interrupt if anything is not correct.

2.3.2.3. Discourse Completion Task (DCT)

The Discourse Completion Task (Blum-Kulka, House & Kasper 1989; Billmyer & Varghese 2000; Félix-Brasdefer 2010) was also included in our set of speech materials. These materials were adapted from the questionnaire primarily built for Catalan studies on intonational variation (Prieto & Cabré, coords., 2007-2012). The DCT allows us to obtain semi-spontaneous productions. A description of everyday situations is orally presented by the interviewer and speakers have to imagine themselves in each situation, being induced by the interviewer to produce an utterance corresponding to a specific sentence type and pragmatic meaning [see example (1) below].

(1) Interviewer: Sabes o que aconteceu a este rapaz e a esta rapariga?

Do you know what happened to this boy and this girl?

Speaker: Casaram.

Married (They got married).



Figure 4 – Image used simultaneously with the oral context transcribed above (1) to elicit a neutral declarative with one single prosodic word (extracted from the Portuguese version of the DCT, available at *InAPoP* – http://www.fl.ul.pt/LaboratorioFonetica/InAPoP/demo/docs_online/Questionario_PE.pdf. See also Appendix IV).

The DCT covers the following sentence types: statements, yes-no questions, wh-questions, echo questions, imperatives and vocatives. If the speaker produces an utterance that does not belong to the desired syntactic and/or pragmatic type, the interviewer must reformulate the presentation of the context until the participant gives the expected response.

The data from the DCT were already partially analyzed in a comparative perspective across varieties of Portuguese (Frota et al. 2011, in press).

2.3.2.4. Reading Task

In the Reading task, we have considered several pre-existing *corpora*, already used for SEP, to allow a closer comparison across EP varieties (and across Romance languages).

Intonation contours per sentence type have been observed in Ale and Alg (and once again in SEP), using the following *corpora*: (i) Frota (2000) for topic, focus and neutral declaratives; (ii) Frota (2002a) for neutral and focused interrogatives; (iii) Frota (2003) for initial peaks and (iv) Frota (in press) for imperatives, requests and calling contours.

Frota's (2000) *corpus* also allows us to examine phrasing. D'Imperio et al.'s (2005) *corpus* took into consideration syntactic and prosodic complexity, as well as phrase length in number of syllables and in number of PWs, and the hypothetical influence of these features on prosodic phrasing.

Finally, the study of rhythm in central-southern varieties is based on the materials of Ramus, Nespor & Mehler (1999), translated and adapted to Portuguese by Frota & Vigário (2001).

All these *corpora* correspond to a global set containing 364 sentences, applied in all varieties (Appendix I).

Besides the global set, our materials also include an additional survey for the South (Appendix II). This was prepared in order to examine the occurrence of a specific segmental phenomenon from a prosodic point of view. Several authors (Vasconcellos 1896, 1987; Maia

1975; Florêncio 2001) mention that the insertion of vocalic material at the right periphery of the word (a phenomenon known as *paragoge*) is very common in central-southern varieties, namely in Alentejo. We thus decided to build a specific *corpus* with a total of 140 sentences where the final segment of Prosodic Words, as well as the position in higher prosodic constituents, was controlled. Our main goal was to inspect whether this phenomenon is favoured by specific prosodic factors.

To summarize, the *corpora* used in the Reading task in Ale, Alg and SEP include a total of 504 sentences, presented in random order on a computer display (one sentence per slide). Several sentences are preceded by a context in order to trigger a specific pragmatic meaning. Contexts are signalled by '[C:]', and the information provided as context is presented within brackets. All sentences were read twice, except the specific set for the South, which gives a total of 868 productions by speaker.

2.3.3. Procedures

Speakers' performance in all tasks was videotaped using a JVC camera, model GY-HM11E. The video was captured in Quick Time format (48000Hz), and the audio was captured by an external microphone Shotgun DPA, model DPA 4017, with the frequency range of ± 2 dB; 70Hz-20000Hz, with a high pass filter at 50Hz. The external microphone was fixed to the camera, both pointed towards the participant and placed at the same distance (one meter away from the participant).

Occasionally we used the flashlight, in order to have a lighter image. The video image will not be useful for the current research, but it was recorded within *InAPoP* in order to collect materials allowing further complementing researches as the alignment between facial gestures (eyebrows movements, eye blinks, lips movements, etc.) and spoken prosody.

The data collection took place in a silent room, in *loco*. Both for Ale and Alg, the place of recording was provided by the local City Halls; for SEP, we have used the Phonetics Lab facilities (CLUL/FLUL).

2.3.4. Main annotation criteria

In order to prepare the recorded speech for analysis, we have first extracted the sound from the video file, using the software *AoA - Audio Extractor Basic* (Version 2.2.8). The output configurations were .wav format files, with a sample rate of 22050Hz, in mono channel. After this extraction, we have semi-automatically cut the sound file in slices – one slice for each sentence – using a *Praat* (Version 5.2) script. All files contain a short initial and

final silence period: 500 milliseconds (ms) before and after sentence production, when it starts or ends with a stop; 200ms in the other segmental contexts.

When the sound file had background noise, we reduced it by means of *Adobe Audition* (Version 1.5), but we always keep both files.

All sound files were labeled with the initials of the speaker's name as well as an abbreviation of each variety's name and, in the case of the Reading task, of sentence type.

The Map Task and the Interview were orthographically transcribed, in a text document, following the guidelines already used by Prieto and colleagues and adapted to the *InAPoP* project: (i) speakers are identified as GIVER and FOLLOWER (in the transcription of the Map Task) or as INTERVIEWER and PARTICIPANT (in the transcription of the Interview); (ii) loanwords have to be written in italic; (iii) time has to be indicated between square brackets, at the right, every 30 seconds; (iv) non-linguistic elements have to be indicated in italic and between brackets; (v) interjections and fillers are transcribed according to the rules of each language; (vi) segmental phenomena already described as being a dialectal characteristic of a given region are identified with a specific label.

After the orthographic transcription, we selected the most important samples from each task, depending on the productions obtained and their respective interest (for the prosodic and intonational analysis of *sandhi* phenomena or sentence type, etc.).

The prosodic annotation criteria were the same for all tasks. Using a *Praat* script, we automatically created textgrids with specific tiers, depending on the prosodic aspect under analysis. Thus, for the analysis of intonation and phrasing, the following three tiers were created (Figure 5):

- **Intonation**: point tier for the phonological annotation of intonational contours (using P_ToBI as proposed in Frota in press);
- **Orthography**: interval tier for the orthographic transcription, word by word;
- **Phrasing**: point tier for the annotation of prosodic boundaries (using P_ToBI).

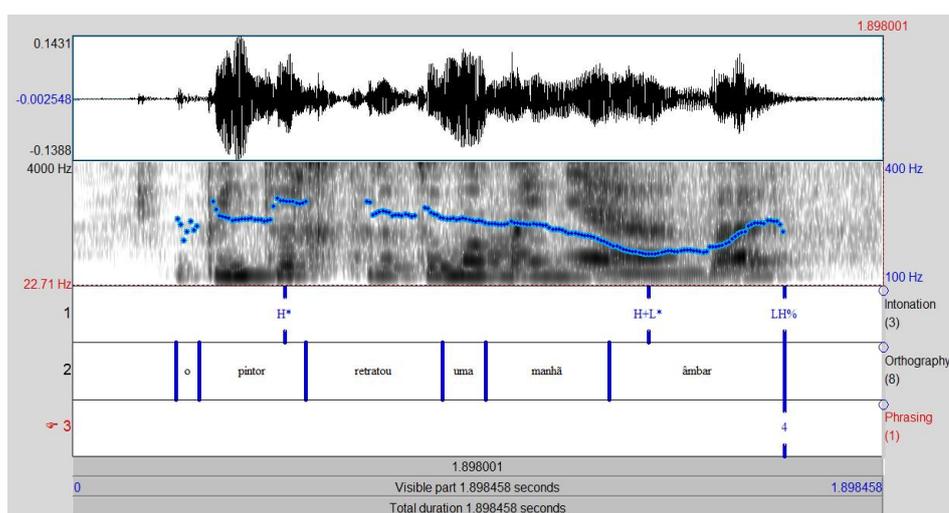


Figure 5 – Annotation of a neutral yes-no question produced in SEP (speaker AG). “O pintor retratou uma manhã âmbar?” *Did the artist paint an amber morning?*

For the analysis of segmental phenomena cueing phrasing properties (Chapter 3, section 3.4.1), besides the **Orthography**, other tiers were used:

- **Prosody**, where prosodic boundaries are annotated, according to the Break Indices (BI) labels, adapted for Portuguese to reflect prosodic phrasing (Vigário 2003, 2010; Frota in press) (0=CL, 1=PW, 2=PWG, 3=PhP, 4=IP);

- **Segment**, where the presence/absence of a given segmental phenomenon is annotated with ‘y’ or ‘n’, aligned with the target prosodic conditions under analysis (‘y’ stands for ‘yes’, and ‘n’ stands for ‘no’). An intonational tier was added whenever necessary.

For the analysis of rhythmic properties, besides **Orthography**, two other tiers were considered:

- **Phonetic**: interval tier for the phonetic transcription, word by word, including resyllabification (using IPA);

- **Rhythm**: interval tier for the segmentation of vocalic and consonantal intervals following the segmentation criteria from Turk et al. (2006) and Frota & Vigário (2001). For further details, see Chapter 5, section 5.4.

Finally, for the analysis of data extracted from the Map Task or the Interview, another tier was considered besides the ones listed for the analysis of intonation or segmental phenomena (Figure 6):

- **Miscellaneous**: interval tier for the annotation of any useful information.

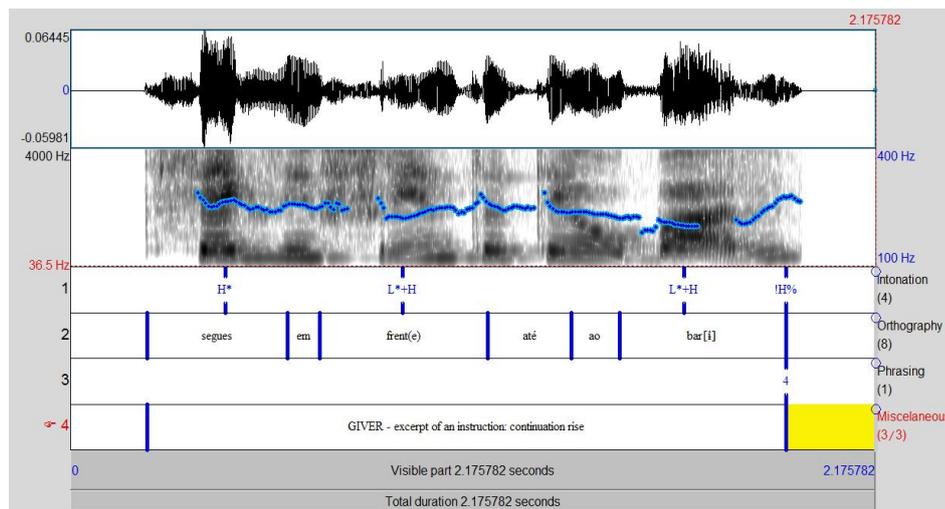


Figure 6 – Annotation of a continuation rise extracted from the Map Task applied in SEP. ‘Segues em frente até ao bar...’ (*Go straight forward until you reach the bar.*). The use of parentheses means deletion. Brackets signal insertion.

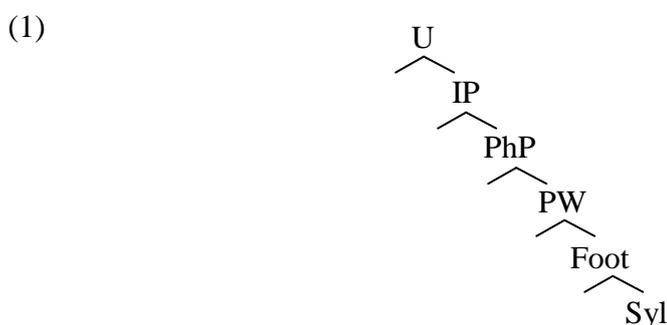
In chapters 3 to 5, we describe the main results for all prosodic aspects considered for analysis. In each chapter, the results and respective discussion are preceded by a description of the theoretical background and by a description of the methodology. Specific annotation criteria for each prosodic aspect considered are mentioned in the respective methodological sections.

3. Prosodic Phrasing

In this chapter, we describe prosodic phrasing in EP varieties on the basis of both segmental and suprasegmental evidence. In section 3.1, we present the theoretical background on which the analysis of prosodic structure is based. In section 3.2, we summarize the main properties of the prosodic structure in EP, as described in the literature. Based on previous studies of the Standard variety of EP, we decided to explore different cues for prosodic phrasing in the central-southern varieties, namely segmental and suprasegmental evidence (section 3). In section 3.4, we present our experimental data on the two central-southern varieties. Finally, in the section 3.5 the main findings are summarized and theoretical implications are discussed.

3.1. General considerations on prosodic structure

Prosodic structure is understood as the grouping of speech chunks into constituents arranged according to a hierarchy (Selkirk 1984, 1986, 1996; Nespor & Vogel 1986/2007), which is usually assumed to be organized as follows: Utterance (U), Intonational Phrase (IP), Phonological Phrase (PhP), Prosodic (or Phonological) Word (PW), Foot, Syllable (Syl).⁴



Besides the fact that prosodic constituents are metrical hierarchically structured constituents, three other basic observations should be made about prosodic structure. First, its non-isomorphism to morphosyntactic constituency, i.e., pure phonological rules apply within domains that do not necessarily coincide with the domains defined by syntax or morphology (Nespor & Vogel 1986/2007, Hayes 1989). A consequence of the possible mismatch between prosodic structure and morphosyntactic structure is that a non-ambiguous sentence from a syntactic point of view may be prosodically ambiguous (Nespor & Vogel 1986/2007).

⁴Both the Syllable and the Foot were not included in the hierarchy in earlier work, although their status as prosodic domains was also discussed (Selkirk 1986), but in later work (Selkirk 1996) they were included in the prosodic hierarchy.

Second, prosodic structure is hierarchically organized according to the Strict Layer Hypothesis (SLH) (Selkirk 1984; Nespors & Vogel 1986/2007), which determines a set of well-formedness properties on prosodic structure, summarized as follows: (i) a given prosodic category cannot dominate a prosodic category of an upper level, (ii) any prosodic category must dominate a prosodic category of a lower level; (iii) a given prosodic category cannot immediately dominate another prosodic category of two levels below (no skipping of levels) and (iv) a given prosodic category cannot dominate another prosodic category of the same level (no recursion). The first two are considered universal and unviolable rules, whereas the last two are violable constraints, i.e. their application is subject to variation. Indeed, aspects (iii) and (iv), i.e. exhaustivity and nonrecursivity, of the SLH have been shown to be too restrictive (Ladd 1996) and do not account for certain phonological phenomena and prosodic domains, such as Compound Prosodic Domains (a prosodic domain of a given type X that dominates two constituents of the same type X), or cliticization (Booij 1996, Vigário 2003, 2010). Consequently, several proposals emerged in order to weaken or relax the restrictions embodied by the SLH (Ladd 1992, Selkirk 1996). Third, prosodic structure is claimed to be universal. However, some prosodic domains seem to be absent or not to play a role in the phonology of a given language (Nespors & Vogel 1986/2007, Vigário 2003, Vogel 2009). Nevertheless, Nespors & Vogel (1986/2007) and Vogel (2009) argue that the lack of rules referring to a particular prosodic domain is not enough to determine that this specific prosodic domain does not play a role in the phonology of the language.

Another domain was proposed (Hayes 1989) as part of the prosodic hierarchy – the clitic group (CG), placed between the Prosodic Word and the Phonological Phrase. This constituent groups a prosodic word and adjacent clitics, and, similarly to other prosodic domains, has been reported as the domain for several phonological rules, such as stress assignment in Latin, Greek Nasal Deletion (Nespors & Vogel 1986/2007), v-Deletion and s,z-Palatalization in English (Hayes 1989), stress assignment within compounds in Hungarian (Vogel 1990), *inter alia*. However, recent research has presented a number of arguments against the existence of the CG as a prosodic constituent, such as the fact that clitics may attach not only to prosodic words, but also to prosodic phrases or even the fact that enclitics and proclitics may attach to different prosodic constituents in the same language (Peperkamp 1997, Vigário 2003, 2010). These asymmetries led to the exclusion of the CG from the set of prosodic constituents. Within some approaches to prosodic structure between the prosodic word and the phonological phrase, a new prosodic constituent at the level of the CG, but grouping also prosodic words and not necessarily clitic-host combinations, has been

suggested and several phonological phenomena were shown to give evidence for this constituent (Selkirk 1986; Selkirk, Shinya & Kawahara 2004; and Vigário 2006, 2010).

Importantly, parallel to the rule-based approach to prosodic structure (Nespor & Vogel 1986/2007; Selkirk 1984, 1986; Truckenbrodt 1999), two other perspectives emerged: the intonation-based approach (Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988, Jun 2005) and the prominence-based approach (Beckmann & Edwards 1990, 1994). Frota (2012a) presents an overview of the main principles of each of these approaches and shows that in both intonation- and prominence-based perspectives, prosodic constituents are postulated with reference to the phenomena that characterize them. In this sense, if according to the rule-based approach, the Intonational Phrase (IP) relates to syntactic clauses (although not all syntactic boundaries of a certain type correspond to prosodic boundaries of a given type and the other way around), for both the intonation- and prominence-based approaches, the presence of a nuclear accent and a boundary tone defines the IP, i.e. prosodic constituents are exclusively defined with reference to the phenomena that characterize them, thus being dependent on speech rate, speech style, discourse structure or rhythmic properties. For some researchers, phrasal rules, intonation and prominence phenomena refer to the same structure of prosodic constituents (Hayes & Lahiri 1991, Frota 2000, Hellmuth 2007). This integrated view was first empirically tested by Hayes & Lahiri (1991), who showed that in Bengali the distribution of boundary tones and the application of segmental phrasal rules of assimilation refer to the same prosodic hierarchy.

3.2. Prosodic structure in European Portuguese

After the pioneering work of Viana (1987), Frota (1993) presents the first account on phonological constituents above the Prosodic Word level and discusses segmental, durational and intonational evidence for prosodic phrasing. This research is developed in Frota (1995), a detailed analysis of sandhi phenomena as a cue for prosodic constituency. The author's proposals were then discussed in subsequent studies (Falé 1995; Vigário 1995, 1998; Mata 1999).

Prosody in EP, in general, and the understanding of the prosodic structure in EP, in particular, have undergone an important development in the following decade (Frota 2000, in press; Vigário 2003, 2006, 2010), assuming an integrated view of prosodic structure. An overview of the main properties of each prosodic constituent at and above the word-level in EP is presented below.

An understanding of prosodic structure at the word-level in EP involves a description of prosodic clitics and prosodic words. A clitic (CL) is a function word that is unstressed and

prosodically dependent (Vigário 2003). The pronominal post-verbal clitic, as other suffixes, incorporates into the previous host word, with which it forms a prosodic word (enclitic). The other clitics, like prefixes, associate with the word at its right (proclitics). Post-lexically, with the exception of pronouns and prepositions, complementizers may (i) be prominent (aligned with a pitch accent within the Intonational Phrase) and (ii) form a single Intonational Phrase (Vigário 2003: 192-195; 317-319).

The prosodic word (PW) is characterized by the presence of word stress. According to Vigário (2003), there are several phenomena providing evidence for this level of the prosodic hierarchy: (i) phenomena that signal both the left and the right edges of the PW; (ii) phenomena selecting the PW as the domain of its occurrence (like truncation); (iii) phenomena related with prominence, such as focus assignment and pitch accent distribution – the PW is not obligatorily pitch accented, and, following Vigário (1998) and Frota (2003), it is the domain of the optional realization of the initial peak (H) associated with the left edge of this constituent.

Vigário (2010) provides evidence for another constituent placed above PW and below the Phonological Phrase (PhP) – the Prosodic Word Group (PWG) –, in alternative to the traditional Clitic Group (Nespor & Vogel 1986/2007). As mentioned above (section 3.1), this constituent also groups PWs (and not only clitic-host combinations). According to Vigário (2010), several types of segmental and suprasegmental phonological phenomena support the need for a phonological constituent above PW and below PhP, involving the perception of prominence, hiatus resolution and focus marking. Thus, while compound (recursive) prosodic domains display a difference in strength with respect to the internal constituents (Ladd 1996/2008; Frota 2000), the PWG does not present a compound-like organization. By contrast, the PWG share all the properties known to characterize prosodic constituents, such as having several types of phonological phenomena as a cue, presenting size restrictions, *inter alia*. In sum, the difference between the PW and the PWG is not one of strength, but one of kind, and this specifically means that recursive, compound prosodic words are not alternatives to the PWG.

The Phonological Phrase (PhP) includes a lexical head, the elements on the non-recursive side of the head and a following non-branching phrase (Frota 2000). Prominence within the PhP is rightmost by default. Differently from American English or even Brazilian Portuguese, PhP in EP is characterized by the absence of final lengthening (Frota 1995, 2000, in press), and this constituent does not need to be tonally marked (Vigário 1998, Frota 2000). It is also not a domain of sandhi phenomena in Standard EP. However, there is some subtle evidence for this prosodic constituent (Frota 2000, in press), namely: (i)

restrictions on *sandhi* phenomena (a word final vowel cannot be deleted if the following word is the head of the PhP) and (ii) patterns of pitch accent distribution in pre-nuclear position (a given PW, within the PhP, can bear a pitch accent only if the PhP's head is also pitch accented).

Finally, the Intonational Phrase (IP) includes all the adjacent PhPs within a root sentence. Importantly, parentheticals, explicative clauses, tags and topics form independent IPs. This prosodic domain presents some phonological restrictions: long phrases tend to be divided when unbalanced, and the longer one is rightmost. Furthermore, shorter IPs may form together a Compound IP (IP^{max}), yielding different levels of phrasing, as shown in Frota (2000). According to the author, both IP^{min} and IP^{max} boundaries display the same general properties, but different boundary strengths, which are reflected on a gradience of the strength of phonetic properties such as preboundary lengthening, pitch range extension and pauses distribution. Differently from PhP, there is strong evidence for the IP (Frota 2000, in press): (i) this constituent is the domain for *sandhi* phenomena (syllabic dissimilation, vowel deletion, fricative voicing); (ii) it is the domain for pre-boundary lengthening; (iii) its edges are *loci* for potential occurrence of pauses and (iv) it is the domain of the minimum tune (only the IP-head must be pitch accented and only the right edge of the IP is marked by a boundary tone). Prominence within the IP is rightmost by default: the head of the last PhP of the IP is also the head of this constituent.

3.3. Prosodic Phrasing

Different types of phonological phenomena are known to provide evidence for prosodic phrasing: segmental processes, durational phenomena, segmental phenomena constrained by prominence, rhythmic properties and intonational phenomena (cf., Frota 2012a for a review).

Within the present research, we examined prosodic phrasing in central-southern varieties of EP based on both segmental and suprasegmental cues. For segmental cues, we limited our analysis to two different phenomena: Fricative Voicing and Paragoge. Fricative Voicing is one of the most well-studied *sandhi* phenomena in EP. Paragoge is a phenomenon that has been described as characteristic of the South (section 3.3.1). For suprasegmental cues as evidence for phrasing, we focused on intonational phrasing by examining the effects of syntactic/prosodic complexity (in terms of presence/absence of branchingness), and prosodic weight (in terms of length/size of prosodic phrases) on intonational patterns, i.e. on the presence/absence of intonational boundaries (section 3.3.2). In the following sections an overview of the most relevant work on these two kinds of cues to prosodic phrasing in EP and in other languages (Romance and non-Romance) is presented.

(3) [... canetas]_{PhP} [aos amigos]_{PhP} [z]

...pens to their friends

(4) [oferecemos]_{PhP} [orquídeas claras]_{PhP} [z]

...gave bright orchids

However, Fricative Voicing does not apply across IP boundaries, as in (5).⁶

(5) Aos jornalistas_{IP} [as angolanas ofereceram especiarias]_{IP}. [ʃ]

To the journalists, the Angolan women offered spices.

In addition to the basic pattern for the occurrence of Fricative Voicing described above, two other findings have shown the relevance of this specific sandhi phenomenon to the characterization of prosodic structure in EP, namely, (i) the non-occurrence of fricative voicing across a putative PhP-boundary when the phrase is long, as in (6), and (ii) the occurrence of this phenomenon across a putative IP-boundary when the phrase is short, as in (7).

(6) A_S alunas dos Açores]_{PhP} [ofereceram canetas aos amigos.

The students from Azores have offered pens to their friends.

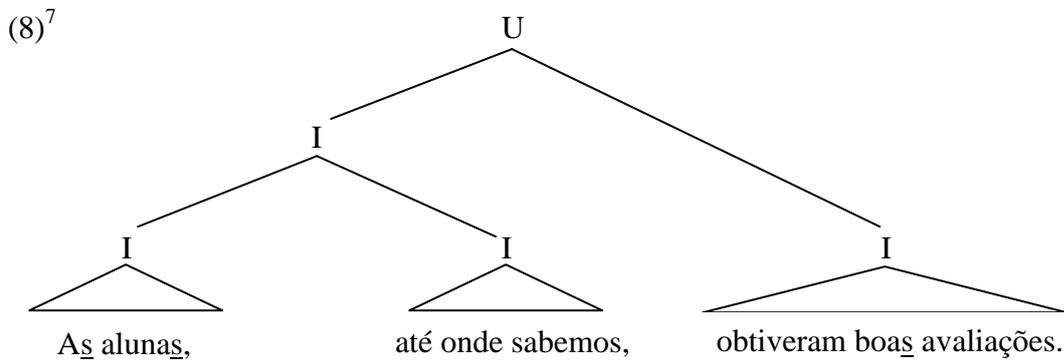
(7) A_S alunas_{IP} [até onde sabemos, obtiveram boas avaliações.

The students, as far as we know, have got good marks.

In the former case, a comparison among subject Noun Phrases (NP) with different lengths allowed us to conclude that the non-occurrence of fricative voicing in (6) is due to the fact that long subjects tend to be phrased as an IP domain (Frota 2000). Indeed, both length and the syntactic boundary between a subject and a verb are known to affect phrasing in several languages, EP included (Truckenbrodt 1995; Frota & Vigário 1996; Elordieta et al. 2003; Elordieta, Frota & Vigário 2005; D'Imperio et al. 2005; Frota et al. 2007; see also section 3.3.2). In the latter case, Frota (1995, 2000) concludes that a structure like (8) provides an adequate account for examples like (7). (8) is a Compound Prosodic Domain (in

⁶ Example (5) extracted from Frota (in press: 14).

the sense of Ladd (1996/2008), and it violates the principle of ‘no recursion’ of the Strict Layer Hypothesis.



The students, as far as we know, have got good marks.

In summary, Fricative Voicing in EP is sensitive to phonological phrasing because it only applies across PWs within the IP^{max} domain, and is expressed by the following rule (Frota 2000: 73):

$$\left[\begin{array}{c} +\text{cont} \\ +\text{ant} \\ +\text{cor} \end{array} \right] \longrightarrow \left[+\text{voice} \right] \quad / \quad \left[\dots \left[\dots __ \right] \omega \left[V \dots \right] \omega \dots \right] \text{IP}^{\text{max}}$$

However, until now, this phenomenon in connected speech was only studied in the Standard variety of EP. Earlier work on Fricative Voicing shows that there is a different phonetic realization of the voiced fricative preceding a word-initial vowel, namely [ʒ] (Sá Nogueira 1941), that is not legitimate in the Standard variety. In the current study we examined Fricative Voicing in the central-southern varieties (section 3.4.1, Experiment 1) in order to see whether this phenomenon (i) has the same phonetic properties as in SEP, (ii) whether it is, as in SEP, sensitive to phonological phrasing, and (iii) whether it provides evidence, as in SEP, for the IP-domain, or, unlike in SEP, for other prosodic constituent. Consequences for our findings for the Compound Prosodic Domain analysis, and for prosodic structure across EP varieties are also discussed (section 3.5).

Word-final Vowel Epenthesis (i.e. Paragoge), as far as we know, has not been as explored as the opposite phenomenon of Vowel Deletion from a prosodic perspective.

⁷ Structure and example extracted from Frota (2000: 70).

Interestingly, there are studies showing that varieties of the same language may behave differently in this respect, i.e. a variety of a given language may be more epenthetical than other varieties of the same language. This is described, for example, for Portuguese, with important consequences on rhythmic patterns (see Chapter 5): the European variety is characterized by vowel reduction and deletion (Mateus & d'Andrade 2000, Frota & Vigário 2001), whereas the Brazilian variety is more prone to vowel epenthesis (Collischonn 2001, Frota & Vigário 2001). In Galician, a vowel [i] is optionally inserted at the end of a word with final stress, corresponding to the head of an Intonational Phrase domain, which follows the peripherality condition, i.e. extrametrical segments are only allowed to be inserted at the (right or left) periphery of a given prosodic domain (Harris 1983, Hayes 1995, *inter alia*). Insertion applies at both internal and external Intonational Phrase boundaries, according to Martínez-Gil (1997). Additionally, this author observes that it may apply to words from all major lexical categories (nouns, verbs, adjectives, and adverbs). Across languages, the epenthetic vowel may have the articulatory properties of [i], [ə], [ɨ], [e] or even [a], the latter case in Welsh (Hall 2011). Interestingly, an epenthetic vowel may have a fixed quality (with its allophones) or it may be constrained by phonological context or even by both its position within the word and morphology, as it is observed in Italian (Repetti 2012). However, nothing is said about this phenomenon from the perspective of prosodic structure in Italian. In EP, as far as we know, there are no studies of epenthesis from a prosodic point of view, and even at the segmental level, Paragoge is barely described.

Several authors mention that the insertion of vocalic material at the right periphery of a word is very common in the central-southern varieties, namely, in the region of Alentejo (Vasconcellos 1890-92, 1896, 1987: 87; Maia 1975; Florêncio 2001). However, most descriptions of Paragoge seem to be impressionistic (i.e. not phonetically or phonologically grounded):

‘13. Ao *e* tonico final junta-se um *i* attenuado, que fórma com o *e* um dissyllabo: *é-ĩ, pé-ĩ, Juzé-ĩ, até-ĩ* [...]’ (in Vasconcellos 1890-92, *Revista Lusitana II*, p. 41)

‘26. PARAGOGE.

[...]

Eis mais exemplos que colhi: *ma-ré-ĩ* (= maré), *nã-sê-ĩ, qué-ĩ?* (ou *quié-ĩ?*).

Em ex-votos da capella da Senhora da Fonte-Santa li: *Carrile* (<monte>) por *Carril*, e *lavradore* por *lavrador*.’ (in Vasconcellos 1896, *Revista Lusitana IV*, p. 32)

‘O FALAR MERIDIONAL [...], que cobre a metade sul do País, abrangendo as três províncias ao sul do Mondego – ou sejam: a Estremadura, o Alentejo e o Algarve – apresenta, entre vários outros, os seguintes traços característicos:

[...]

3) o *e* final passa frequentemente a *-i*: [sɛ̃ti] ‘sete’, [...];

[...]

5) o *i* paragógico, principalmente nas palavras terminadas em *e*, é frequente: [pɛ̃i] ‘pé’, [tʃuminẽi] ‘chaminé’;’ (in Paiva Boleo & M. H. Santos Silva, *Boletim de Filologia XX*, pp. 100-101).

According to these previous descriptions, we may infer that Paragoge is probably contextually dependent. When considering the multiple examples presented in the literature (and illustrated above), word-final epenthesis seems to be preceded by (i) a low front vowel [ɛ], (ii) the nasal vowel [ɛ̃], or (iii) the liquids [r] and /l/. The final grapheme <e> of words such as ‘sete’ (seven) is also reported to be produced as [i]. We can also observe that Paragoge affects words with both final and penult stress (‘pé’ – *foot*; ‘sete’ – *seven*, respectively).

Taking into account the studies mentioned above, we examined the occurrence of Paragoge to establish (i) whether word-final vowel epenthesis in the central-southern varieties is constrained by prosodic structure (as in the case of Fricative Voicing for SEP); and (ii) if it cues the Intonational Phrase, as segmental phenomena in general do in SEP, or other prosodic domains (section 3.4.1, Experiment 2). Consequences of our findings for prosodic structure in EP are discussed in section 3.5.

3.3.2. Suprasegmental evidence to phrasing

The presence of intonational boundaries has been shown to be associated with different grammatical features, such as branchingness of a syntactic phrase, effects of focus, and prosodic weight in terms of length or size of prosodic phrases (Nespor & Vogel 1986/2007; Selkirk 1984, 1995; Hayes & Lahiri 1991; Jun 1993; Frota 1993, 2000, in press; Truckenbrodt 1999).

Despite the known non-isomorphism between prosodic and syntactic structures, boundaries of syntactic constituents and syntactic branching are relevant factors for the formation of prosodic constituents (Nespor & Vogel 1986/2007; Selkirk 1984, 1995; Truckenbrodt 1999). Prosodic focus also plays an important role in intonational phrasing: e.g.,

both in Bengali (Hayes & Lahiri 1991) and Chichewa (Truckenbrodt 1999), the focalized constituent is followed by a prosodic boundary; in Japanese (Beckman & Pierrehumbert 1986) as well as in dialects of Korean (Jun 1993), the production of focus triggers the placement of a prosodic boundary immediately before the focalized element. In EP, focus assignment does not affect prosodic phrasing (Frota 1993, 2000, in press; see also Chapter 4, section 4.3.2.2, as well as Cruz & Frota 2011a, c; Cruz & Frota 2012a), in contrast with the Brazilian Portuguese variety of São Paulo, where the focalized element may be followed by a Phonological Phrase boundary tone (Fernandes 2007a, b; Tenani & Fernandes-Svartman 2008).

Prosodic weight is another factor affecting intonational phrasing. In Korean, the phrase length in number of syllables also constrains phrasing: when S (or O) is longer than 5 syllables, it tends to form a separated phrase (Jun 1993).

In previous work, intonational phrasing was compared across Romance languages (EP, Spanish, Catalan, Italian) on the basis of a common *corpus* adapted for each language – the *Romance Languages Database* (RLD). Initially developed within the project *Intonational Phrasing in Romance* (<http://www.fl.ul.pt/LaboratorioFonetica/intphraro.htm>), this database is now partially available online (Frota, Cruz & Vigário 2011), and being extended to include data collected within the ongoing project *Interactive Atlas of the Prosody of Portuguese*.

The RLD *corpus* (Elordieta et al. 2003; D’Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Prieto et al. 2006; Frota et al. 2007) comprises Subject-Verb-Object (SVO) sentences with varying length in number of syllables (short and long constituents) and syntactic complexity (presence/absence of branching in S and O). This *corpus* was designed to examine the influence of constituent length and syntactic branching on intonational phrasing. Previous work on SEP and NEP has shown that, in SEP, S, V and O are grouped into an IP (SVO), similarly to Cairene Arabic (Hellmuth 2004, 2007; Frota et al. 2007). In NEP, as in Italian, Catalan and Spanish, S is phrased into an IP, separately from V and O, which form another IP (S)(VO), even in non-branching conditions (Elordieta et al. 2003; D’Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Prieto 2005; Frota & Vigário 2007). It was also observed that, in SEP, the (S)(VO) phrasing pattern is triggered by length in number of syllables: subjects longer than 8 syllables may form an IP apart from the V and the O (Elordieta, Frota & Vigário 2005). Length or branchingness of O was found not to be relevant for intonational phrasing in SEP. By contrast, in NEP, (S)(VO) is mainly triggered by branchingness. Additionally, in NEP, O length also favors the (S)(VO) phrasing pattern.

Building on the findings for SEP and NEP, we investigated intonational phrasing in the central-southern varieties on the basis of the same *corpus* (the RLD *corpus*). We hope to provide additional data for the understanding of prosodic phrasing across varieties of EP.

3.4. Experiments

3.4.1. Segmental evidence for prosodic phrasing

3.4.1.1. Experiment 1: Fricative Voicing

Based on previous work on Fricative Voicing as evidence for prosodic phrasing in the Standard European Portuguese variety, we ran a reading task using the same *corpus* (Frota 1995, 2000). As shown above (section 3.3.1), sentences include targets in different prosodic positions, considering the type of prosodic boundary and the length of the phrase. The following conditions were considered in the analysis⁸:

Condition 1: within PhP

- (9) [A_s alunas]_{PhP} ofereceram canetas [a_os amigos]_{PhP}.

The students have offered pens to their friends.

Condition 2: within ‘restructured’ PhP (non-branching complement)

- (10) [A_s alunas africanas]_{PhP} ofereceram canetas aos amigos.

The African students have offered pens to their friends.

Condition 3: across PhP (branching complement)

- (11) Todos nós [oferecemos]_{PhP} orquídeas claras às idosas.

We all gave bright orchids to the old ladies.

Condition 4: across PhP (≠ from Subject/Verb)

- (12) As alunas africanas [ofereceram canetas]_{PhP} aos amigos.

The African students have offered pens to their friends.

Condition 5: across PhP (= Subject/Verb)

- (13) [As alunas africanas]_{PhP} ofereceram canetas aos amigos.

The African students have offered pens to their friends.

⁸ For the whole list of sentences, taken from Frota (2000) sandhi *corpus* (Frota 2000: 53-111), see Appendix I.

Condition 6: across IP

(14) [As alunas]_{IP}, até onde sabemos, obtiveram boas avaliações. – **short subject**

The students, as far as we know, have got good marks.

(15) [As alunas estrangeiras nos Açores]_{IP}, até onde sabemos, aceitaram vir. – **long subject**

The foreign students in Azores, as far as we know, have agreed to come.

The materials were produced by 3 speakers aged between 20-45, for each of the two central-southern varieties – Ale and Alg (3x2). A total of 16 sentences were read twice by each speaker (16x2x6), thus a total of 192 sentences were analyzed. The analysis was both acoustic (using spectrograms) and perceptive. Each sentence was annotated in *Praat*, where 3 tiers were created: (i) the Orthographic tier (orthographic transcription word by word, aligned with the spectrum), (ii) the Phonetic tier, with phonetic transcription word-by-word, reflecting resyllabification as a result of the fricative voicing phenomenon, (iii) the Prosodic tier, where relevant prosodic boundaries were annotated (reflecting the prosodic structure), according to the Break Indices (BI) labels, adapted for Portuguese within the *InAPoP* Project⁹, and (iv) the Segmental tier, where the realization of the fricative is annotated, aligned with the respective prosodic boundary, actually produced (Figure 7). The correspondence between type of prosodic boundary and the BI used is the following: 0=CL, 1=PW, 2=PWG, 3=PhP, 4=IP.

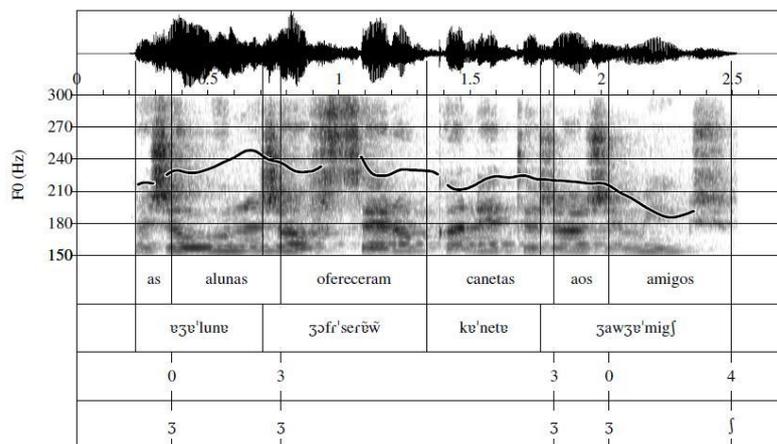


Figure 7 - Textgrid structure for the analysis of fricative voicing. ‘As alunas ofereceram canetas aos amigos.’ (The students have offered pens to their friends), produced by a speaker from Alg.

⁹ In the Compound IP domain, the difference between the boundaries of the inner and the outer IPs is one of strength (Frota 2000, in press). However, differently from Frota (in press), where a Break Index 3 is used to reflect this difference, we follow the criteria adopted within the *InAPoP* Project, according to which Break Indices should reflect the prosodic structure. Thus, inner IPs are also associated to the Break Index 4, as outer IPs.

Let us first consider the phonetic nature of the fricative segment produced when Fricative Voicing applies (Figure 8). In Ale and in Alg, besides the realization of the fricative as [z], the voiced palatal [ʒ] also occurs (unlike in SEP). This confirms previous impressionistic observations by Sá Nogueira (1941). However, the phonetic realization [ʒ] does not show the same properties across the central-southern varieties in terms of frequency of occurrence and its prosodic distribution.

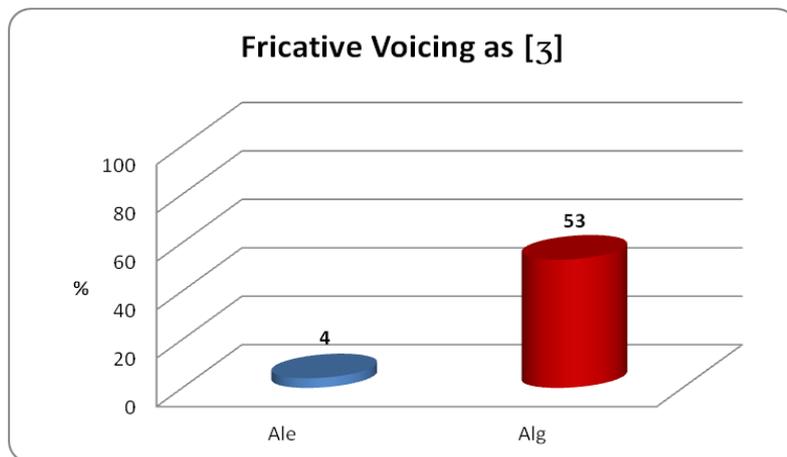


Figure 8 – The realization of the fricative as [ʒ], not legitimated in SEP, but present in the central-southern varieties: frequency of occurrence.

The realization of the voiced fricative as [ʒ] is more frequent in Alg than in Ale, as shown in Figure 8. Furthermore, it presents both inter and intra-speaker variability, since it does not occur with comparable frequencies across speakers of the same variety nor systematically at the same prosodic positions in the two renditions of the same sentence produced by each speaker, as illustrated in Figure 9.

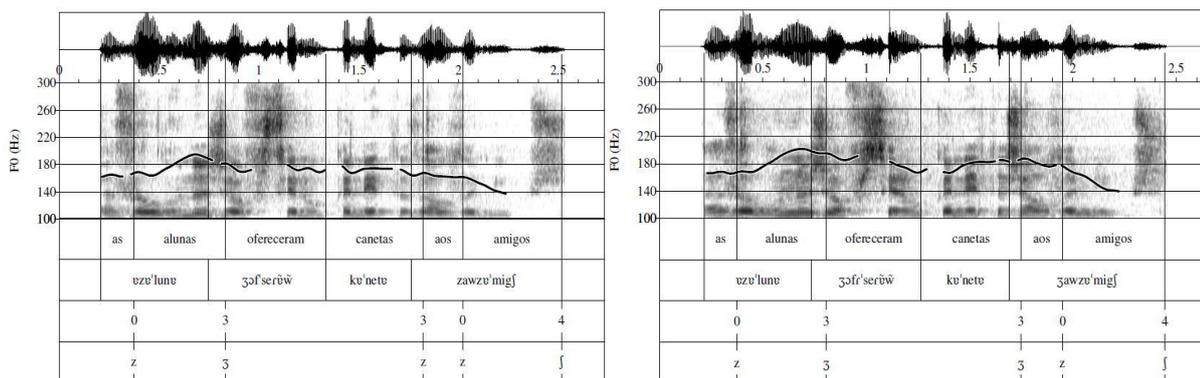


Figure 9 – Fricative voicing in Alg: the realization of the voiced fricative may vary within the same speaker – [kə'netɛzawzɐ'miɡʃ], at the left panel vs. [kə'netɛʒawzɐ'miɡʃ] (pens to their friends), at the right panel. Both renditions were produced by speaker AZ, in random order.

Secondly, the prosodic domain for Fricative Voicing is the Intonational Phrase. This is shown in Figure 10, plotting the results obtained on the basis of the target prosodic structure. Fricative Voicing in Ale and Alg occurs systematically within and across PhPs (Conditions 1-

5), and is blocked across IP (Condition 6), as it was previously observed for the Standard variety of EP (Frota 1995, 2000).

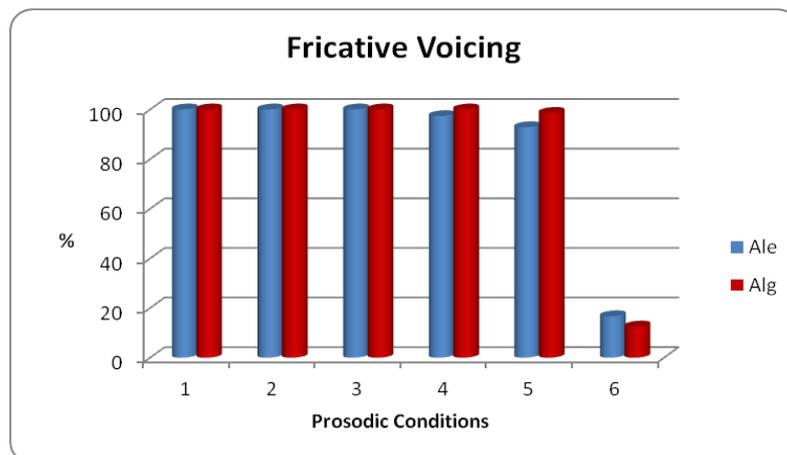


Figure 10 – The realization of the voiced fricative by prosodic condition: 1=within PhP; 2=within ‘restructured’ PhP (non-branching complement); 3=across PhP (branching complement); 4=across PhP (\neq from Subject/Verb); 5=across PhP (= Subject/Verb); 6=across IP).

We also observe above that in Ale the Fricative Voicing may be blocked across PhPs (Condition 5), although with very reduced frequency. A more detailed analysis revealed that this phenomenon may be blocked, in Ale, when subjects are longer than 6 syllables (see the contrast in Figure 11 – Subject with 4 syllables (left panel) and Subject with 6 syllables (right panel)). This strongly suggests that these subjects were phrased as IPs, as the same sort of IP-restructuring was also observed in SEP (Frota 1995, 2000).

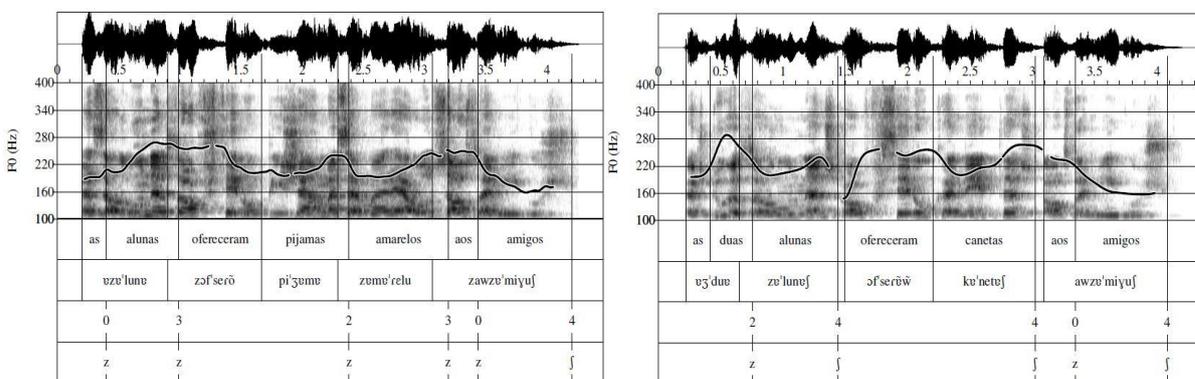


Figure 11 – Effect of length in the fricative voicing process (Ale): left panel – subject with 4 syllables produced as a PhP, thus favoring the occurrence of fricative voicing. ‘As alunas ofereceram pijamas amarelos aos amigos.’ (The students have offered yellow pyjamas to their friends.); right panel – subject with 6 syllables restructured in an IP, thus blocking the occurrence of fricative voicing. ‘As duas alunas ofereceram canetas aos amigos.’ (The two students have offered pens to their friends.).

The right panel of Figure 11 also illustrates the blocking of the Fricative Voicing across target PhPs that do not involve the subject and the verb. In Ale, this kind of IP-restructuring only occurs in two cases, corresponding to the phrasing pattern (S)(V)(O) that is not common in this variety (see section 3.4.2 for further details).

The results plot for the across-IP Condition (Figure 10) also displays a pattern similar to the results reported for SEP: Fricative Voicing is bound by the IP, although it occurs in few cases of potential IP edges (17% in Ale; 13% in Alg), corresponding to one of the edges (not both) of a parenthetical expression. As in SEP, Fricative Voicing in this specific prosodic context provides evidence for the Compound IP domain, since the parenthetical may form an intonational unit together with the previous or the following phrase within the root sentence. These possibilities are illustrated in Figure 12 and Figure 13, and represented by the respective schemes in (16) and (17).

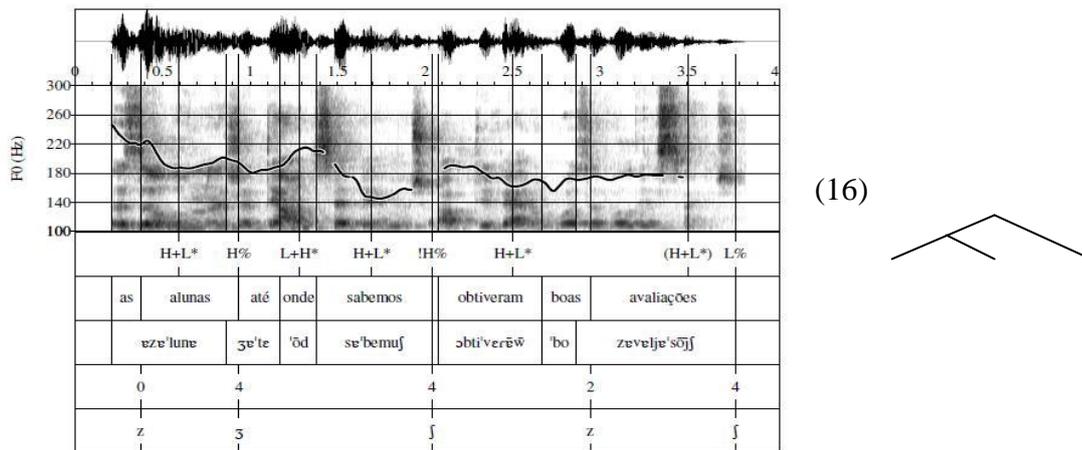


Figure 12 – Fricative Voicing in Ale with parenthetical structures: the parenthetical form an intonational unit with the previous phrase of the root sentence, which is shown by both intonational analysis (here added to the basic tiers considered for the prosodic analysis of segmental phenomena) and by the Fricative Voicing at the inner IP. ‘As alunas, até onde sabemos, obtiveram boas avaliações.’ (The students, as far as we know, have got good marks.).

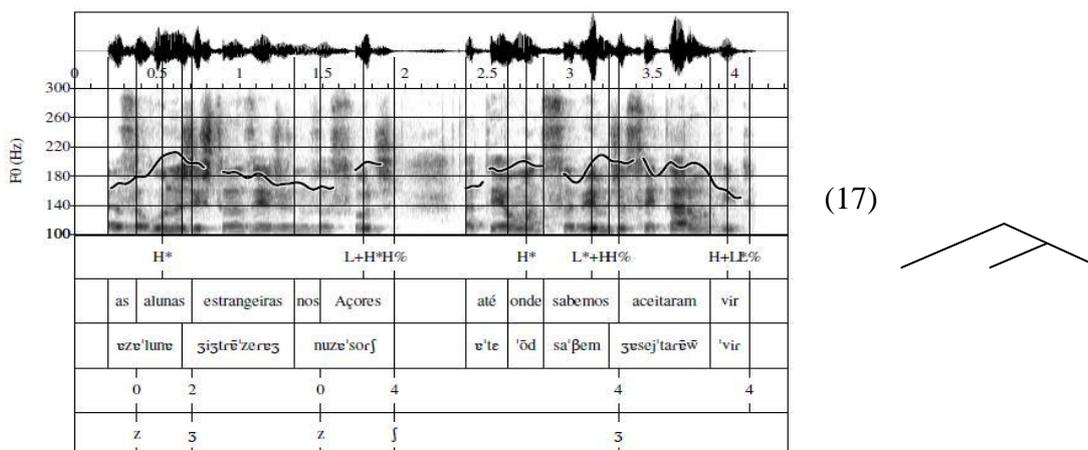


Figure 13 - Fricative Voicing in Alg with parenthetical structures: the parenthetical form an intonational unit with the following phrase of the root sentence, which is shown by both intonational analysis (here added to the basic tiers considered for the prosodic analysis of segmental phenomena) and by the Fricative Voicing at the inner IP. ‘As alunas estrangeiras nos Açores, até onde sabemos, aceitaram vir.’ (The foreign students in Azores, as far as we know, have agreed to come.).

In both examples, the parenthetical is phrased with the shorter IP of the root sentence into a Compound IP domain, thus allowing the formation of more balanced IPs, as it was already observed in the Standard variety (Frota 2000).

In conclusion, fricative voicing in the central-southern varieties only differs from the Standard variety with respect to its phonetic nature: besides the standard realization [z], [ʒ] also occurs (confirming previous impressionistic descriptions), although it is more frequent in Alg than in Ale. Thus, we propose the following adaptation to the rule presented in Frota (2000: 73), in the case of the two varieties under study.

$$\left[\begin{array}{l} +\text{cont} \\ +\text{ant} / -\text{ant} \\ +\text{cor} \end{array} \right] \longrightarrow \left[+\text{voice} \right] \quad / \quad \left[\dots \left[\dots ___ \right] \omega \left[V \dots \right] \omega \dots \right] I^{\text{max}}$$

Importantly, no differences were found between the Standard variety and the central-southern varieties with respect to the prosodic distribution of Fricative Voicing: (i) Fricative Voicing occurs within and across PhP boundaries; (ii) the IP domain is cued by the absence of Fricative Voicing; (iii) PhPs containing subjects longer than 6 syllables may be restructured into an IP domain, which is shown by the non-occurrence of the Fricative Voicing; (iv) Fricative Voicing also gives evidence for the Compound IP, as parentheticals may be phrased into a single IP with no compounding, but they can also be phrased together with the previous or the following phrase of the root sentence into a Compound IP (IP^{max}), depending on length conditions. In conclusion, the central-southern varieties display the same prosodic phrasing patterns as SEP, on the basis of Fricative Voicing.

3.4.1.2. Experiment 2: Paragoge

Taking into account the descriptions of Paragoge in the Interior Centre and South (Vasconcellos 1896, 1987: 87; Maia 1975; Florêncio 2001), we built a *corpus* including sentences with the same target word in different prosodic positions, in order to investigate whether this segmental phenomenon is prosodically constrained. We have considered 4 prosodic conditions, illustrated below:¹⁰

Condition 1: internal position of the PhP ([...]_{PhP})

(18) [O **café** português]_{PhP} lidera.

The coffee portuguese leads (the market).

¹⁰ The **bold** signals the target word.

Condition 2: final position of the PhP ([.._]PhP)

(19) [Aquele **café**]_{PhP} desperta os sentidos.

That coffee awakes our senses.

Condition 3: final position of the IP ([.._]IP)

(20) [O presidente tomava esse **café**]_{IP}. –

The president used to drink that coffee.

Condition 4: final position of an internal IP ([.._]IP [...]IP)

(21) C¹¹: [O café verde é delicioso. Sabes o que tomava o presidente?]

[Tomava esse **café**]_{IP} o presidente.

(He) Used to drink that coffee, the president.

A total of 35 sentences per condition (35x4), with target words controlled for (i) stress pattern (most have final stress, except for target words ending in [i], which have penult stress); (ii) final segment ([ɛ], [r], /l/, and [i], like in <ponte>, *bridge*) that in SEP may be produced as a schwa [põti], although vowel deletion applies frequently in this specific context – Mateus & d’Andrade 2000, Vigário 2003); (iii) number of syllables (monosyllables and disyllables), and (iv) morphosyntactic category (verbs - <cantar> *to sing* - and nouns - <radar> *radar*). Besides these criteria established on the basis of previous studies on segmental variation, we decided to test target words (i) with other segmental contexts, namely other low vowels ([ɔ], [a]), and the nasal vowel [ẽ], and (ii) with a final morphological and non-morphological [ʃ] (<sofás> *sofas*, and <rapaz> *boy*, respectively). For the whole list of sentences used, see Appendix II.

The total set of 140 sentences was read once in each region by 3 speakers aged between 20 and 45 and another 3 speakers with 60 years-old or older. Thus, a total of 12 speakers (6x2) performed the reading task. Each sentence was annotated in *Praat*, where 3 tiers were created: (i) the Orthographic tier (orthographic transcription word by word, aligned with the spectrum), (ii) the Prosodic tier, where prosodic boundaries are annotated, according to the Break Indices (BI) labels, adapted for Portuguese within the *InAPoP* Project (0=CL, 1=PW, 2=PWG, 3=PhP, 4=IP), and (iii) the Segmental tier, where the presence/absence of a paragogic vowel is annotated with “y” or “n”, aligned with the target prosodic condition under

¹¹ This is the abbreviation for *Context*. See Chapter 2, section 2.3.2.4 for further methodological details.

analysis (“y” stands for “yes”, i.e. presence of a paragogic vowel, and “n” stands for “no”, i.e. absence of a paragogic vowel). An intonational tier is added whenever necessary. The basic structure of the textgrid is illustrated below (Figure 14).

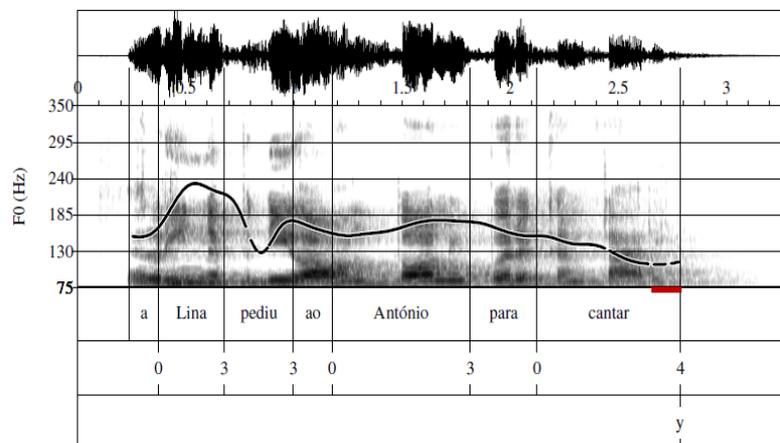


Figure 14 – Textgrid structure for the analysis of Paragoge (Ale). ‘A Lina pediu ao António para cantar.’ (Lina asked António to sing).

The presence/absence of a paragogic vowel was first determined on the basis of perception; acoustic inspection was performed when perception is not enough to determine whether a paragogic vowel is produced or not. Although the phonetic characteristics of the paragogic vowel are not our focus of interest, we have observed that it corresponds, perceptually, to either [i] or [i]. However, spectrographic inspection of paragogic vowels is not trivial and the distinction between these two realizations does not seem to be easy. As mentioned above, we have also considered the possibility that a paragogic vowel may occur in contexts where, in SEP, vowel deletion usually applies (Mateus & d’Andrade 2000, Vigário 2003), as illustrated below.

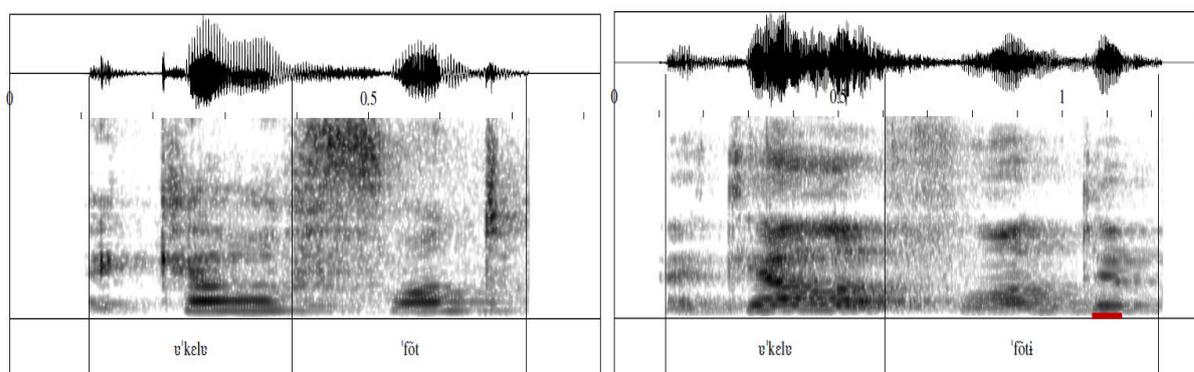


Figure 15 – Vowel deletion in SEP (left panel) and vowel realization in Ale (right panel), which is also considered here as the occurrence of a paragogic vowel. ‘Aquela fonte’ (That fountain). This was extracted from the production of the sentence ‘Aquela fonte parece um riacho.’ (That fountain seems like a stream).

Let’s first observe the segmental context that precedes the paragogic vowel. This segmental phenomenon does not occur in Alg, in neither of the contexts, thus being specific

from Ale¹² (Figure 16). In Ale the new contexts considered ([a, ɔ, ẽ, ʃ]) do not trigger Paragoge; only the contexts commonly mentioned in the literature may show the epenthetic vowel.

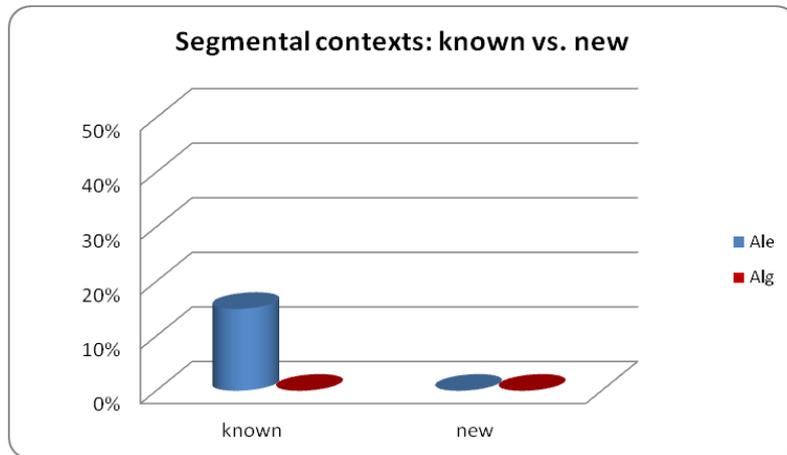


Figure 16 – Paragoge occurrence depending on the segmental preceding contexts: known ([r], /l/, [ɛ], [i]) versus new ([a], [ɔ], [ẽ], [ʃ]).

Within the segmental contexts impressionistically known to trigger the occurrence of a paragodic vowel, target words with a final [r] or a final [i] are the most affected by Paragoge, followed by target words with a final /l/, as shown in Figure 17.

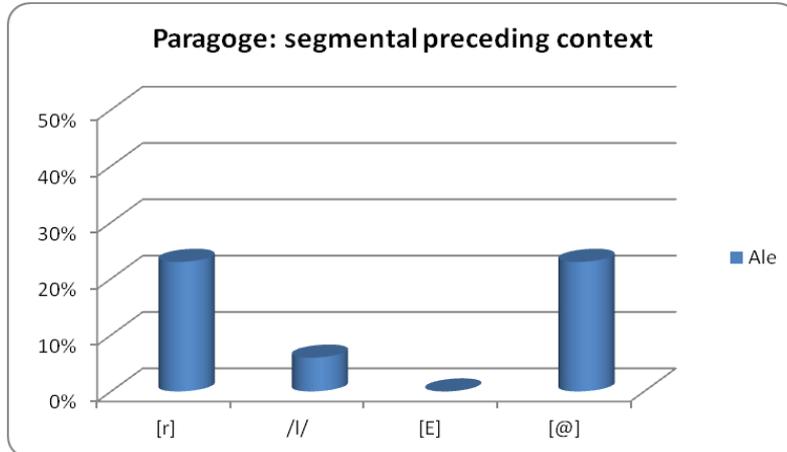


Figure 17 – Distribution of Paragoge in Ale by segmental context. Phonetic symbols follow the SAMPA¹³ transcription for Portuguese.

Interestingly, in contrast with previous studies for Portuguese (Vasconcellos 1896, 1987; Maia 1975; Florêncio 2001) and for Galician (Martínez-Gil 1997), target words with a final low vowel [ɛ] are not followed by a paragodic vowel.¹⁴

¹² For this reason, all the results reported below this note refer only to Ale.

¹³ See these annotation conventions in Appendix V.

When we compare both the amount and the distribution (in terms of the preceding segmental context) of Paragoge across age groups (Figure 18), we conclude that (i) older speakers produce more paragogic vowels than younger speakers, (ii) the two segmental contexts most prone to the occurrence of a paragogic vowel are the same across age groups ([r], [i]), but with different weights. In fact, there is a predominance of paragogic vowels with target words ending in [r] in the younger group, while in the older group target words with the final [i] are those mostly affected by Paragoge. In sum, besides the general tendency to the reduction of the amount of paragogic vowels across generations, we may also observe developments on the dominant segmental context triggering the occurrence of Paragoge.

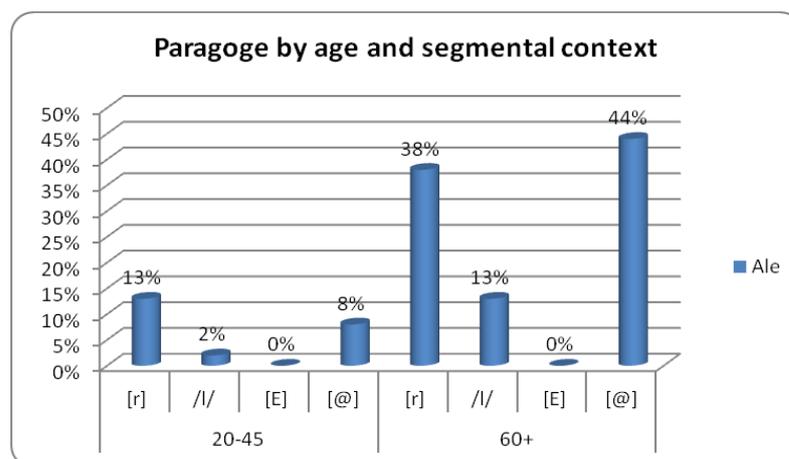


Figure 18 - Distribution of Paragoge in Ale by age group, considering each final segmental context of target words. Phonetic symbols follow the SAMPA criteria for Portuguese.

The analysis of the prosodic conditions that trigger Paragoge shows that this phenomenon only occurs at the Intonational Phrase edge. Similarly to word final epenthesis in Galician (Martínez-Gil 1997) we thus have arguments to say that word final epenthesis in Ale applies postlexically, it is constrained by metrical factors, and it only occurs at the right periphery of the Intonational Phrase. It may occur at the edge of the final IP of the utterance, i.e. at the IP-head (which also corresponds to the Utterance-head) or at the edge of an internal IP (e.g., the right edge of an IP^{min}). The Phonological Phrase level is clearly not relevant for the occurrence of this segmental phenomenon (Figure 19).

¹⁴ This observation does not mean that we contradict the impressionistic data from previous studies. Indeed, this phenomenon does not occur after the low vowel [ɛ] in Castro Verde, an urban region here mentioned as Ale. However, other urban or even rural regions from Ale should be studied from this point of view, in order to determine about the geographical coverage of this segmental phenomenon, as well as its segmental and prosodic nature.

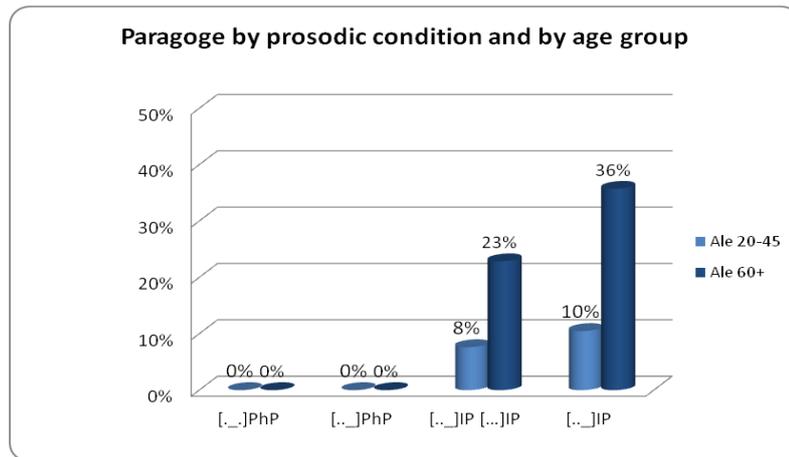


Figure 19 – Distribution of Paragoge in Ale by prosodic condition and age group.

We may also observe, in Figure 20, that the preference for the edge of a final IP or for the edge of an internal IP as a prosodic *locus* for the paragogic vowel is similar across age groups: in fact, IP-head position corresponding to the Utterance-head is the dominant one. However, it seems that in the younger group the preference for either the edge of an internal or a final IP tends to disappear, since the difference between the amount of paragogic vowels at one or another position is very reduced (2%), which contrasts with the eldest group (less 13% of paragogic vowels at the edge of an internal IP than at the edge of a final IP). This clearly suggests that the IP domain is the relevant one (and not the Utterance).

We must clarify that 3 of the 35 target words (produced by different speakers from the younger group) at the right edge of a PhP were affected by Paragoge. These 3 occurrences were spectrographically inspected and we concluded that these constituents were in fact phrased as an IP (and thus considered in the [..]IP columns), on the basis of both intonational facts and presence of a pause. Indeed, these 3 cases correspond to subjects NPs, which are known to tend to be phrased as IPs in certain circumstances (Frota 2000, also above in this section). Figure 20 illustrates one of these subject NPs phrased as an IP.

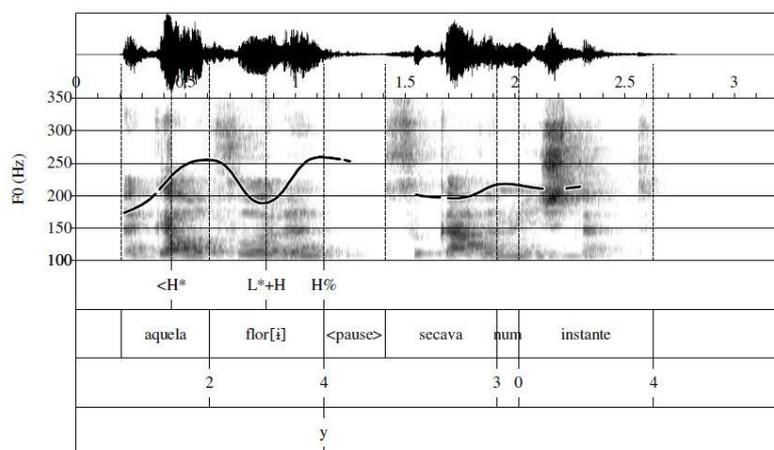


Figure 20 – Subject NP phrased as an IP, which is cued by Paragoge. ‘Aquela flor secava num instante.’ (That flower got dried instantly.).

This means that Paragoge, together with Fricative Voicing (Experiment 1), has a prosodic distribution, since this segmental phenomenon, specific from Ale, only occurs at the right edge of the Intonational Phrase. However, this does not mean that in Ale Paragoge obligatory co-exists with IP edges. We may have IP edges, corresponding or not to the subject NP, that do not show Paragoge. Such IP edges are cued by other factors like pauses, sustained pitch before the pause and pre-boundary final lengthening, as illustrated in Figure 21. In other words, Paragoge is an optional phenomenon that is triggered both by segmental and prosodic conditions.

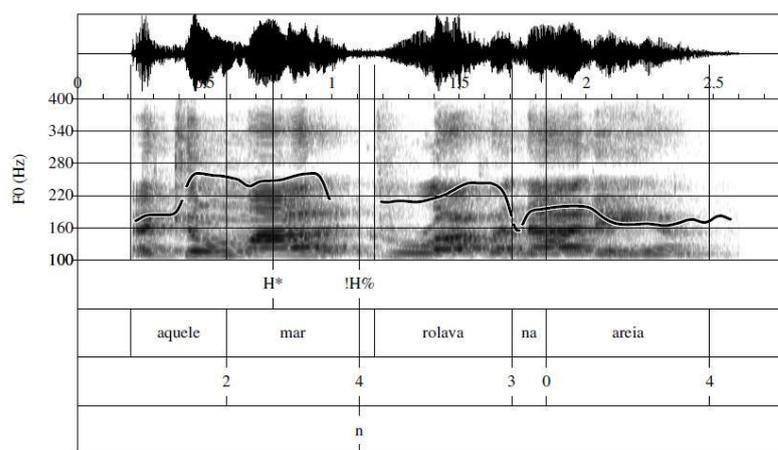


Figure 21 – Example of an IP edge with no Paragoge. ‘Aquele mar rolava na areia.’ (That sea rolled in the sand.).

An important question needs to be clarified in the cases with final [i], such as in <ponte> (*bridge*): whether we are dealing with a word final epenthesis process or with the blockage of a word final deletion process. According to Vigário (2003), non-back vowel deletion applies postlexically in the following contexts: (i) in sentence final position, (ii) when the target word is followed by a word starting with a consonant, (iii) when the target word is followed by a word starting with a stressless vowel, (iv) when the target word is followed by a word starting with a stressed vowel, but only when it does not bear the prominence of the compound prosodic word (Vigário 2003: 224-225). However, certain prosodic conditions trigger the blockage of word final deletion, namely: (i) when the target word is followed by a word starting with a stressed vowel, but only within a compound unit, and thus, bearing the prominence of the compound; (ii) when the target word is followed by a pronominal clitic (Vigário 2003: 104-108). We could thus hypothesize that in Ale non-back vowel deletion in sentence final position would be blocked (instead of a word final insertion analysis), when the target word is at the edge of either an internal or a final IP. However, this analysis could not account for the presence of the word-final vowel in the other segmental contexts where it was also found, namely after a sonorant coda. Although further research is needed to clarify what

is the best analysis for the phenomenon, the word final epenthesis account has the advantage of providing a unified analysis across segmental contexts.

It is important to note that word-final epenthesis also occurs in SEP, at the IP edge (Frota 2002a, Frota in press, Frota et al. in press). However, the phenomenon is apparently not the same: in SEP, it tends to occur in interrogatives (as shown in Figure 22), vocative chants and continuation rises. In Ale, word-final epenthesis also occurs in declaratives (at IP-final position) (Figure 23, left panel) and with IP internal falling contours (Figure 23, right panel).

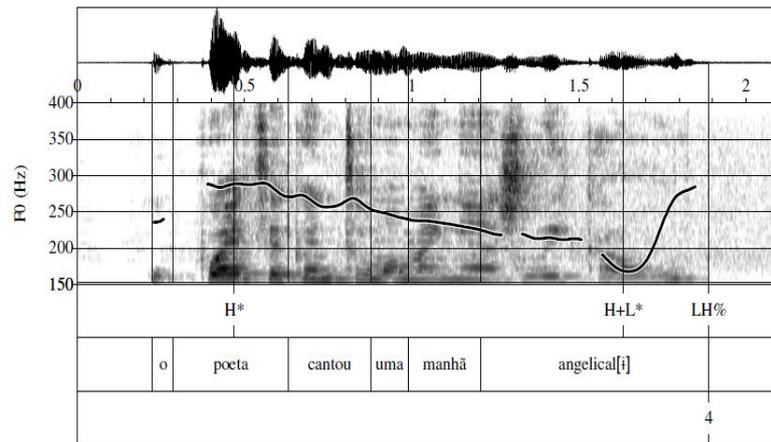


Figure 22 - Neutral yes-no question produced by AG (SEP). Epenthesis as a strategy of text-tune accommodation. ‘O poeta cantou uma manhã angelical?’ (Did the poet sing an angelical morning?)

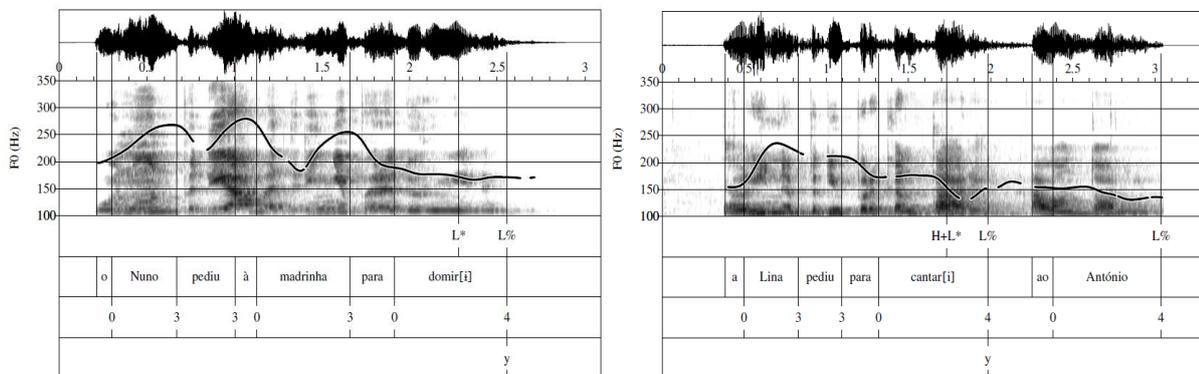


Figure 23 - Neutral declaratives produced in Ale. An intonational tier was added to the basic structure for the analysis of Paragoge. Left panel: speaker LM (20-45 years-old). ‘O Nuno pediu à madrinha para dormir.’ (Nuno asked his godmother to sleep.) Right panel: declarative with a topicalized complement *in situ*, produced by speaker AC (60+ years-old). ‘A Lina pediu para cantar, ao António.’ (Lina asked (him) to sing. António.) Epenthesis with a nuclear falling contour at the edge of an internal IP.

Unlike in SEP, where Epenthesis is seen as a strategy of text-tune accommodation (Frota 2002, Frota in press, Frota et al. in press), in Ale that seems not to be the case, since the nuclear fall of declaratives mainly corresponds to a monotonal contour and the segmental string does not need to be extended to cope with the realization of the tune. A question thus seems to be left open for future research: why do paragogic vowels occur in Ale? Additionally, we have seen that it is constrained by prosodic factors but we still do not know whether it is

constrained by the edge of the IP, or by prominence, or both. IP prominence is thus not excluded as a possible trigger of this segmental phenomenon, which could be tested by using sentences with early focus. However, our *corpus* is not prepared to disentangle this question, since it would be necessary to have both the early focus and the IP-edge ending with one of the segmental contexts shown here to be relevant for the occurrence of paragodic vowels. The inspection of more spontaneous tasks (conversation and map task) and the comparison with the reading task will also be a step forward for the understanding of this phenomenon.

In summary, both Fricative Voicing and Paragoge in Ale and Alg are phenomena of the IP level: Fricative Voicing is blocked at the IP-edge, and the paragodic vowel is inserted only at the IP-edge. If the prosodic properties of Fricative Voicing in the central-southern varieties do not differ from those observed in SEP, the same is not valid for the word-final epenthesis: in the South, the phenomenon of Paragoge is not used as a strategy of text-tune accommodation; in SEP, vowel epenthesis has been reported to be motivated by tune-text accommodation factors.

3.4.2. Suprasegmental evidence for prosodic phrasing

The present experiment addresses the relation between prosodic phrasing and factors such as (i) syntactic/prosodic complexity, and (ii) length in number of syllables. Thus, the main goal of this experiment is to explore the influence of the syntactic and prosodic factors listed above on prosodic phrasing in two central-southern varieties of European Portuguese (EP).

3.4.2.1. Methodology

Three female speakers from each region (Ale and Alg) (3x2), aged between 20 and 45, were recorded according to the procedures described in Chapter 2, section 2.3.3. All speakers performed a reading task containing the RLD *corpus* (Elordieta et al. 2003; D’Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Prieto et al. 2006; Frota et al. 2007): 76 SVO sentences, uttered twice by each speaker (76x2x3), included constituents (subjects and objects) with varying length (short = 3, 5 syllables; long = 5 to 15 syllables) and syntactic complexity (non-branching, branching and double branching). The combination of these factors yields the following conditions:

Condition 1: Short non-branching phrases (3 syllables)

A loura_{NP} mirava morenos.
The blond girl looked at dark-haired boys.

Condition 2: Long non-branching phrases (5 syllables)

A boliviana_{NP} falava do namorado.
The Bolivian girl talked about her boyfriend.

Condition 3: Short branching phrases (5 syllables)

A nora loura_{NP+AdjP} falava do namorado.
The blond daughter-in-law talked about her boyfriend.

Condition 4: Long branching phrases (10 syllables)

O boliviano mulhereng_{NP+AdjP} memorizava uma melodia.
The Bolivian ladies' man memorized a melody.

Condition 5: Short double branching phrases (9/10 syllables)

A nora morena da velha_{NP+AdjP+PP} maravilhava meninos.
The old lady's dark-haired daughter-in-law marveled boys.

Condition 6: Long double branching phrases (15 syllables)

O namorado megalómano da brasileira_{NP+AdjP+PP} mirava morenas.
The Brazilian's girl megalomaniac boyfriend looked at the dark-haired women.

The RLD *corpus* is given in Appendix I. For further details on the *corpus*, see Elordieta et al. (2003), D'Imperio et al. (2005), and Elordieta, Frota & Vigário (2005).

For the analysis, sentences produced by 2 of the 3 speakers were considered per variety, thus a total of 608 sentences (304x2) were inspected. The dominant phrasing pattern was observed on the basis of all sentences (with both subjects and objects controlled for length and syntactic complexity). For the analysis of the effect of length and syntactic complexity, sentences with objects controlled for these factors were not considered. As in previous studies (Frota & Vigário 2007, Frota et al. 2007), intonational phrase boundaries were determined according to both perceptive and acoustic-based measures. The following boundary cues were considered: presence of a pause, pre-boundary lengthening, pitch movement before the boundary (continuation rise, sustained pitch) and pitch reset.

For each sentence, three tiers of analysis were created in *Praat 5.2* (Boersma & Weenink 2007): (i) the Tonal tier for intonational analysis, following the Autosegmental Metrical approach (see further details in Chapter 4, section 4.1) for the analysis of EP intonation (Frota in press); (ii) the Orthographic tier, which contains the orthographic transcription of the sentence aligned word by word with the spectrogram; and (iii) the

Prosodic tier, where break indices are annotated reflecting the prosodic structure relevant to intonation (according to the criteria followed within the *InAPoP* Project).

3.4.2.2. Dominant phrasing pattern

The inspection of boundary cues in Ale and Alg is determinant for the analysis of phrasing patterns. We have observed that, as in SEP and NEP (Frota & Vigário 2007), both Ale and Alg present a high frequency of the H% boundary tone (99% each), mainly preceded by a continuation rise. However, sustained pitch is also used in Ale and Alg, as in NEP, but with a higher frequency (32%, 34% respectively vs. 8% in NEP). Pre-boundary lengthening is also frequently perceived as a cue to phrasing in Ale (75%) and in Alg (66%), contrasting with SEP (15%), but not with NEP (72%). The comparison of duration differences (relative to the duration of the prosodic word) between sentences produced with and without an intonational break shows that the last stressed syllable of the IP is on average 6.21% longer in Ale and Alg. Contrary to SEP, where the post-stressed vowel is usually deleted, in Ale it is frequently produced (57%), similarly to NEP (Frota & Vigário 2007) but differently from Alg (2%). Finally, pauses are more frequent in Ale and in Alg (10%, 11% respectively) than in SEP (5%), but not as frequent as in NEP (17%).

In Table 1, we summarize the overall frequency of occurrence of phrasing patterns (SVO) and (S)(VO), calculated on the basis of all sentences (with subjects and objects controlled for length and syntactic complexity). In order to allow a comparison between these cases and the dominant phrasing pattern when only sentences with subjects controlled for length and syntactic complexity are considered, we added this information to Table 1.

	Ale		Alg	
	(SVO)	(S)(VO)	(SVO)	(S)(VO)
Overall	34%	66%	65%	35%
Non-branching S	49%	51%	93%	7%
Branching S	11%	89%	22%	78%

Table 1 – Frequency of occurrence of (SVO) and (S)(VO) phrasing patterns in Ale and in Alg.

In Ale, similarly to NEP (Vigário & Frota 2003, Frota & Vigário 2007), the (S)(VO) phrasing pattern is preferred overall (66%). Even in non-branching conditions, S tends to be phrased into an IP apart from V and O (51%), as illustrated in Figure 24.

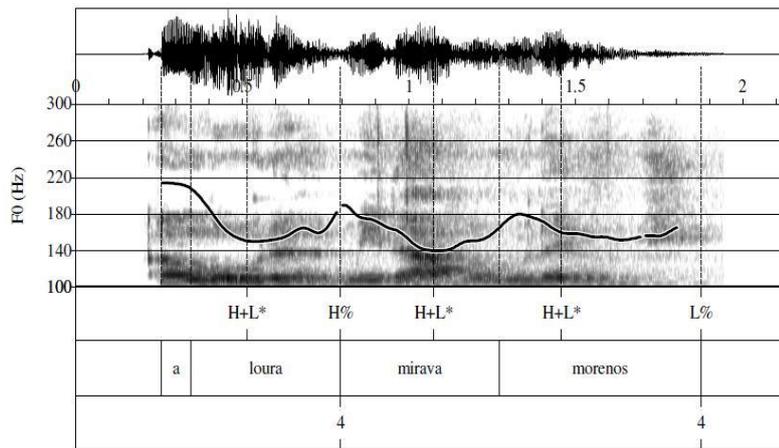


Figure 24 - (S)(VO) phrasing. Short non-branching S. ‘A loura mirava morenos.’ (The blond girl looked at dark-haired boys.), produced by a speaker from Ale.

By contrast, in Alg, and similarly to SEP (Vigário & Frota 2003, Frota & Vigário 2007), (SVO) is the dominant phrasing pattern (65%). Furthermore, the preference for (SVO) is stronger in non-branching conditions (93%) (see Figure 25). Only in branching conditions the S is mainly phrased apart from the V and the O (78%), which suggests that branchingness is the relevant factor triggering the (S)(VO).

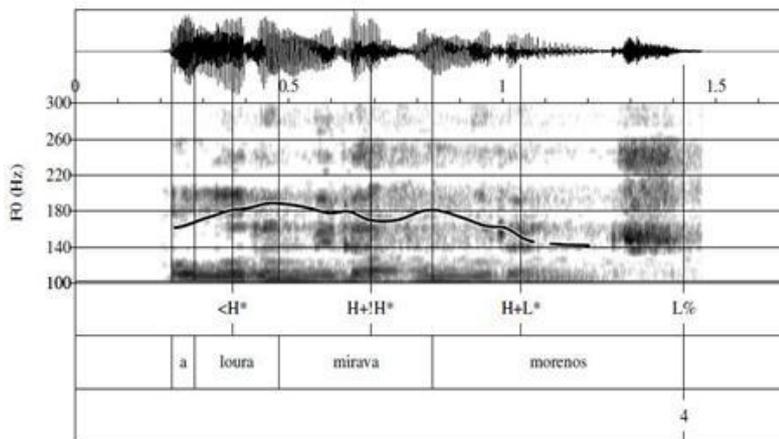


Figure 25 - (SVO) phrasing. Short non-branching S. ‘A loura mirava morenos.’ (The blond girl looked at dark-haired boys.), produced by a speaker from Alg.

The two central-southern varieties show different dominant phrasing patterns overall (without considering the effects of constituent length and syntactic/prosodic complexity): Ale is more similar to the Northern variety, whereas Alg is closer to the Standard variety. Both speakers from each variety present similar results (speakers from Ale produce less than 50% of (SVO) sentences, while speakers from Alg produce higher percentages of (SVO) sentences (62% and 67%). These results show that varieties previously classified as being distinct, on the basis of phonological segmental variation (Cintra 1971, Segura & Saramago 2001, Rodrigues 2003, *inter alia*), may share similar prosodic characteristics, as in the case of NEP and Ale; and regions belonging to the same variety (Interior Centre and South) on the basis of

phonological segmental variation may display different prosodic characteristics, as Ale and Alg do.

3.4.2.3. Triggering (S)(VO) phrasing: the effect of syntactic/prosodic complexity

To examine the effect of branching as a potential trigger of the (S)(VO) phrasing pattern, conditions with identical length in number of syllables but different complexity were analyzed (e.g., conditions 2 and 3, section 3.4.2.1). As shown in Table 2, in Ale, as in Alg, short branching S was mostly phrased into a single IP, unlike long non-branching S.

	Ale	Alg
Long non-branching S	63%	25%
Short branching S	94%	72%

Table 2 - Role of branching in the (S)(VO) phrasing pattern – Ale and Alg.

Although syntactic/prosodic branching promotes the phrasing of S into a single IP in both varieties, it clearly plays a more relevant role in Alg than in Ale. In Alg, non-branching S phrase together with V and O and only branching S tend to be phrased into a single IP (Figure 25 vs. Figure 26).

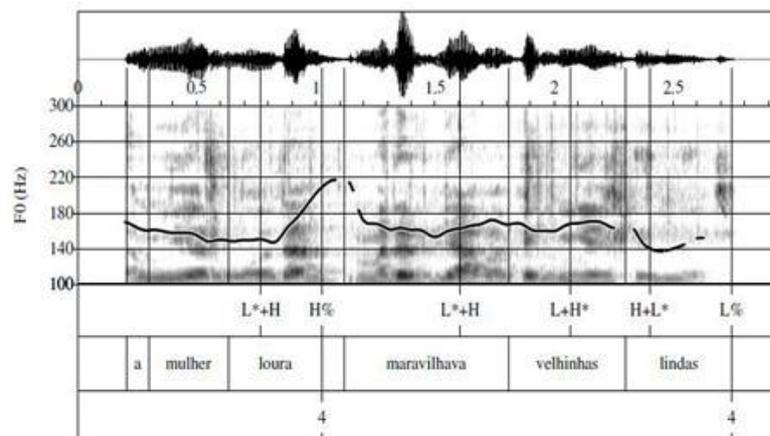


Figure 26 - (S)(VO) phrasing. Short branching S. ‘A mulher loura maravilhava velhinhas lindas.’ (The blond woman marveled beautiful old ladies.), produced by a speaker from Alg.

By contrast, in Ale, (S)(VO) phrasing of non-branching S is a common pattern (Figure 24 and Figure 27).

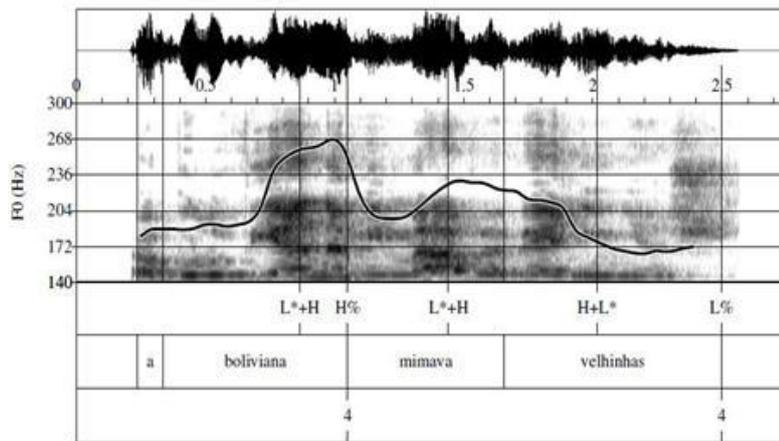


Figure 27 - (S)(VO) phrasing. Long non-branching S. ‘A boliviana mimava velhinhas.’ (The Bolivian girl spoiled old ladies.), produced by a speaker from Ale.

The comparison of these data with previous results for NEP and SEP (Table 3) shows that both in Ale and in Alg, similarly to NEP, syntactic/prosodic branching constrains prosodic phrasing. In contrast with both the Northern variety and the central-southern varieties, in SEP, syntactic/prosodic branching has no effect on (S)(VO) phrasing. This phrasing pattern in the Standard variety is only triggered by length in number of syllables, as observed in Frota & Vigário (2007).

	NEP	SEP
Long non-branching S	56%	4%
Short branching S	69%	4%

Table 3 - Role of syntactic branching in the (S)(VO) phrasing pattern – NEP and SEP (from Frota & Vigário 2007).

3.4.2.4. Triggering (S)(VO) phrasing: the effect of length

In this section, the effect of phonological length (in number of syllables) is examined. Table 4 shows that besides syntactic branching, length in number of syllables also triggers the (S)(VO) phrasing pattern in Ale: the dominant pattern in long non-branching S is (S)(VO) (63%), whereas in short non-branching S (SVO) prevails. In Alg, by contrast, length plays a reduced role compared to syntactic/prosodic branching: (S)(VO) becomes the dominant pattern only in branching conditions.

	Ale	Alg
Short non-branching S	38%	6%
Long non-branching S	63%	25%
Short branching S	94%	72%
Long branching S	95%	89%

Table 4 - Role of length (in number of syllables) in the (S)(VO) phrasing pattern – Ale and Alg.

In sum, in Ale, length in number of syllables together with syntactic/prosodic branching promote the (S)(VO) phrasing pattern, whereas in Alg syntactic/prosodic branching is the relevant factor. Differently from the central-southern varieties, in SEP only length plays a major role in the (S)(VO) intonational phrasing: a S with more than 8 syllables tends to form a single IP (Elordieta, Frota & Vigário 2005).

To sum up, two varieties from the Interior Centre and South of EP were inspected in terms of the influence of some factors on phrasing, namely, syntactic/prosodic complexity, and length (in number of syllables) of prosodic phrases. It was found that in Ale, as is NEP, there is a preference for the (S)(VO) pattern, contrasting with the predominance of (SVO) in Alg, as in SEP. These results show that varieties reported to be identical on the basis of their segmental phonetics and phonology (Cintra 1971, Segura & Saramago 2001) do not necessarily share the same prosodic properties, and varieties reported to be segmentally different are not necessarily prosodically different. Besides contributing to the characterization of the prosodic system of EP, this finding strengthens the need to map within-language prosodic variation (as it has been done within the *InAPoP* Project – Frota & Cruz, coords., 2012-2014).

Finally, both syntactic complexity and length (in number of syllables) were found to constrain intonational phrasing although with varying degrees across varieties. In Ale, as in NEP, (S)(VO) is favored by syntactic/prosodic branching and length. However, syntactic branching is the most relevant factor in NEP, whereas length plays the most important role in Ale. In Alg, syntactic/prosodic branching is the trigger of (S)(VO). In SEP, length is the crucial factor behind (S)(VO) intonational phrasing. This strongly suggests that these factors are relevant dimensions of variation within EP. Furthermore, the fact that these factors play different roles in each EP variety provides evidence for the existence of several grammars within the same language.

3.5. Conclusions and final discussion

Our segmental experiments testing both sandhi phenomena and Paragoge in the central-southern varieties of EP confirms the relevance of the Intonational Phrase. In fact, Fricative Voicing is bounded by the IP, whether internal or not, and the paragogic vowel may occur at the same prosodic boundaries. Although these segmental phenomena cue differently the IP level (by its absence in the first case and by its presence in the second one), it is important to underline that these segmental phenomena do not present specific distributional properties, i.e., they do not apply differently within internal or external IPs. This fact confirms

that the Intonational Phrase domain is the relevant one (and not the Utterance). Future research was pointed out as needed in order to see whether only the IP edge is relevant for the occurrence of Paragoge in Ale or if prominence also plays a role (or both). As in SEP, we have not found segmental evidence for the Phonological Phrase domain in the central-southern varieties.

The analysis of prosodic phrasing patterns in Ale and in Alg showed that although length in number of syllables and syntactic/prosodic branching of phrases provide evidence for the IP domain in EP, not all these aspects play a role in prosodic phrasing across EP varieties, or they may have different weights in the IP boundaries assignment. Namely, we have observed that in SEP only length (in number of syllables) affects the IP-phrasing, while in NEP both length and syntactic/prosodic branching are relevant for prosodic phrasing. Our experiments described above show that even within the central-southern varieties, these factors may play different roles in prosodic phrasing: in Alg, only syntactic/prosodic branching has an effect on phrasing; in Ale, as in NEP, both length and syntactic/prosodic branching are relevant factors for phrasing, with a higher relevance of the former in Ale and a higher importance of the latter in NEP.

The results presented here allow us to conclude that the analysis of both segmental and suprasegmental phenomena is determinant to improve our knowledge of the prosodic phrasing of European Portuguese varieties. Furthermore, a cross-comparison analysis within EP varieties allows us to extract two general conclusions. Firstly, the same prosodic dimensions of variation seem to be relevant to characterize the EP varieties (for instance, the effect of length and branchingness on phrasing choices), but playing different roles in each variety (in Alg, branchingness constrains prosodic phrasing; in Ale, both length and branchingness are important factors). Secondly, two regions previously classified as belonging to the same variety, on the basis of segmental phenomena (Ale and Alg – central-southern varieties), may display different prosodic properties and the same dimensions of variation may provide evidence for specificities, which leads to the interpretation that these two regions present different prosodic grammars. This hypothesis must be explored within other prosodic aspects, namely intonation and rhythmic properties. In the following chapter, the main nuclear configurations are observed in Ale and Alg, and compared both within EP and across Romance languages.

4. Intonation

Research on intonation across languages is known to raise a fundamental question: does intonation differ across languages or not? Those who assume a universalist view of intonation (Hockett 1963, Bolinger 1989, *inter alia*) have presented several empirical generalizations about intonation across languages, like the fact that languages of different origins share linguistic and paralinguistic functions of intonation: the tendency of pitch to fall at the end of an utterance, the use of a higher pitch in questions, the use of pitch accents on important words within an utterance. This universalist view of intonation has been challenged by findings showing that there are obvious differences between languages, or even between dialects of the same language (Ladd 1996/2008; Fox 2000). However, other studies provide evidence for intonational tendencies, thus suggesting, at least, a near-universal view of intonation: Rialland (2007), for instance, on the basis of the analysis of 78 languages spoken in Africa, confirms that rising intonation in questions is a strong tendency. That's why question intonation in the Southern Japanese dialect of Kagoshima, characterized by a falling contour (Kubozono 2007, Uwano 2007), is considered 'atypical' (Riad & Gussenhoven 2007). In an attempt to explain certain universal tendencies, Gussenhoven (2002), following earlier work from Ohala (1983, 1984), proposes biological codes in the use of prosody.

A considerable bulk of research has focused on identifying the ways in which languages differ, rather than the ways in which they are similar. By comparing a survey of intonation systems of twenty languages, Hirst & Di Cristo (1998) tried to identify different dimensions of variation. For Ladd (1996/2008), languages may differ intonationally from each other in four possible different ways: (i) semantic – the same tune may convey different meanings; (ii) systemic – differences in the inventory of tune types, irrespective of semantic differences; (iii) realisational – the same tune may have different phonetic realisations; (iv) distributional – phonotactic constraints of a given element of the system (e.g. differences in tune-text association).

Based on these general observations of intonational variation across languages, we first aim to observe whether varieties of EP differ in any of the above mentioned dimensions. Our final goal is to provide an overall description of the prosodic system of central-southern varieties of EP, thus contributing to expand the knowledge on intonational variation in Portuguese, and compare varieties of Portuguese with both Romance and non-Romance languages.

After presenting the theoretical framework behind this research (section 4.1), we provide a summary of the most recent work developed on intonational variation in Portuguese, as well as in other Romance and non-Romance languages (section 4.2). In section

4.3 we present our intonational analysis of the central-southern varieties. After describing the methodology used (section 4.3.1), we explore the main results obtained across sentence types and speech styles (section 4.3.2) for the following intonational aspects: (i) nuclear contours, (ii) tonal marking of prosodic edges, (iii) prosodic focus and post-focal behavior in early focus cases, (iv) pitch accent distribution. At the end of this chapter, we summarize the main conclusions and discuss implications of our findings for the intonational system of Portuguese (section 4.4).

4.1. The Autosegmental Metrical Model

According to the Autosegmental Metrical (AM) framework (Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988, Ladd 1996/2008, Gussenhoven 2004, Jun 2005, *inter alia*), intonation is described by two types of units: pitch accents and boundary tones. The phrase accent¹⁵ (H⁻ or L⁻) was also included as a kind of edge-related element (Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988), which occurs between the rightmost pitch accent and the boundary tone. However, Beckman & Pierrehumbert (1986) suggest that the phrase accent must be analyzed as a boundary tone, as it signals the edge of the intermediate phrase (ip). Hayes & Lahiri (1991) and Grice, Ladd & Arvaniti (2000) also provide evidence for the phrase accent as a part of the intonational phonology of some languages. In some languages, the phrase accent has been incorporated in the intonational system – Italian (Grice 1995, Grice & Savino 1997, D’Imperio 1999), Greek (Arvaniti 1998, Arvaniti & Baltazani 2000), Spanish (Beckman et al. 2002, Aguilar et al. 2009, Prieto & Roseano 2010) –, while in other languages it has not – Dutch (Gussenhoven et al. 1999), Portuguese (Frota 2000, in press). However, some authors consider the phrase accent as dispensable (Sosa 1999, for Spanish) or whose presence in the tonal inventory is doubtful (Grice et al. 2005, for Italian). Although Grice, Ladd & Arvaniti (2000) agree to a certain extent with the view that the phrase accent is associated with the intermediate phrase level, the authors deliberately prefer not to assume this since there is disagreement about phrase-size units in the prosodic hierarchy and different views of prosodic structure (see Chapter 3 for more details).

Pitch accents are associated with prominent syllables while boundary tones are aligned with the edges of prosodic constituents. Each type of tonal event is analyzed by means of two discrete tones – high (H) and low (L). When associated with stressed syllables, these tones are starred (*). Pitch accents and boundary tones can be simple (monotonal) or complex (bitonal).

¹⁵ Also known as ‘sentence accent’ (Bruce 1977).

Bitonal pitch accent types may have leading or trailing tones. The leading tone precedes the starred tone, whereas the trailing tone follows the starred tone. The relation between leading and trailing tones and the starred tone is shown to be different: the leading tone is timed independently of the starred tone and the trailing tone is timed with reference to the starred tone (Frota 2002b).

Recently, two additions to the AM model have been proposed on both pitch accent and boundary tone types. Considering alignment properties, Gili Fivela (2002, 2006) and Prieto et al. (2009) proposed tritonal pitch accents and boundary tones: respectively, L+H*+L as a contrastive pitch accent (in relation to the broad bitonal pitch accent L+H*) in Pisa Italian, and LHL% as a boundary tone type found in exhortative requests produced in Catalan. The analysis of scaling also led several authors to include a mid tone level in the system: Prieto, Torres-Tamarit & Vanrell (2008) for Catalan; Beckman et al. (2002) for Spanish; Arvaniti & Baltazani (2005) for Greek. The mid boundary tone (M%) was proposed as an alternative to the !H%, interpreted by these authors as being dependent on preceding pitch accents. Thus, M% was argued to directly encode final pitch height. Furthermore, perceptive experiments have shown that Catalan listeners, for instance, are able to identify the contrast between the final tonal configurations that rise from low to high and from low to a mid or downstepped high level (Prieto, Torres-Tamarit & Vanrell 2008). Some of the authors who proposed the mid boundary tone have recently adopted the !H% for coding the same final tonal configuration, i.e. a downstepped high level (Prieto in press, Prieto et al. in press).

The model briefly described above was proposed for all intonational languages and establishes that these units are enough for the representation of all contours. However, this does not mean that a given phonological category used in a specific language or dialect should always have the same phonetic realization across languages or dialects. Pitch accents and edge tones are abstract phonological units, subject to contextual variability and to different types of implementation across languages (Gussenhoven 2004, Ladd 1996/2008, Frota 2013).

Within the AM framework, a prosodic labelling system was created as a phonological analysis of intonation contours – the ToBI system. It includes labels for tones (“To” derives from tones) and for the degree of breaks between two prosodic levels (“BI” means Break Indices). The original conventions of ToBI contain four layers of labelling aligned with the acoustic signal: (i) words (orthographic transcription aligned with the spectrum), (ii) tones, (iii) break indices (reflecting the prosodic structure of a given language/variety) and (iv) miscellaneous (useful for the annotation of an alternative analysis or phenomena such as hesitation pauses, disfluencies, among others). Nevertheless, it is assumed that both the amount and the type of tiers depend on the prosodic system of each language and on the

interests of the research group involved. This system should be flexible in order to describe the prosody of each language and/or variety but without losing its purpose of being also useful for a comparison across languages/varieties (Jun 2005, Ladd 1996/2008). As Jun (2005) observes, as the prosodic model behind ToBI is a phonological and not a phonetic model, the ToBI system that describes a given language or dialect may not be suitable for describing another language or dialect.

Recently, there has been a great effort to develop ToBI systems for various languages: Cat_ToBI for Catalan, Sp_ToBI for Spanish, *inter alia*. For EP, a preliminary version of P_ToBI was proposed (Viana & Frota, coord. 2007), which has been developed in subsequent work (Frota in press), also with the goal of accounting for data from several EP and BP varieties (Frota et al. in press, Frota & Cruz 2013). The present research aims to give a description of the intonational system of two varieties of EP, and thus provide a contribution to a ToBI system for Portuguese. Additionally, the present work, as well as the *InAPoP* enterprise, takes into account the long-term goal of developing a common approach for the analysis and transcription of intonation for Romance languages (Frota & Prieto under contract).

4.2. Intonational variation in Portuguese and other Romance and non-Romance languages

The study of intonational variation in Portuguese is fairly recent and it has known important developments with the *InAPoP* project, as already mentioned (Chapter 2). The current research, by contributing to this project, aims to offer additional knowledge of the characterization of the intonational system of Portuguese, considering not only the intonational lexicon, but also intonational phrasing, phrasal prominence, focus assignment and pitch accent distribution. This chapter is centred on the main nuclear contours per sentence type and focus assignment, and pitch accent distribution is also described. However, first we provide a summary of the theoretical background of these intonational aspects both in Portuguese and in other (non-)Romance languages.

In European Portuguese, there are two types of tonal events, which correspond to morphemes coding pragmatic information in a given tune (Frota 2000, 2012b, in press): pitch accents (associated with stressed syllables) and boundary tones (associated with IP edges). In contrast with English (Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988), or with Brazilian Portuguese (variety spoken in São Paulo – Fernandes 2007a, b), there is no evidence for phrase accents in EP. Bitonal nuclear accents predominate

in SEP, in combination with monotonal or bitonal boundary tones, whereas in NEP there is a preference for simple tunes, i.e. both monotonal nuclear accents and monotonal boundary tones (Frota 2002a, Vigário & Frota 2003, Frota & Vigário 2007). H+L* is the most common nuclear pitch accent, as it was also observed by Frota et al. (in press), associated with different pragmatic meanings across Portuguese varieties: neutral declaratives (SEP, BP), yes-no questions (SEP), wh-questions (SEP), commands (BP). In NEP, the pitch also falls from the beginning until the end of the IP in declaratives, yes-no questions and wh-questions, but differently from SEP or BP, the nuclear word is already low (Frota & Vigário 2000, Tenani 2002, Vigário & Frota 2003, Moraes 2008, Frota et al. in press). Differently from EP, the intonational inventory of the Brazilian variety of Portuguese is characterized by more rises than falls, as it was also observed in Peninsular Spanish (Armstrong & Cruz in press).

As an overview of the main nuclear contours per sentence type, declaratives are produced in SEP with a falling nuclear contour (H+L*), while in NEP the nuclear PW is produced with a low pitch, followed by a low boundary tone (L* L%) (Vigário & Frota 2003). In these two varieties, the same nuclear configuration (H+L* L% in SEP, and L* L% in NEP) can also be found in both declaratives and wh-questions. Yes-no questions are produced in SEP with the nuclear configuration H+L* LH%. By contrast, in NEP, yes-no questions are realized with a low nuclear syllable (L*), followed by a complex falling boundary tone (HL%). The first detailed phonological account of imperative intonation (commands and requests) in EP was presented by Frota (in press), for the Standard variety. The difference between commands and requests, as well as pragmatic distinctions within requests (politeness or insistence), was inspected by the author. Requests are intonationally characterized by a low nuclear pitch accent followed by a low boundary tone (L* L%), whereas commands may present two patterns: (i) the focus accent of yes-no questions (L*+H) or of declaratives (H*+L) aligned with the verb (early nucleus), followed by a low boundary tone (L%); (ii) the focus accent of declaratives (H*+L) aligned with the verb object (late nucleus), followed by a low boundary tone (L%). As for requests and commands, the first account of vocative chants in EP was also presented in Frota (in press). In EP, two variants of the calling contour were already inspected: (i) the sustained pitch variant (or greeting call), with a high pitch in the nuclear syllable followed by a sustained high pitch level (H* !H%); (ii) the low pitch variant (or insistent call), with a high pitch in the nuclear syllable, followed by a fall until the end of the contour (H* L%) (Frota in press).

Tonal alignment conveys differences in meaning in EP (Frota 2002a,b, 2012b): H+L* is mainly used in Portuguese to produce neutral statements, while H*+L is used in focused statements, across almost all Portuguese varieties analyzed so far (Frota et al. in press).

Differently from other Romance languages, such as Spanish (Beckman et al. 2002; Face 2005, 2011), Catalan (Borràs-Comes et al. 2010, Vanrell 2011), French (Post 2000), Friulian (Roseano, Vanrell & Prieto 2011) or Bari Italian (Savino & Grice 2007, 2011), tonal scaling has not been inspected in Portuguese.

In SEP, when a sequence of tones is associated to a single syllable, tonal patterns are not truncated (as in Hungarian – Ladd 1996/2008, Grice et al. 2000 – or Palermo Italian – Grice 1995) nor compressed (as in English – Ladd 1996/2008 – or Catalan – Prieto 2002). In SEP, the segmental string is extended to cope with the tonal realization, i.e. there is a text-tune accommodation, not a tune-text accommodation, as described for both truncation and compression languages (Frota 2002b, in press).

Büring (2010) suggests a typology of focus realization. Along this line, he proposes five classes of languages depending on the strategy used for focus realization: (i) boundary languages – Chichewa, Bengali, Japanese; (ii) edge languages – Hungarian; (iii) mixed languages, which use either prosodic or syntactic structure to convey focus – Slavic languages, German, Finnish, European Portuguese; (iv) particle languages, that mark the focused constituent by a special morpheme – Chickasaw, Gúrúntúm – a Chadic language spoken in Nigeria, Turkish (Göksel & Özsoy 2003); (v) non-marking languages in which focus is marked by prominence as either syntax-based (Hausa, a Chadic language; see also Thompson Salish – Koch 2011) or prosody-based (English).

Considered a mixed language by Büring (2010), European Portuguese was shown to convey prosodic focus by prominence and intonation (Frota 1993, 2000, 2012b, in press): (i) focus is signalled by a specific tonal event (H^*+L), like Italian (D'Imperio & House 1997, D'Imperio 2002); (ii) it is the head of the IP, independently of its position (early or late) in this constituent; (iii) it triggers post-nuclear subordination of pitch accents (thus showing pitch range compression, not deaccenting as in French or Danish); and (iv) it presents an optional extended pitch range. Thus, in early focus cases, the prominent element is the focused constituent and not the final Prosodic Word of the Intonational Phrase.

According to Frota (2000, 2002c), differences in prosodic marking of focus correlate with syntactic differences shown to signal focus: phrasing effects are obligatory in languages in which focus occurs in a specific syntactic position (as Hungarian – Mády & Kleber 2010 or Korean – Kiss 1995); prominence-related effects are important cues to focus in languages lacking a clear overt morphological and syntactic strategies to signal focus (as English, Italian and EP). Finally, other languages, such as Wolof (Rialland & Robert 2001), express focus by using morphology with no syntactic consequences (and thus with no effects of phrasing).

Prominence-related effects are not expected in Wolof, since this language has no pitch accent system.

Besides prominence and intonation, other phonological phenomena are crucial to the realization of focus. Arvaniti & Adamou (2011) suggest that the most common strategy of focus is the prosodic marking, assuming different possibilities, such as prosodic phrasing changes like in Korean (Jun 2005). In Brazilian Portuguese (variety spoken in São Paulo) – BP –, differently from EP (Frota 1993, 2000, in press), focus also affects phrasing, i.e. the focused constituent is followed by a low phrase boundary (L-) (Fernandes 2007a, b; Tenani & Fernandes-Svartman 2008; Truckenbrodt et al. 2009; Frota et al. in press). Pitch range variation and duration may also be used to convey focus. These are the main strategies used in Mandarin Chinese (Chen, Wang & Xu 2009) and in Hindi (Genzel & Kügler 2010). Indeed, focalized words in Beijing Mandarin and in Taiwan Mandarin have a higher intensity, a higher pitch range and a greater duration than in Taiwanese. In Hindi, there is a higher scaling for the H tone in contrastive focus than in broad focus and focalized words are lengthened. In Catalan, pitch range also plays a role: neutral statements, focused statements and echo questions have the same nuclear contour (L+H*) and the distinction between these sentence types lies on pitch height (Borràs-Comes, Vanrell & Prieto 2010). Another way of marking focus, though unusual, consists in changing the location of stress to an earlier syllable from the one that is canonically stressed, which was observed in Romani (Adamou & Arvaniti 2010, Arvaniti & Adamou 2011).

In early focus cases, the behavior of the post-focal material in terms of presence/absence of a post-nuclear pitch accent and considering its formal and distributional properties is determinant in the sense that it adds to the controversial debate on post-nuclear subordination or deaccentuation (Ladd 1996: 212-216). In SEP, focus prominence triggers the post-nuclear subordination of the post-focal pitch accent (H+L*), associated with the last stressed syllable of the IP, and produced with a compressed pitch range (Frota 2000, 2002c, 2012b, in press). Similarly to SEP, the Neapolitan and Bari varieties of Italian (D'Imperio 1997; Grice & Savino 1997) also present post-focal subordination. Interestingly, post-focal behavior may be relevant to distinguish varieties that use the same strategy to convey focus: perceptive experiments show that in Beijing Mandarin the pitch range and the intensity of post-focal words are compressed (post-focal compression), which does not occur in Taiwan Mandarin (Chen, Wang & Xu 2009). Other languages, such as French (Di Cristo 1998, Chen & Destruel 2010), Danish from Copenhagen (Grønnum 1998) or Greek (Botinis 1998) are characterized by post-focal deaccenting, i.e. pitch accents after the focalized element are deleted. In general, the pre-focal part of a sentence is less affected than the post-focal part: the pre-focal pitch

pattern is described as unmodified in Southern dialects of Swedish (Gårding 1998), or reduced as in Danish (Grønnum 1998).

Pitch accent distribution (PAD) is yet another dimension of intonational variation. Several studies observed the relation between pitch accent distribution and informational status of words (new vs. given) in a discourse. However, there is a wide variability in the relative semantic weight and its relation with pitch accent distribution. Ladd (1996/2008) shows that this relation is conditioned by both lexical and syntactic factors, and may differ across languages and varieties. Additionally, pitch accentuation and newness/givenness do not share a one-to-one correspondence: a noun can be deaccented in a given language/dialect, but not in another (Ladd 1996/2008: 184-187).

Besides the relation between pitch accentuation and informational status of words, there are studies also observing the relation between pitch accent distribution and prosodic structure or intonational phrasing (Frota & Vigário 2003; Hellmuth 2004, 2007). Within EP, SEP is characterized by a sparse pitch accent distribution, whereas NEP presents a high tonal density (Vigário & Frota 2003, Frota & Vigário 2007). In BP, almost every Prosodic Word bears a pitch accent (Frota & Vigário 2000, Frota et al. in press, Tenani 2002), thus being closer to NEP, in particular, and to other Romance languages (in many varieties of Spanish one pitch accent is found per Prosodic Word in declarative sentences - Hualde 2002). Two different views were proposed on the relation between pitch accent distribution and intonational phrasing. In Standard European Portuguese (SEP), subject (S), verb (V) and object (O) are usually grouped together in a single Intonational Phrase (IP), except when S is longer than 8 syllables (Elordieta, Frota & Vigário 2005). On the basis of data from both SEP and Northern European Portuguese (NEP), a correlation between these two prosodic factors was proposed to hold within a given prosodic system, as fewer pitch accents correlate with fewer phrases (Vigário & Frota 2003, Frota & Vigário 2007). Based on data from Cairene Arabic, an alternative proposal was put forward that sees phrasing and domain for PAD as orthogonal dimensions of a prosodic system (Hellmuth 2007). As far as we know, the relation between pitch accent distribution and sentence types was not explored with the exception of Portuguese. This analysis contributes to the distinction between statements and wh-questions in EP varieties, whereas in BP there is a dense pitch accent distribution independently of the sentence type (Frota et al. in press).

Building on the previous studies, we aim to describe the main intonational properties of central-southern varieties of EP and thus contribute to a better understanding of intonational system of Portuguese.

- (3) [C: Disseram-me ontem:] paroxytone (with pre-tonic σ)
As angolanas ofereceram especiarias aos jornalistas.
[C: Yesterday I was told:]
The Angolan girls offered spices to the journalists.
- (4) [C: Não faço ideia do que aconteceu.] oxytone
Ela foi ver o mar?
[C: I have no idea of what happened.]
Has she gone to see the sea?
- (5) [C: Não faço ideia do que aconteceu.] paroxytone
Ela foi ver a Maria?
[C: I have no idea of what happened.]
Has she gone to see Maria?
- (6) [C: Gostaria de saber o que se passou.] proparoxytone
Os rapazes compraram lâminas?
[C: I would like to know what happened.]
Did the boys buy slides?
- (7) [C: Gostava de ouvir esse disco.] oxytone
Quem cantou uma manhã angelical?
[C: I would like to listen to this album.]
Who sang an angelic morning?
- (8) [C: Ainda não vi a exposição.] paroxytone
Quem pintou uma manhã âmbar?
[C: I have not seen the exhibition yet.]
Who has painted an amber morning?
- (9) Anda ver o mar. oxytone
Come and see the sea.
- (10) Pinta uma manhã âmbar. paroxytone
Paint an amber morning.

(16)[C: Vi esse quadro na exposição, mas não me recordo se o motivo era uma manhã ou um entardecer âmbar.]

O pintor retratou uma MANHÃ âmbar?

[C: I've seen that painting in the exhibition, but I don't remember if the motif was an amber morning or an amber afternoon].

Did the artist paint an amber morning?

(17) [C: Gostaria de saber se foram mesmo lâminas que eles compraram e não outro objecto qualquer.]

Os rapazes compraram LÂMINAS?

[C: I would like to know if boys have bought slides or any other object.]

Did the boys buy slides?

Experiment 2 – DCT

From the Discourse Completion Task (described in detail in section 2.3.2.3), covering 37 everyday situations, we have selected comparable sentence types and pragmatic meanings with those obtained in the reading task: 5 declaratives (3 neutral – situations 1, 2 and 3¹⁶ – and 2 focused – situations 6 and 8), 4 yes-no questions (2 neutral – situations 11 and 11b – and 2 focused – situations 26 and 26b), 2 wh-questions (situations 18 and 19), 2 imperatives (1 request – situation 29 – and 1 command – situation 28) and 2 vocatives (1 greeting call and 1 insistent call – situations 30 and 31, respectively). Thus, a total of 15 sentences per speaker were inspected. As in the reading task, in the DCT, we have chosen the best rendition of each speaker from the younger group for each region, and thus a total of 135 sentences were analyzed (15x3x3).

Experiment 3 – Map Task

As described in detail in section 2.3.2.2, four participants per variety performed this task (one pair per age group), assuming different roles: as a Giver, i.e. providing instructions on how to get to the point signalled on the map, or as a Follower, i.e. asking for all the information needed in order to draw the route on the map. This task was designed to obtain specific types of interrogatives produced in a natural/spontaneous way. In this sense,

¹⁶ These numbers refer to general labels applied across Romance languages to each sentence covered in DCT (see Appendix IV for the correspondence between numbers and sentences).

examples from this task are provided in this chapter as a complement to the analysis of productions obtained both in the reading task and the DCT.

All the sentences were analyzed in *Praat 5.2*. (Boersma & Weenink 2007). Textgrids include 3 tiers for (i) the intonational analysis, (ii) the orthographic transcription word by word, aligned with the spectrum and (iii) the annotation of prosodic boundaries, according to the Break Indices (BI) labels, adapted for Portuguese to reflect prosodic phrasing (Vigário 2003, 2010; Frota in press). In the following sections, we describe the intonational properties of the central-southern varieties and we discuss the implications of this analysis for the intonational system of Portuguese.

4.3.2. Results across sentence types and tasks

4.3.2.1. Nuclear contours

The results presented in this section were partially described in previous studies (Cruz & Frota 2010a, b; Cruz & Frota 2011b; Frota et al. in press).

Neutral declaratives

Data obtained in the reading task shows that, as in SEP, neutral declaratives in the central-southern varieties are mainly produced with a falling nuclear pitch accent (H+L*). Besides the falling contour, neutral declaratives in Ale are also frequently produced with a low pitch (L*) aligned with the nuclear syllable (Figure 28 – left panel), as in NEP (Vigário & Frota 2003). The data obtained with the DCT provide similar results. In fact, L* in Ale (Figure 28 – right panel) is more frequently observed in this semi-spontaneous speech style than in the reading task. Whether a bitonal or a monotonal nuclear pitch accent is used, neutral declaratives always end with a low boundary tone (L%) in the central-southern varieties, as in all EP varieties studied (Frota et al. in press).

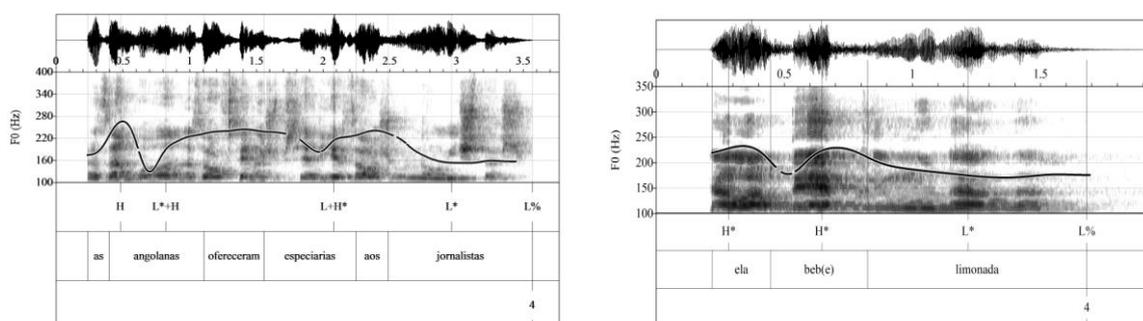


Figure 28 – Ale – neutral declaratives produced in the reading task (left panel) and in the DCT (right panel). Left panel: ‘As angolanas ofereceram especiarias aos jornalistas.’ (The Angolan girls offered spices to the journalists.). Right panel: ‘Ela bebe limonada.’ (She drinks lemonade.), extracted from Frota et al. (in press).

Neutral yes-no questions

Neutral yes-no questions, as produced in the reading task, show similar nuclear contours both in Ale and Alg, in the sense that both present a rising configuration. However, in Ale the nuclear syllable is produced with a low pitch level followed by a post-tonic rising movement to the end of the contour – L* H% (Figure 29 – left panel). In Alg, the beginning of the rising movement of pitch is aligned with the nuclear syllable, followed by a high boundary tone – L*+H H% (Figure 29 – right panel). Thus, central-southern varieties exhibit a different nuclear contour in yes-no questions from the one observed in SEP: the same falling contour as in declaratives (H+L*) produced in the same variety, but with a more complex (bitonal) boundary tone (LH%).

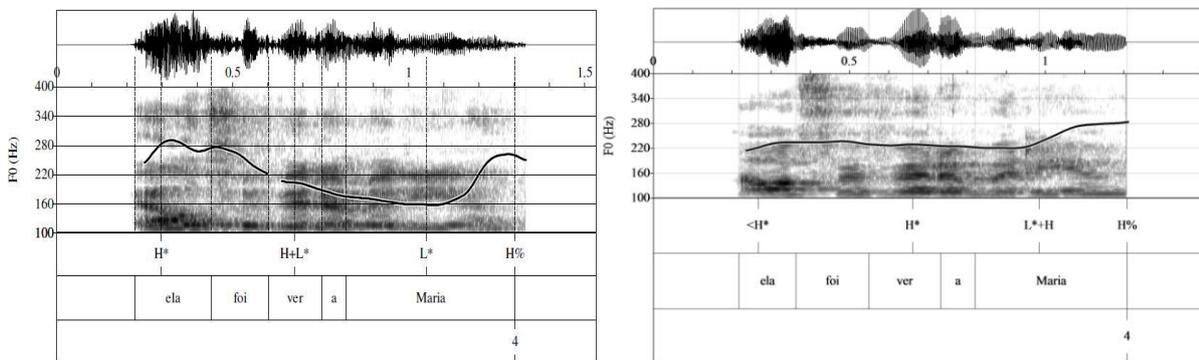


Figure 29 – Neutral yes-no questions produced in the reading task: Ale (left panel) and Alg (right panel). ‘Ela foi ver a Maria?’ (Has she gone to see Maria?).

Thus, if L*+H is a focus marker in yes-no questions in SEP, signalling the focused constituent in non-neutral yes-no questions (Frota 2002a), in Alg this pitch accent is used in neutral yes-no questions. In Ale, neutral yes-no questions are characterized by the same nuclear pitch accent as in NEP (Vigário & Frota 2003). However, Ale and NEP differ in the tonal boundary marking of yes-no questions: in Ale, there is a monotonal high boundary tone (H%); in NEP there is a bitonal falling boundary tone (HL%) (Vigário & Frota 2003). Neutral yes-no questions in central-southern varieties present the same boundary tone (H%) as in other Romance languages/varieties (e.g., Palermo and Standard Italian also present a high boundary tone, just differing from central-southern varieties in the use of a low phrase accent that immediately precedes the high boundary tone – Grice 1995).

In the DCT, SEP, Ale and Alg present the same nuclear contour as the one used for neutral yes-no questions produced in the reading task: L* H% in Ale (Figure 30 – left panel); L*+H H% in Alg (Figure 30 – right panel); H+L* LH% in SEP (Figure 31).

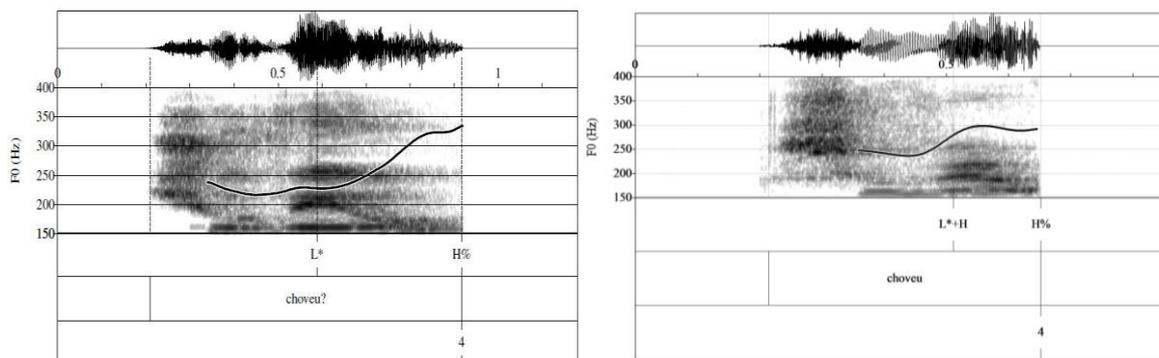


Figure 30 - Neutral yes-no questions produced in the DCT: Ale (left panel) and Alg (right panel). ‘Choveu?’ (Did it rain?).

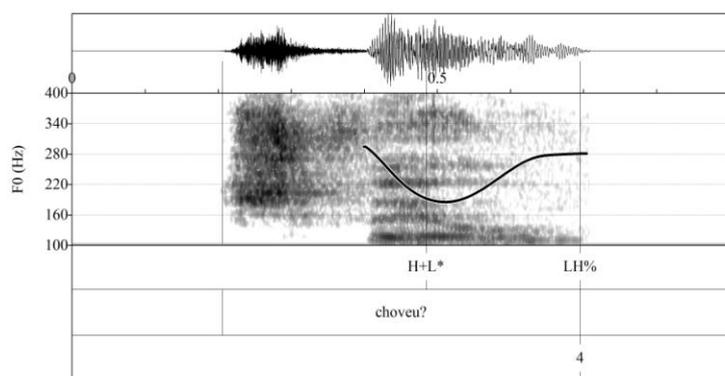


Figure 31 – SEP – neutral yes-no question produced in the DCT. ‘Choveu?’ (Did it rain?).

The analysis of yes-no questions with monosyllabic nuclear words in Ale and Alg confirms previous observations of EP as not being either a truncation nor a compression language (Frota 2000, 2002a, in press). Instead of tune-text accommodation (Ladd 1996/2008), in EP the segmental string is extended to cope with the tonal realization (text-tune accommodation). Three main strategies were observed in the Standard variety of EP, supporting previous descriptions: (i) vowel epenthesis after a sonorant coda, (ii) vowel lengthening, and (iii) vowel split. The last two were more common in calling contours (see further details later in this section), while the first one was more common in interrogatives. These strategies were also observed in the central-southern varieties, as shown by the occurrence of vowel epenthesis in Figure 32.

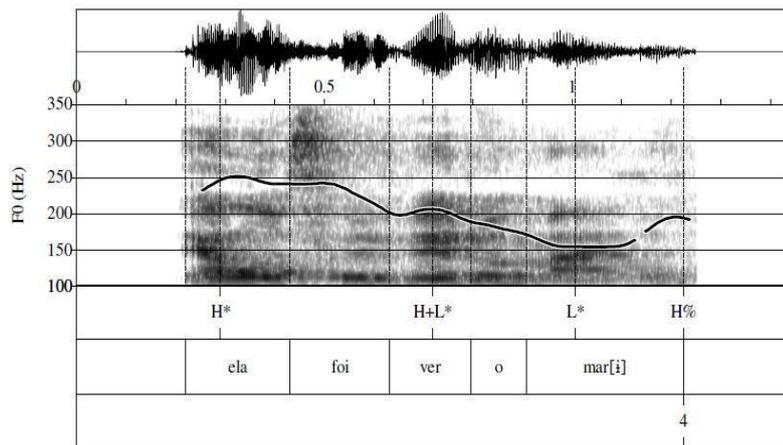


Figure 32 – Ale – Vowel epenthesis in a yes-no question (reading task). ‘Ela foi ver o mar?’ (Has she gone to see the sea?).

The comparison between neutral yes-no questions and neutral declaratives in these varieties of EP allow us to extract some conclusions on the use of tune types. It is already known that both in Standard and Northern varieties the difference between these two sentence types lies on the tonal boundary marking (L% in declaratives vs. LH% in yes-no questions for SEP; L% in declaratives vs. HL% in yes-no questions for NEP) (Vigário & Frota 2003). If in Ale the difference between these two sentence types also lies on the tonal boundary marking, as in SEP and NEP (L% in declaratives vs. H% in yes-no questions), in Alg it lies on the combination of contrasting nuclear pitch accent (a falling movement in declaratives vs. a rising movement in yes-no questions) and boundary tone (a low boundary tone in declaratives vs. a high boundary tone in yes-no questions).

Wh-questions

Wh-questions do not differ from neutral declaratives in terms of pitch accent types and this applies to the central-southern varieties under analysis, in the reading task and in DCT. In fact, in Ale and Alg, this sentence type is produced, both in the reading task (Figure 33 – left panel) and in the DCT (Figure 33 – right panel), with the same falling nuclear contour (H+L*) and low boundary tone (L%) as in SEP, and as in neutral declaratives. This confirms previous observations on the central-southern varieties and previous descriptions for SEP (Cruz & Frota 2010a, b, 2011b; Frota in press; Frota et al. in press).

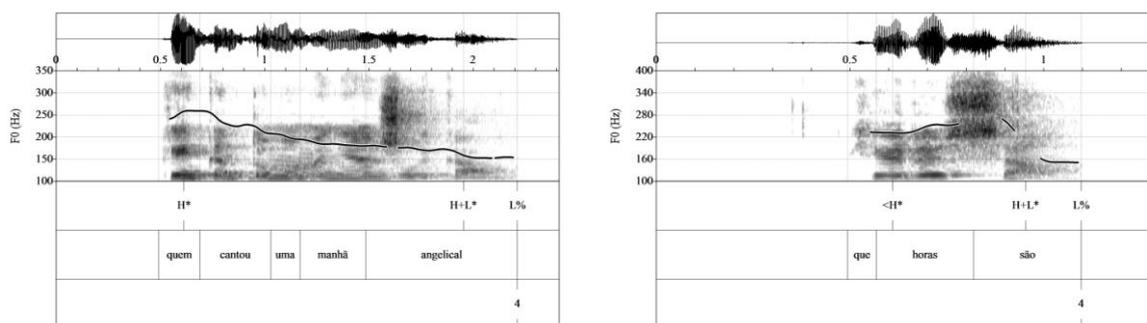


Figure 33 – Wh-questions. Left panel: Ale, reading task. ‘Quem cantou uma manhã angelical?’ (Who has sung an angelic morning?). Right panel: Alg, DCT. ‘Que horas são?’ (What time is it?).

In Ale, wh-questions may also be produced with a low nuclear accent (L*), followed by a low boundary tone (L%), similarly to neutral declaratives (Figure 34). This is also common in NEP, where the nuclear pitch accent L* is used for neutral declaratives, yes-no questions and wh-questions (Vigário & Frota 2003). In sum, wh-questions are characterized by a statement-like intonation, a fact that was already observed across EP varieties (Frota et al. in press).

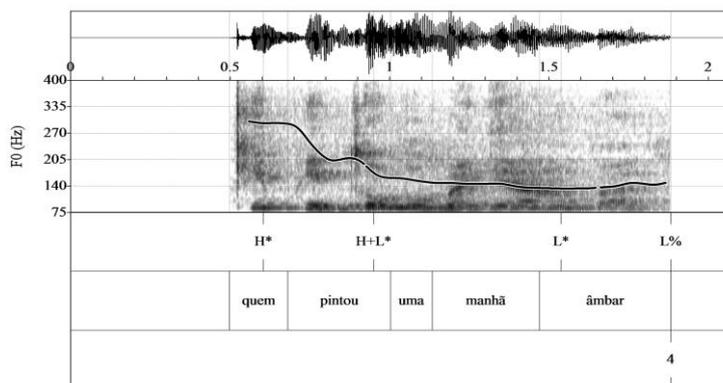


Figure 34 – Ale – Wh-question produced in the reading task. ‘Quem pintou uma manhã âmbar?’ (Who has painted an amber morning?).

Imperatives

Imperatives may be produced as requests or commands, depending on the pragmatic meaning of the utterance. Frota (in press) describes two different tunes for requests and commands in SEP. For requests, a low nuclear pitch accent (L*), preceded by a peak on the first stressed syllable (H*), and followed by a low boundary tone (L%). For commands, (i) a peak in the stressed syllable immediately followed by a fall in the post-stressed syllable (H*+L), or a low stressed syllable immediately followed by a rise (L*+H), aligned with the

verb (early nucleus) or (ii) the nuclear contour H*+L aligned with the last stressed syllable (late nucleus). The same tunes are found in the central-southern varieties, both in the reading task and the DCT: see Figure 35 for a request produced in Ale and Figure 36 for commands with a late nucleus, produced in Alg.

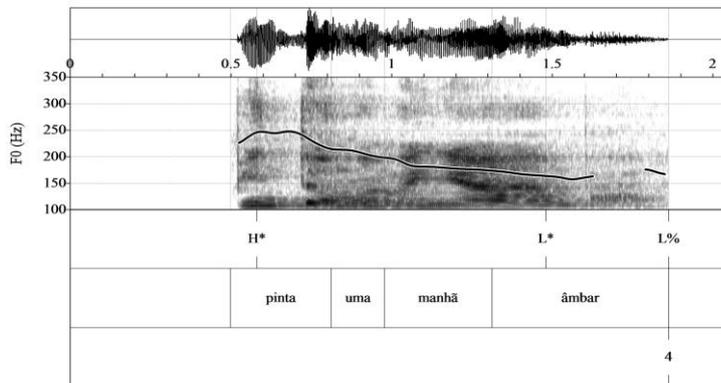


Figure 35 – Ale – Request produced in the reading task. ‘Pinta uma manhã âmbar.’ (Paint an amber morning.).

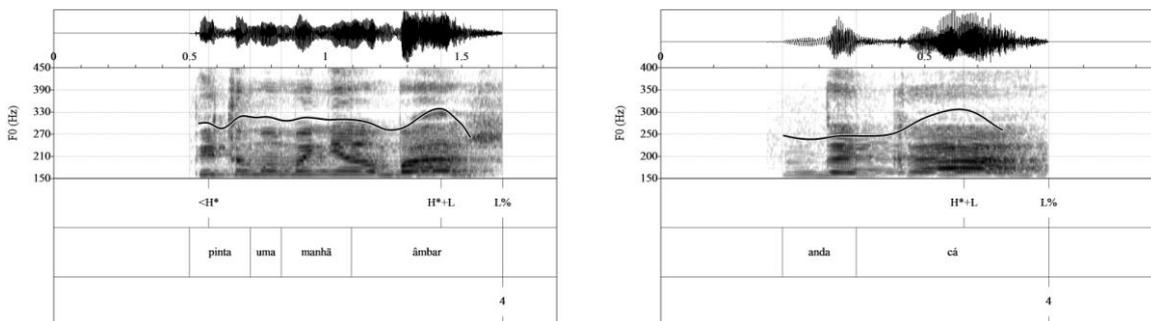


Figure 36 – Alg – Commands across tasks. Left panel: reading task. ‘Pinta uma manhã âmbar.’ (Paint an amber morning.). Right panel: DCT. ‘Anda cá.’ (Come here.).

As in Frota’s data (in press) for SEP, we also find in the central-southern varieties commands with either early or late nucleus, as mentioned above. However, the DCT materials do not allow include early nucleus cases, as it was already observed by Frota et al. (in press), and thus early and late nuclei can only be found in the reading data. Like in SEP (Frota in press), in Ale and Alg commands may be expressed by an early rising or falling nuclear accent (either L*+H – Figure 37 –, or H*+L) or a late nucleus (in this case, only H*+L occurs – Figure 36 above).

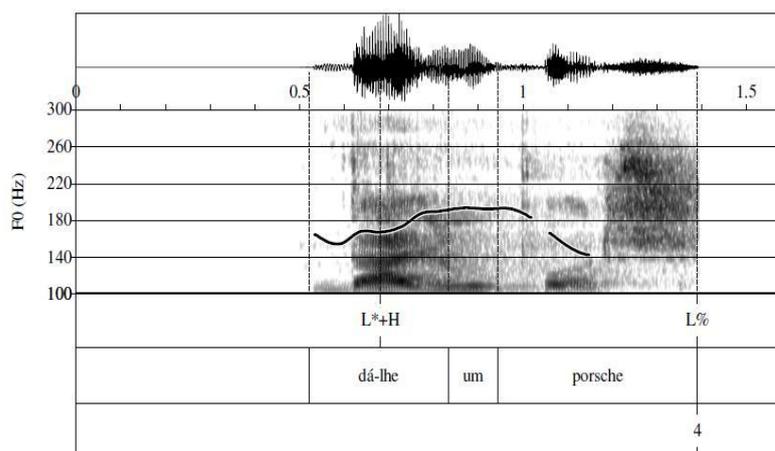


Figure 37 – Alg – Command produced with an early nucleus. ‘Dá-lhe um porsche.’ (Give him a porsche.).

Pragmatic differences among requests (gentle request, request, insistent request) or commands (command, strong command), as seen by Frota (in press), or by Falé & Faria (2007), are out of the scope of the present investigation. We intend to run perceptive experiments in future research to address these issues.

Vocatives

The first analysis of the intonation of vocatives was given in Frota (in press) for SEP. Two contours were described: (i) the sustained pitch variant (or greeting call), with a high pitch in the nuclear syllable followed by a sustained high pitch level ($H^* !H\%$); (ii) the low pitch variant (or insistent call), with a high pitch in the nuclear syllable, followed by a fall until the end of the contour ($H^* L\%$).

Both the greeting and the insistent calls are produced, in the central-southern varieties and in the tasks included in experiments 1 and 2, with the same nuclear contours reported in previous studies for SEP and the other EP varieties (Cruz & Frota 2010a, b, 2011b; Frota in press; Frota et al. in press). Thus, a sustained pitch contour is observed in greeting calls (Figure 38), with a high pitch on the nuclear syllable and a downstepped high boundary tone ($!H\%$) aligned with the post-nuclear syllable.

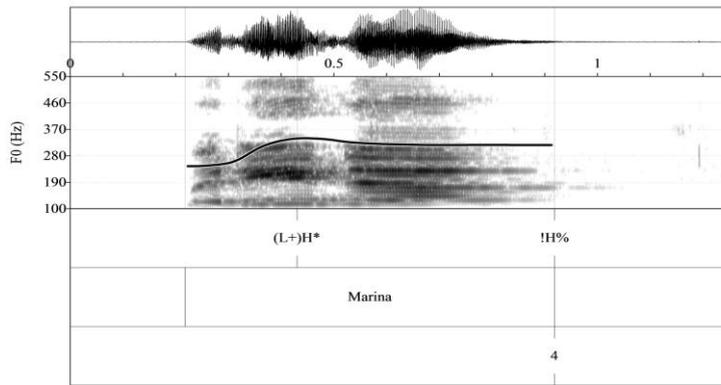


Figure 38 – Alg – Greeting call produced in the reading task. ‘Marina.’ (Marina.).

In insistent calls, the low pitch variant predominates, with a high pitch on the nuclear syllable, as in the sustained pitch variant, but a low boundary tone aligned with the post-nuclear syllable (L%), as illustrated in Figure 39. We adopted the (L+)H* label for the nuclear accent in vocatives from Frota (in press), as similarly to SEP, in the central-southern varieties the low seems to be an optional prefix to the nuclear peak, with no consequences for the pragmatic meaning of the contour.

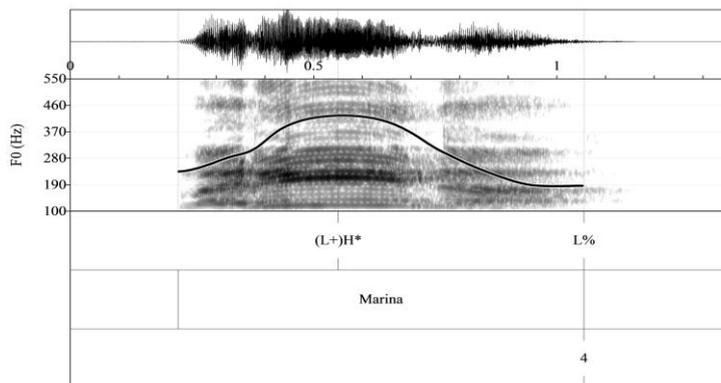


Figure 39 – Alg – Insistent call produced in the reading task. ‘Marina.’ (Marina.).

As in yes-no questions, calling contours also provide information about text-tune accommodation in EP. Indeed, as mentioned above, vowel lengthening and vowel split are frequent strategies used in this specific sentence type, either in greeting (Figure 40 – left panel) or insistent (Figure 40 – right panel) calls, and similarly to SEP and other EP varieties (Frota in press, Frota et al. in press).

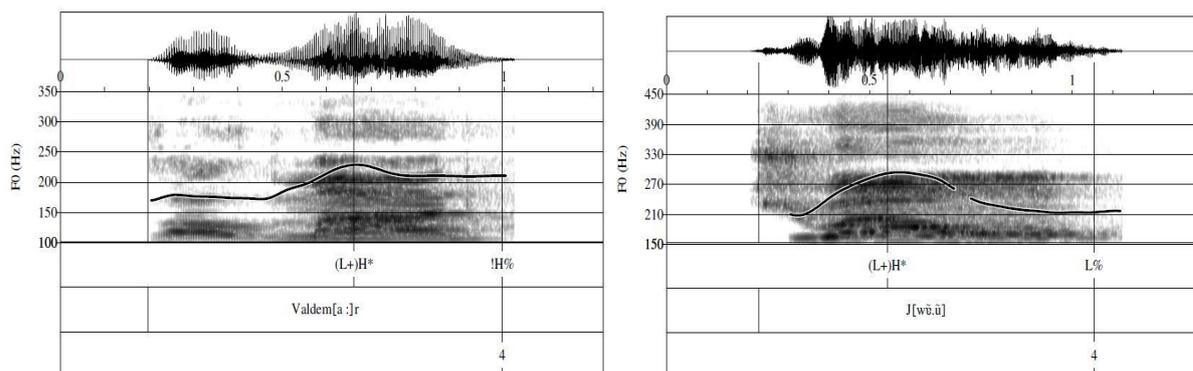


Figure 40 – Vocatives. Left panel: Alg. greeting call with vowel lengthening. ‘Valdemar.’ (Valdemar.). Right panel: Ale, insistent call with vowel split. ‘João.’. (João.). Both figures were extracted from Frota & Cruz (2012).

Interestingly, text-tune accommodation strategies occur across varieties and speech styles. In a previous analysis focusing on the three main strategies of text-tune accommodation in EP (Frota & Cruz 2012, Frota et al. in press), it was shown that vowel epenthesis, for instance, also occurs in yes-no questions produced in Oporto (Por – included in the Northern varieties, according to the dialectal classification on the basis of segmental phenomena – Cintra 1971, Segura & Saramago 2001) in the map task.

In the following tables, we illustrate the distribution of each type of text-tune accommodation strategy per sentence type, task and variety (Table 5) and their incidence in terms of percentage of occurrence (Table 6).

Sentence Type	Reading			DCT			Map task		
	SEP	Ale	Alg	SEP	Ale	Alg	SEP	Ale	Alg
Declarative	---	ep	ep				ep	ep	---
Interrogative	ep	ep/vs	---	ep	ep	---	---	ep	---
Request	ep	ep	---						
Vocative	vs/vl	ep/vs/vl	vs/vl						

Table 5 – Type of text-tune accommodation strategies per sentence type, across varieties and tasks. ‘ep’ stands for ‘epenthesis’; ‘vs’ stands for ‘vowel split’; ‘vl’ stands for ‘vowel lengthening’; ‘---’ stands for ‘do not occur’; blank cells mean that there are no relevant contexts.

Sentence Type	Reading			DCT			Map task		
	SEP	Ale	Alg	SEP	Ale	Alg	SEP	Ale	Alg
Declarative	---	22%	2%				13%	21%	---
Interrogative	17%	58%	---	50%	83%	---	---	100%	---
Request	8%	17%	---						
Vocative	58%	29%	58%						

Table 6 – Incidence of text-tune accommodation strategies (%) per sentence type, across varieties and tasks. ‘---’ stands for ‘do not occur’; blank cells mean that there are no relevant contexts.

As we can see in the tables above, declaratives may also trigger the occurrence of vowel epenthesis as a strategy of text-tune accommodation, both in reading task and map task. However, it is limited to a specific tune – the continuation rise. In the present study, we also observed that yes-no questions and calling contours are the sentence types that more frequently promote text-tune accommodation strategies, confirming previous studies (Frota 2000, 2002a, in press). In addition, these strategies were found to occur across speech styles and varieties, as shown in Table 5 and Table 6, with the following complex tunes: H+L* LH% and L*+H H% for yes-no questions; (L+)H* !H% and (L+)H* L% for vocatives.

4.3.2.2. Tonal marking of prosodic edges

The results presented in this section were partially described in previous studies (Cruz & Frota 2012c, Frota & Cruz 2012).

Besides the description of the main nuclear contours by sentence type, tonal marking of prosodic phrase edges is also a matter of interest for the account of the intonation of central-southern varieties. A given phrasal level (IP, ip or PhP) is usually marked as intonationally relevant by the presence of an initial and/or a final edge tone. Previous studies on SEP showed that only IPs are signalled by edge tones in this variety, unlike in languages such as English or Bengali (Frota 2000, in press). The analysis of the central-southern varieties provides evidence for another phrasal level that also requires tonal marking in European Portuguese.

We analyzed boundary tone types and their association with specific prosodic edges in data obtained in the three tasks considered (reading task, DCT and map task) and found a tonal edge-marking phenomenon specific to Ale. In Ale (not in Alg), the left edge of the last Phonological Phrase of an Intonational Phrase is signalled by a low edge tone. We propose labelling this edge tone as pL¹⁷, where ‘p’ stands for ‘phonological phrase’ and ‘L’ stands for the low tone associated to this edge. A detailed inspection of the distribution of pL allows us

¹⁷ Our label is different from the L- used in the Brazilian Portuguese variety spoken in São Paulo. We first decided to adopt a different label since pL and L- seem to have different phonotactic properties (L- marks the right edge of a focalized element). However, two main arguments can be evoked to legitimate a future adaptation of this label: first, the fact that pL has different distributional properties from L- cannot be synonymous of a different label; second, we are dealing with the same prosodic level (PhP), though with the opposite edge. For these reasons, we do not discard the possibility of using a mirrored intonational label (-L) to mark the left edge of the last Phonological Phrase of the Intonational Phrase in Ale. An additional issue to be considered here is the fact that L- is the traditional label for the boundary tone of the intermediate phrase.

to conclude that it is aligned with the left edge of the PhP that constitutes the head of either an internal IP or of a final IP (Figure 41).

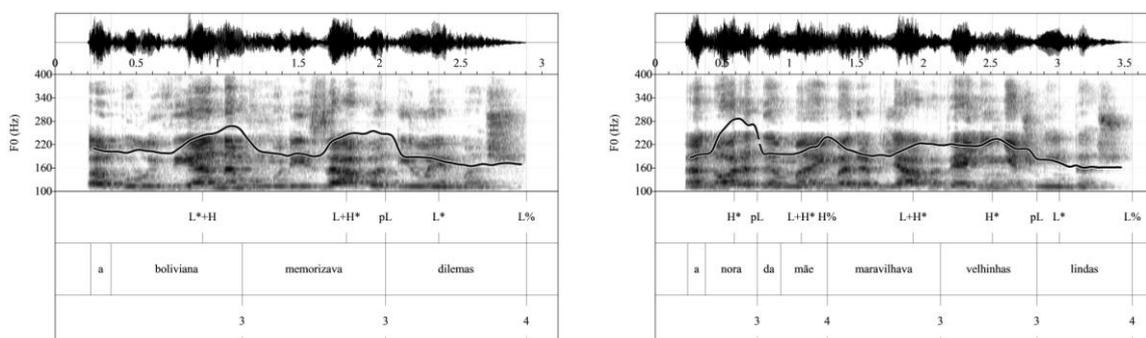


Figure 41 – Ale – Tonal edge marking in the reading task: left edge of the last Phonological Phrase of the Intonational Phrase. Left panel: ‘A boliviana memorizava dilemas’. (The bolivian girl memorized dilemmas.). Right panel: ‘A nora da mãe maravilhava velhinhas lindas.’ (Mother’s daughter-in-law marveled beautiful old ladies.).

The tonal edge marking of the last Phonological Phrase of the Intonational Phrase is not obligatory and its frequency of occurrence is variable across speakers.

Furthermore, this boundary tone occurs in different sentence types, and not only in declaratives. It also occurs in interrogatives, as shown in Figure 42. pL was also found across speech styles, as illustrated by the example from the DCT in Figure 43.

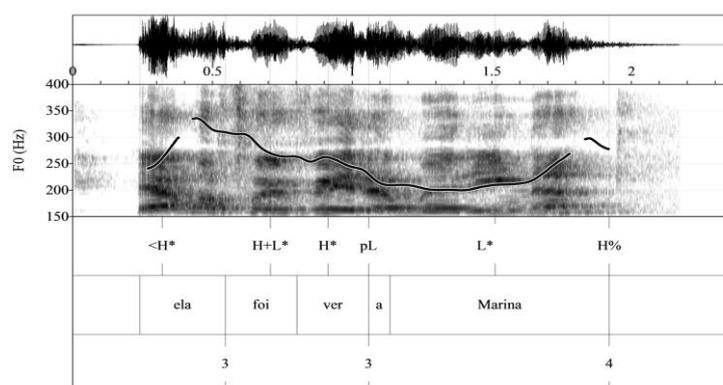


Figure 42 – Ale – Tonal edge marking across sentence types: neutral yes-no question produced in the reading task. ‘Ela foi ver a Marina?’ (Has she gone to see Marina?).

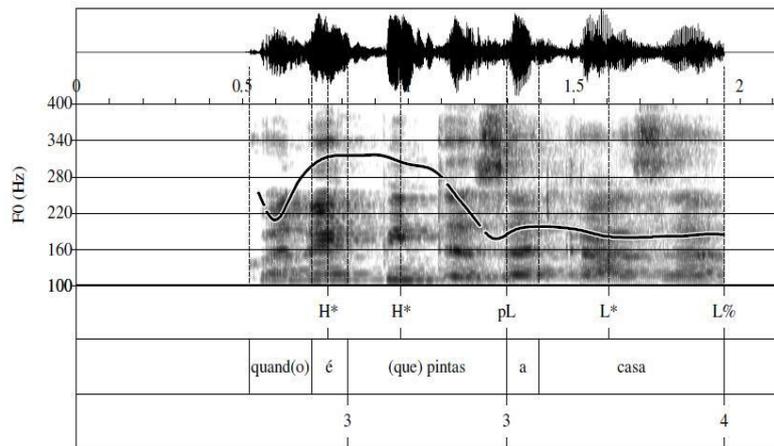


Figure 43 – Ale – Tonal edge marking across speech styles: wh-question produced in the DCT. ‘Quando é que pintas a casa?’ (When will you paint the home?).

This finding raises two interesting questions. First, these data supports the suggestion that prosodic edges and tonal boundary marking should be dissociated in prosodic labelling systems in order to account for prosodic variation within and across languages. In fact, in Portuguese, differently from English or Bengali, there is not a one-to-one mapping between a given prosodic edge and a given tonal boundary marking (with the exception of the right edge of the IP) and this should be captured by the prosodic labelling system, i.e., relevant/contrastive prosodic properties of each language/variety should be reflected in each labelling system. In the case of Ale, only a specific phrase-edge, the left edge of the PhP that heads the IP, gets a tonal boundary. Second, and as we have seen for phrasing patterns (section 3.4.2.), once again Ale and Alg, typically classified as belonging to the same broad variety on the basis of segmental phenomena, show different prosodic properties.

4.3.2.3. Prosodic focus and post-focal behavior in early focus cases

The results presented in this section were partially described in previous studies (Cruz & Frota 2011a, c, 2012a, Frota et al. in press).

According to Frota (1993, 2000, 2002a, in press) and Frota et al. (in press), prosodic focus in European Portuguese is expressed by means of prominence and intonation, but does not affect prosodic phrasing: (i) it is the head of the intonational phrase (IP), independently of its position (early or late) in the IP; (ii) it is intonationally expressed by a specific tonal event (H*+L in declaratives, L*+H in interrogatives, in the standard variety - SEP) and (iii) it triggers post-nuclear subordination of pitch accents (in declaratives, there is pitch range compression of the post-nuclear H+L*, as in Neapolitan and Bari varieties of Italian). Similar findings for SEP were also reported in Vigário (1998) and Fernandes (2007a, b).

Based on previous findings for SEP, as well as on the background described above in section 4.2, we examined the following aspects of the intonation of Ale and Alg: (i) the nuclear pitch accent of both neutral and focalized sentences; (ii) average pitch range of nuclear pitch accents per sentence type and variety, and (iii) post-focal behavior in early focus cases. We have analyzed two sentence types (declaratives and yes-no questions) produced in two different tasks (reading task and DCT) by speakers from three EP varieties (Ale, Alg and SEP).

Both in the reading task and in the DCT, declaratives with narrow focus are produced with the same nuclear contour across the three varieties (H^*+L), which differs from the nuclear contour of neutral declaratives ($H+L^*$ or L^* , also possible in Ale). This is shown by the examples in Figure 44, from Alg.

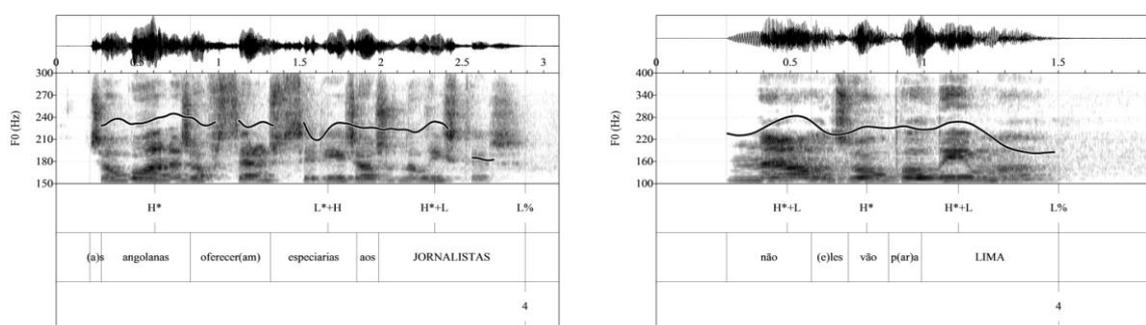


Figure 44 – Alg – Declarative with narrow focus across speech styles. Left panel: reading task. ‘As angolanas ofereceram especiarias aos JORNALISTAS.’ (The Angolan girls offered spices to the JOURNALISTS.). Right panel: DCT. ‘Não, eles vão para LIMA.’ (No, they go to LIMA.).

Thus, all varieties use the same strategy to produce focused declaratives: a specific pitch accent type, confirming the analysis proposed for SEP on the basis of reading data (Frota 2000, in press) and for SEP and other varieties of EP on the basis of DCT data (Frota et al. in press).

By contrast, for yes-no questions with narrow focus, we observed that each variety uses a different strategy to express focus. Namely, in SEP, there is a specific pitch accent type, both in the reading task and the DCT: a rising nuclear contour (L^*+H), followed by a falling boundary tone in late focus cases ($HL\%$) or a rising boundary tone in early focus cases ($LH\%$), as previously described (Frota 2002a, Frota in press, Frota et al. in press).

In Ale, different ways of expressing prosodic focus were found in the reading task and the DCT. In the reading task data, focalized yes-no questions are produced with a rising nuclear contour (L^*+H). The difference between late and early focus cases lies on the boundary tone: a falling boundary tone ($HL\%$) in late focus cases (Figure 45 – left panel) or a

rising boundary tone (LH%) in early focus cases (Figure 45 – right panel), just like in yes-no questions with narrow focus in SEP.

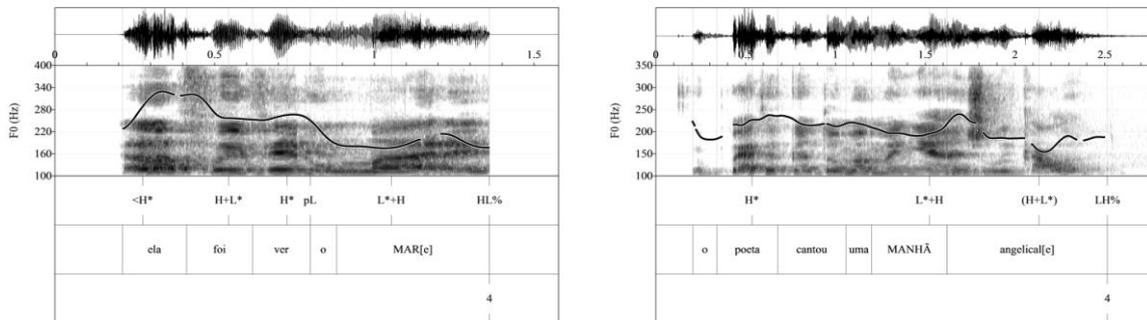


Figure 45 – Ale – Focalized yes-no question produced in the reading task. Left panel: late focus case. ‘Ela foi ver o MAR?’ (Has she gone to see the SEA?). Right panel: early focus case. ‘O poeta cantou uma MANHÃ angelical?’ (Did the poet sing an angelic MORNING?).

In the DCT, focalized yes-no questions in Ale are expressed by means of a different nuclear pitch accent (H+L*) and a falling boundary tone (HL%), as already noted in Frota et al. (in press). Thus, in this variety a difference across tasks was found.

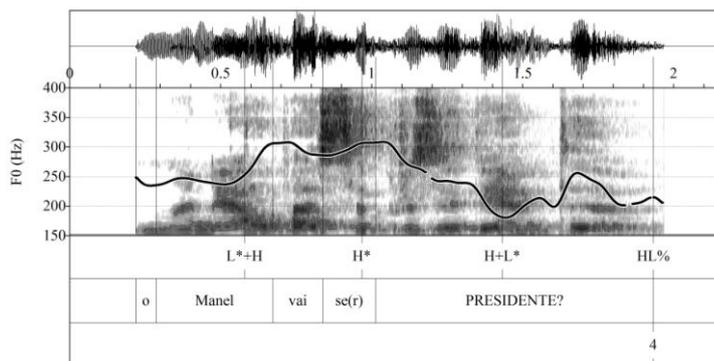


Figure 46 – Ale – Focalized yes-no question produced in DCT. ‘O Manel vai ser PRESIDENTE?’ (Manel is going to be PRESIDENT?).

In Alg, neutral and yes-no questions are produced with the same tune both in the reading task and the DCT: a rising nuclear pitch accent aligned with the stressed syllable (L*+H) followed by a high boundary tone (H%). Although further research is needed, these two pragmatic meanings seem to differ in the phonetic implementation of the tunes: focused yes-no questions have a larger pitch range, as shown in Table 7.

Reading Task				DCT			
Neutral	PR (Hz)	Focus	PR (Hz)	Neutral	PR (Hz)	Focus	PR (Hz)
L*+H H%	62.71	L*+H H%	83.04	L*+H H%	71.58	L*+H H%	136.28

Table 7 – Prosodic focus in the reading task (at the left) and in the DCT (at the right): nuclear configuration and its realization (pitch range – PR) in Alg.

The role of pitch range in establishing intonational contrasts has been documented in other languages, e.g., pitch range was shown to play a role in distinguishing between contrastive and non-contrastive declarative sentences in Italian, but not in Spanish or Catalan (Vanrell et al. 2013). In Alg, pitch range seems to play a role in differentiating broad and narrow focus in yes-no questions (but not in declaratives), which needs to be confirmed by perceptual experiments. Figure 47 illustrates the contrast between broad and narrow focus in yes-no questions in Alg.

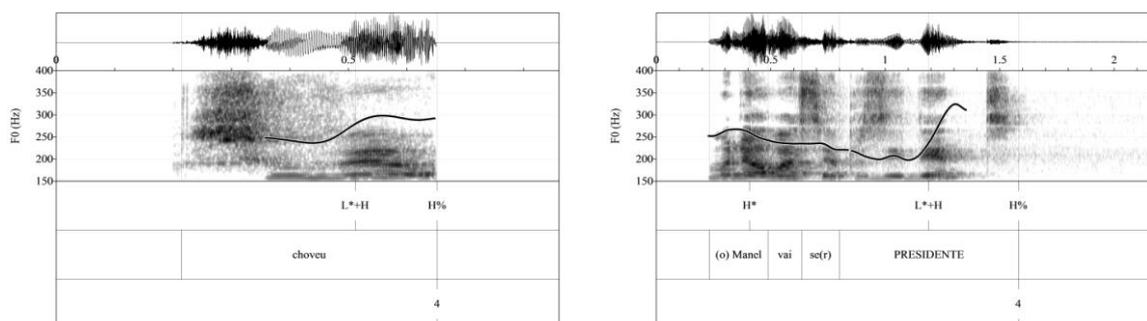


Figure 47 – Alg – Yes-no question produced in DCT. Left panel: broad focus. ‘Choveu?’ (Did it rain?). Right panel: narrow focus. ‘O Manel vai ser PRESIDENTE?’ (Manel is going to be PRESIDENT?).

Let us now consider the post-focal material in early focus cases. In declarative sentences produced in SEP, there is a post-focal event (H+L*) whose pitch range gets compressed even when the early nucleus is closer to the last stressed syllable, as reported previously (Frota 1993, 1997, 2000, in press). Recently, this post-focal pitch accent was also reported for early focus yes-no questions (Frota et al. in press). In Ale and in Alg, as in SEP, we also detected a post-nuclear falling contour (H+L*) with varying degrees of compressed pitch range, both in declaratives¹⁸ (Figure 48 – left panel) and yes-no questions (Figure 48 – right panel).

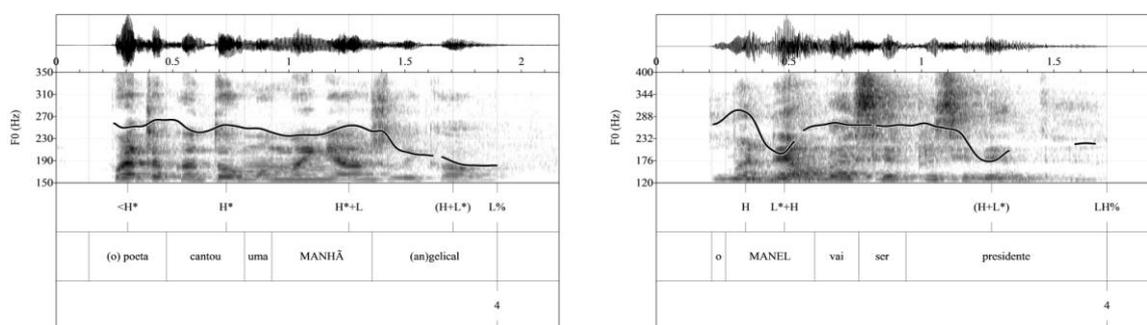


Figure 48 – Post-focus compression in early focus cases across varieties, sentence types, and speech styles. Left panel: focused declarative produced in Alg, in the reading task. ‘O poeta cantou uma MANHÃ angelical.’ (The poet sang an angelic MORNING.). Right panel: focused yes-no question produced in Ale, in the DCT. ‘O MANEL vai ser presidente?’ (MANEL is going to be president?).

¹⁸ The post-focal behavior cannot be observed in declaratives produced in the DCT, since this *corpus* does not include early focus cases.

In sum, there is a higher homogeneity across varieties with respect to the strategy used to convey focus in declaratives: a specific nuclear pitch accent that differs from the neutral counterpart in its tonal alignment (H^*+L vs. $H+L^*$). The same is not valid for focalized yes-no questions, produced with different intonational properties across varieties: (i) in SEP, both the nuclear pitch accent and boundary tone change; (ii) in Alg, there is a different phonetic implementation of the same tune, corresponding to a larger pitch range in narrow focus than in broad focus; (iii) in Ale, both the nuclear pitch accent and the boundary tone change, assuming different intonational configurations in each speech style – in the reading task, a rising nuclear contour is followed by a falling boundary tone (L^*+H HL% - late focus), similar to the contour found in focalized yes-no questions in SEP; in the DCT, a falling nuclear contour is followed by a falling boundary tone, yielding a contour specific to Ale ($H+L^*$ HL%).

Similarly to other languages and/or varieties (Chen, Wang & Xu 2009, D'Imperio 1997, Grice & Savino 1997), there is a post-nuclear pitch accent that shows a compressed pitch range, thus leading to the conclusion that in the central-southern varieties, as in SEP (Frota 1993, 2000, in press), there is a post-nuclear subordination of pitch accents.

4.3.2.4. Pitch accent distribution

As mentioned in section 4.2 above, SEP is characterized by a sparse pitch accent distribution (17-27%), which contrasts with NEP, where we find a high tonal density (74%) (Vigário & Frota 2003). These are global results for pitch accent distribution in each variety, i.e. this analysis was not performed per sentence type. In Frota et al. (in press), it is suggested that pitch accent distribution may vary across sentence types, and thus be an additional factor for the intonational characterization of sentence types.

Based on the assumption that varieties may show distinct tonal densities and that different sentence types may present different tonal densities, we have examined pitch accent distribution in the central-southern varieties. The first study conducted included the analysis of 204 read sentences per variety (102x2 speakers), corresponding to 57 declaratives (30 neutral and 27 with focus), 30 yes-no questions (15 neutral and 15 with focus) and 15

wh-questions per speaker¹⁹. The proportion of pitch accents per IP, excluding both initial peaks and nuclear pitch accents, was calculated per sentence type.

We observed that, similarly to NEP (Vigário & Frota 2003), both Ale and Alg present a high tonal density: in declarative sentences, 100% of IP-internal stressed syllables in Ale are pitch accented, meaning that every PW bears a pitch accent; in Alg, 87% of IP-internal stressed syllables of declarative sentences bear a pitch accent. A more detailed analysis of pitch accent distribution, considering different sentence types leads to the conclusion that declarative sentences have a higher tonal density than questions, which present a sparser pitch accent distribution (Table 8).

	Study 1	
	Ale	Alg
Sentence Type	%PA/PW	%PA/PW
Declarative	100%	87%
Yes-No Question	22%	3%
Wh-Question	33.50%	0%
Total (average)	54%	30%

Table 8 – Study 1: percentage (%) of pitch accents (PA) per Prosodic Words (PW), excluding both nuclear PA and initial peaks, per sentence type. Left panel – Ale. Right panel – Alg.

We have also observed that Alg presents a lower tonal density than Ale, and that pitch accent distribution in interrogatives produced in Alg are almost restricted to the minimum tune, since the percentage of IP-internal stressed syllables bearing a pitch accent is very reduced or non-existent.

Once again, as we have seen in other prosodic dimensions of variation (such as phrasing, and choice of tonal events), there are differences in pitch accent distribution within the central-southern varieties: Ale is closer to NEP and Alg seems to display mixed properties (as in phrasing choices – section 3.4.2), i.e. a high tonal density in declaratives, as in NEP, but a sparse pitch accent distribution in interrogatives, as in SEP.

In order to avoid internal variability in our data caused by a comparison of data produced by different speakers, a similar analysis was run on the same varieties, but now we have considered the sample of speakers analyzed for other prosodic aspects, as well as the same methodology followed in the analysis of prosodic phrasing and intonation. We aimed to compare tonal density not only across varieties and sentence types, but also across speech

¹⁹ For further details, see Cruz & Frota (2011b). Calling contours, requests and commands, also included in the *corpus*, are not mentioned here because these sentence types were not considered for the analysis of tonal density.

styles (reading task and DCT). The same measurements as in the first study were computed, i.e. we have calculated the proportion of PA per IP, excluding the nuclear PA and the initial pitch accent.

As we observe in Table 9 below, and similarly to the results obtained in the first study, in the reading task declaratives have a dense pitch accent distribution both in Ale and in Alg. Interrogatives have a lower tonal density than declaratives, and wh-questions in Alg have less pitch accents assigned to IP-internal PWs than yes-no questions. We may also conclude that Alg presents a lower tonal density than Ale. Thus, these general results obtained from the analysis of the reading task confirmed previous results from the first study.

Sentence Type	Reading Task	
	Ale	Alg
	%PA/PW	%PA/PW
Declarative	83%	67%
Yes-No Question	34%	9%
Wh-Question	34%	3%
Total (average)	50%	26%

Table 9 – Reading task: percentage (%) of pitch accents (PA) per Prosodic Words (PW), excluding both nuclear PA and initial peaks, per sentence type. Left panel – Ale. Right panel – Alg.

Although the DCT does not provide the best materials to examine pitch accent distribution²⁰, data obtained with the DCT was also considered for analysis. The results, summarized in Table 10 allow us to conclude that there is a high tonal density in both varieties (although not as dense as the one observed in the reading task). Once again, interrogatives tend to present a lower pitch accent distribution than declaratives.

Sentence Type	DCT	
	Ale	Alg
	%PA/PW	%PA/PW
Declarative	56%	46%
Yes-No Question	54%	50%
Wh-Question	25%	14%
Total (average)	49%	41%

Table 10 – Discourse Completion Test (DCT): percentage (%) of pitch accents (PA) per Prosodic Words (PW), excluding both nuclear PA and initial peaks, per sentence type. Left panel – Ale. Right panel – Alg. Data also reported in Frota et al. (in press).

²⁰ Unfortunately, the DCT materials were not designed for the analysis of pitch accent distribution. The majority of sentences elicited in this task are short utterances with few IP-internal PWs. Nevertheless, we decided to calculate the tonal density per sentence type, also on the basis of these materials.

In sum, the analysis of pitch accent distribution in Ale and Alg, across sentence types and speech styles, leads to four major conclusions. First, the two central-southern varieties are characterized by a higher tonal density than SEP. In this sense, Ale and Alg are closer to NEP (Vigário & Frota 2003), and to Oporto, the other Northern variety studied in Frota et al. (in press). Second, interrogatives present a lower tonal density than declaratives in both varieties, which suggests that there is a different pitch accent distribution per sentence type. Third, results obtained from both the reading task and the DCT show similar patterns, thus suggesting that there are no differences across speech styles. Finally, the comparison between the two central-southern varieties shows that Alg and Ale are not fully alike: Alg tends to present a lower tonal density than Ale, especially in interrogative sentences (wh-questions in particular). These results match with the already observed mixed prosodic nature of Alg in terms of phrasing choices (Chapter 3).

The relation between pitch accent distribution and phrasing was also considered. Based on previous work on SEP and NEP varieties, we examined two alternative views: (i) the approach that sees the two prosodic factors as interdependent (Vigário & Frota 2003, Frota & Vigário 2007); and (ii) the approach that sees them as independent dimensions of variation within a prosodic system (Hellmuth 2004, 2007). As shown in Table 11, a dense pitch accent distribution in NEP co-occurs with a preference for the (S)(VO) phrasing pattern, whereas in SEP a sparse pitch accent distribution is associated with the predominance of (SVO). The sparse distribution of pitch accents in SEP is illustrated in Figure 49.

Variety	Dominant phrasing pattern	Tonal density
NEP	(S)(VO)	74%
SEP	(SVO)	17-27%

Table 11 - Intonational phrasing and tonal density in NEP and SEP (from Vigário & Frota 2003, Frota & Vigário 2007).

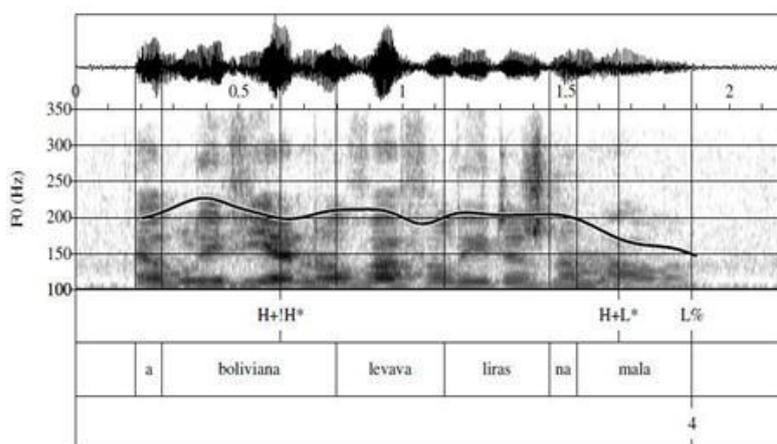


Figure 49 - SEP – Sparse pitch accent distribution and (SVO) phrasing. ‘A boliviana levava liras na mala.’ (The Bolivian girl took liras in her purse.)

We examined whether the suggested correlation spreads or not to other varieties of EP. Based on the dominant phrasing patterns in Ale and Alg, discussed in the present research (Chapter 3, section 3.4.2.2), and assuming the hypothesis that the two prosodic factors are inter-related, the following results would be expected: (i) a dense pitch accent distribution in Ale, since this variety is characterized by a preference for the (S)(VO) phrasing pattern (similarly to NEP); and (ii) a sparse pitch accent distribution in Alg, given the predominance of the (SVO) phrasing pattern (similarly to SEP).

The results obtained are given in Table 12. The analysis of tonal density in the central-southern varieties shows that both Ale and Alg, similarly to NEP but in contrast with SEP, are characterized by a dense pitch accent distribution: 100% of IP-internal stressed syllables bear a pitch accent in Ale, and 87% of IP-internal stressed syllables are pitch accented in Alg. Consequently, phrasing pattern and tonal density seem to be correlated in Ale (Figure 50), as suggested for NEP and SEP, but not in Alg (Figure 51).

Variety	Dominant phrasing pattern	Tonal density
Ale	(S)(VO)	83%
Alg	(SVO)	67%

Table 12 - Intonational phrasing and tonal density in Ale and Alg. Data on tonal density refers to the reading task.

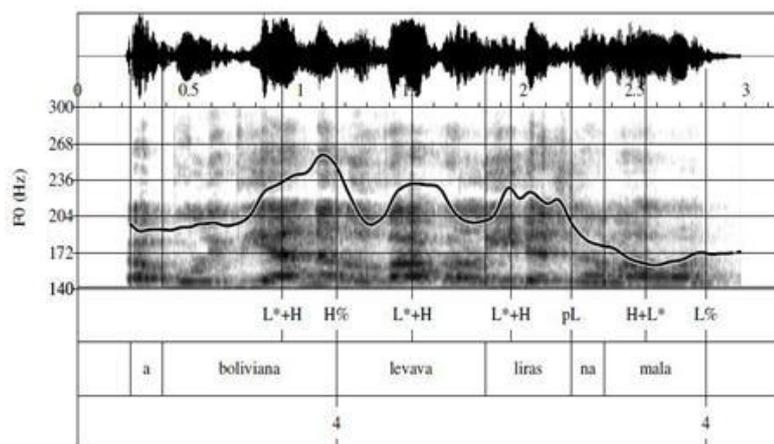


Figure 50 - Ale – Dense pitch accent distribution and (S)(VO) phrasing. ‘A boliviana levava liras na mala.’ (The Bolivian girl took liras in her purse.)

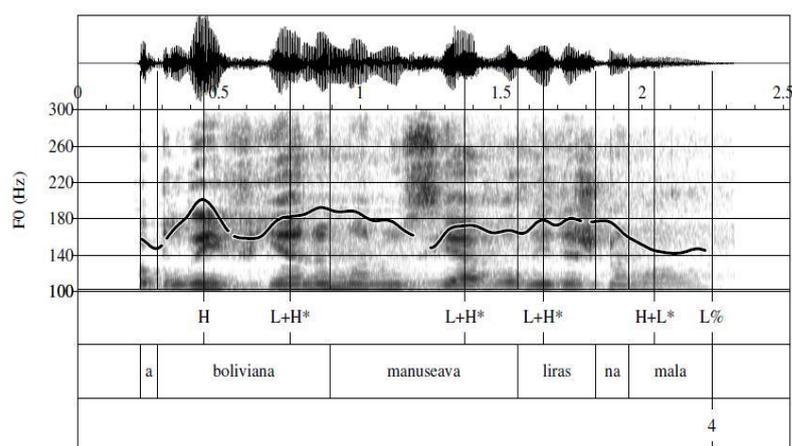


Figure 51 - Alg – Dense pitch accent distribution, but (SVO) phrasing. ‘A boliviana manuseava liras na mala.’
(The Bolivian girl handled liras in her purse.)

In sum, in Alg, and similarly to Cairene Arabic (Hellmuth 2004, 2007), there is a predominance of (SVO) together with a dense pitch accent distribution, which shows that the suggested interdependence between these two prosodic factors does not spread across all varieties of EP and is therefore not a general property of the prosodic system of the language.

4.4. Conclusions and final discussion

Our findings on nuclear contours, prosodic focus and pitch accent distribution in the central-southern varieties of EP point to some general conclusions.

Considering the main nuclear contours in neutral sentences, we have observed that there are no differences across speech styles. Both in the reading task and in the DCT, declaratives are produced with a falling nuclear contour (H+L*) followed by a low boundary tone (L%), as in SEP. In Ale, as in NEP, the tune L* L% is also possible in declaratives. The analysis of the difference between neutral yes-no questions and declaratives across varieties shows that this difference does not always lie on the same intonational units of the tune: (i) in SEP, it lies on the boundary tone type (L% in declaratives; LH% in yes-no questions), and the nuclear pitch accent is the same (H+L*); (ii) in Ale, similarly to SEP, it also lies on the boundary tone type (L% in declaratives; H% in yes-no questions), and the nuclear pitch accent is the same (L*); (iii) in Alg, all the nuclear configuration changes (H+L* L% in declaratives; L*+H H% in yes-no questions). This suggests that varieties of the same language may use different intonational strategies to produce the same sentence types. Similarly to declaratives, but differently from yes-no questions, wh-questions, requests, commands and calling contours were found to be produced with the same nuclear contour across the varieties under analysis. Table 13 presents a summary of the nuclear contours across sentence types and speech styles

for the two central-southern varieties. As can be seen, only yes-no questions display different nuclear contours. First, we observed that neutral yes-no questions present a different nuclear pitch accent within central-southern varieties, independently of the task performed (in gray): a low pitch in Ale, and a rising nuclear pitch accent in Alg. Finally, focused yes-no questions in Ale display a different nuclear pitch accent depending on the task involved (in bold): a rising nuclear pitch accent in the reading task, and a falling nuclear pitch accent in the DCT.

Sentence Type	Reading Task		DCT	
	Ale	Alg	Ale	Alg
Neutral declarative	(H+)L* L%	H+L* L%	(H+)L* L%	H+L* L%
Focused declarative	H*+L L%	H*+L L%	H*+L L%	H*+L L%
Neutral yes-no question	L* H%	L*+H H%	L* H%	L*+H H%
Focused yes-no question	L*+H HL% (LH%, early)	L*+H H%	H+L* HL%	L*+H H%
Wh-question	(H+)L* L%	H+L* L%	(H+)L* L%	H+L* L%
Request	L* L%	L* L%	L* L%	L* L%
Command	H*+L L% (H*+L/L*+H, early)	H*+L L% (H*+L/L*+H, early)	H*+L L%	H*+L L%
Greeting call	(L+)H* !H%	(L+)H* !H%	(L+)H* !H%	(L+)H* !H%
Insistent call	(L+)H* L%	(L+)H* L%	(L+)H* L%	(L+)H* L%

Table 13 – Nuclear contours across sentence types and speech styles, in Ale and Alg.

Prosodic focus, as in SEP (Frota 2000, 2002a, in press), is conveyed by the same specific pitch accent in declarative utterances in Ale and Alg (H*+L). By contrast, in yes-no questions two different strategies are used within the central-southern varieties: (i) a different boundary tone type in Ale – HL% in late focus cases; LH% in early focus cases (the nuclear pitch accent of neutral yes-no questions is the monotonal L*, whereas focused yes-no questions are characterized by the bitonal nuclear pitch accent L*+H); (ii) a higher pitch range in Alg (the nuclear pitch accent is the same – L*+H). Interestingly, while for SEP L*+H is a focus marker, for Alg, it is the nuclear pitch accent in both neutral and focused yes-no questions. Also important is that focus in declaratives is conveyed by a specific pitch accent type across all the varieties under analysis. In focused yes-no questions, this homogeneity is not observed.

In early focus cases, as in SEP (Frota 2000, in press), we have observed that post-focal material in both declaratives and yes-no questions produced in Ale and Alg shows a falling

accent with a compressed range (H+L*). This suggests that post-focal subordination is a general characteristic of Portuguese (it was also observed in several Brazilian varieties – Frota et al. in press). Similarly, the analysis of calling contours and yes-no questions also shows that, as in SEP (Frota 2002a, in press), both in Ale and Alg the segmental string is extended to cope with the tonal realization. Thus, differently from truncation (Hungarian or Palermo Italian) or compression (English) languages (Ladd 1996/2008, Grice 1995, Grice et al. 2000), European Portuguese presents text-tune accommodation strategies.

Beyond these generalizations, the analysis of tonal edge-marking of prosodic phrases shows that there are some specificities within Portuguese. As in SEP, in Ale and in Alg not every phrase edge gets a boundary tone (except in the case of the right edge of the IP). However, differently from SEP, where only IPs get an edge tone, the analysis of the central-southern varieties provides evidence for another phrasal level that may show tonal marking – the Phonological Phrase. A particular trait of Ale (not of Alg) is the presence of a low edge tone signalling the left edge of the last Phonological Phrase of the IP. This first suggests that PhP (or to be more specific, the rightmost PhP within a given IP) is a relevant domain for tonal edge marking in Ale, which contrasts with SEP and Alg. Secondly, the fact that this is specific from Ale leads to the conclusion that there are prosodic differences within central-southern varieties also with respect to features governing the prosodic distribution of tonal events.

Results on tonal density show that both Ale and Alg present a higher tonal density than SEP (but lower than NEP) and that declaratives present more pitch accents per IP-internal PWs than interrogatives. The relation between pitch accent distribution and intonational phrasing reveals that the hypothetical correlation between these prosodic factors observed in SEP and NEP (Vigário & Frota 2003, Frota & Vigário 2007) is not a general property of the prosodic grammar of Portuguese: in Ale, as in NEP, there are more phrases, as the dominant phrasing pattern is (S)(VO), and a dense pitch accent distribution; in Alg, however, the dominant phrasing pattern is similar to the one of SEP (SVO), but differently from SEP, Alg presents a dense pitch accent distribution, as observed in Ale.

In sum, and along the lines of Ladd (1996/2008), varieties of a given language also may differ intonationally in the four dimensions: (i) semantic (L*+H is a focus marker of yes-no questions produced in SEP, but this is also the nuclear pitch accent of neutral yes-no questions produced in the central-southern varieties); (ii) systemic (a specific phrasal level in Ale, but not in Alg, may show tonal marking); (iii) realisational (in Alg, the same tune is used in neutral and focused yes-no questions – L*+H; however, the analysis of pitch range leads to the conclusion that the pitch range is larger in focus cases); and (iv) phonotactic (in SEP, only

the IP edge is signalled with a boundary tone; in Ale the left edge of the rightmost PhP within the IP is signalled with a low boundary). The last two examples also show that even within the same regional variety, defined on the basis of segmental phenomena, there is variation. This is because we are considering here that Ale and Alg belong to the same variety – Interior Centre and South – according to the classification proposed on the basis of the analysis of segmental variation (Cintra 1971, Segura & Saramago 2001). The results obtained in the present research thus provide evidence for a mismatch between the classification of varieties on the basis of segmental and suprasegmental variation.

Besides the differences across varieties, similarities are also important. We have observed that (i) nuclear contours do not differ across speech styles (with the exception of focused yes-no questions), (ii) each sentence type analyzed is produced with the same (or a similar) nuclear contour across varieties (with the exception of yes-no questions), (iii) focus is conveyed by a specific pitch accent type, which is the same across varieties, (iv) a post-focal pitch accent (H+L*) occurs in declaratives and yes-no questions of all varieties, thus providing evidence for post-focal subordination, (v) text-tune accommodation strategies are used across all varieties (epenthesis, vowel split and vowel lengthening), which confirms that Portuguese is not a truncation nor a compression language, (vi) only the IP edge requires a tonal boundary marking, (vii) pitch accent distribution is not correlated with intonational phrasing choices. In sum, these similarities correspond to general properties, and thus, to the main traits of the prosodic grammar of Portuguese.

5. Rhythm

The most recent research on rhythm focuses on the relevance of considering new approaches to speech rhythm in order to provide further and clearer knowledge on how and whether languages differ rhythmically (Turk & Shattuck-Hufnagel 2013). This is particularly important (or even imperative) when rhythm measures are used for instance as a tool of diagnosis of disordered speech, which requires that specific metrics are proven to be indicators of a given disorder. This goal was not attained yet, but recent research on rhythm typology is aware that rhythm metrics might be more useful than simply to characterize a language.

In the following sections, we provide a snapshot of the research on speech rhythm over the past years. Section 5.1 is devoted to the traditional debate on the rhythmic organization of languages – in classes or along a continuum. The use of different measures according to different proposals in order to identify reliable correlates of rhythm is explored in section 5.2. Then, an overview of rhythmic properties of European and Brazilian Portuguese is presented (section 5.3), followed by the inspection of rhythm in the central-southern varieties of EP (section 5.4). This analysis comprises data obtained from production (section 5.4.1) and perception experiments (section 5.4.2). Finally, in section 5.5, we discuss the main results found and the respective theoretical implications, and we draw some preliminary conclusions about rhythm across central-southern varieties.

5.1. Rhythmic organization of languages: classes or continuum?

According to a traditional perspective of the rhythmic organization of speech (Lloyd James 1940, Pike 1945, Abercrombie 1967, Ladefoged 1975, *inter alia*), languages fall into one of three classes, depending on the level of isochrony (i.e. similar durations) observed: (i) syllable-timed (isochrony between syllables), (ii) stress-timed (isochrony between interstress intervals), and (iii) mora-timed (isochrony at the level of the mora). Several phonetic and acoustic studies were then developed in order to provide evidence for each type of isochrony. However, it was not present in the signal. Dauer (1983), for instance, has analyzed the duration of interstress intervals of three syllable-timed languages (Spanish, Greek, and Italian) and compared it with English, a stress-timed language. The author concludes that there are no differences across languages. Although the isochronous organization of speech failed to be empirically shown, the difference between rhythmic properties of languages was unquestionable.

Thereafter, a new approach emerged, that considers rhythmic distinctions among languages as a consequence of different phonological and phonetic properties, such as syllable

structure, vowel reduction and correlates of stress (Dasher & Bolinger 1982, Dauer 1983). According to this new perspective, syllable-timed languages present a lower variety of syllable types than stress-timed languages and do not display vowel reduction (that is why syllables are more similar to each other in duration, giving the illusion²¹ of isochrony). Instead, syllable-timed languages are known for their phonological processes that tend to simplify syllabic structure, such as epenthesis. With this new approach, a new debate emerged: whereas some languages are classified by consensus (English and Dutch as stress-timed, Spanish and Italian as syllable-timed, Japanese and Tamil as mora-timed), others have been considered mixed or intermediate languages (Catalan, Brazilian Portuguese, Polish) (Dauer 1987, Nespors 1990). Consequently, the discussion of the organization of languages in rhythmic classes or along a rhythmic continuum was initiated (and is still current). In fact, the hypothetical organization of languages along a rhythmic continuum does not provide an explanation for the results obtained in several perception studies. Indeed, perceptual experiments run both with adults (Ramus & Mehler 1999; Ramus, Dupoux & Mehler 2003) and newborns (Mehler et al. 1996; Nazzi, Bertoncini & Mehler 1998) confirm the discrimination between languages belonging to different rhythmic classes, but not between those of the same class, and give evidence for the encoding of rhythmic differences in the speech signal (sentences are low-pass filtered, i.e. segmental information is reduced, but prosodic information is preserved). This would lead us to the logical prediction that listeners would not be able to distinguish between varieties of the same language. However, Ghazali, Hamdi & Barkat (2002) show that although Arabic dialects are consistently described as stress-timed, unexpectedly, since it seems to contradict the results obtained by means of perceptual experiments run with both adults and newborns (Mehler et al. 1996; Nazzi, Bertoncini & Mehler 1998), listeners are able to distinguish speakers from North Africa from those of the Middle East. Complex syllables and reduced vowels in the Western dialects, as well as longer vowels in the Eastern dialects, seem to explain the perceived differences between these Arabic varieties (Ghazali, Hamdi & Barkat 2002). Thus, four main questions arise: which property in the signal is thus responsible for this observed discrimination between languages belonging to different rhythmic classes? Which ‘secondary’ (if we can consider it in this terms) property in the signal is allowing listeners to distinguish between varieties of the same language, although not strong enough to consider this variety as belonging to a different rhythmic class? Would it be possible to have the opposite picture, i.e.

²¹ We took this term from studies that refer to isochrony as an illusion or impression caused by different phonological properties of each language (e.g., Nespors, Shukla & Mehler 2011).

varieties of the same language belonging to different rhythmic classes? Would this situation lead to the classification of a given language as a mixed language?

Several studies have been developed in order to answer similar questions. However, beyond the inspection of cross-linguistic differences in rhythm and the perception of these differences, i.e. beyond the attempt to classify languages considering their rhythmic properties, other research has been conducted in order to provide important tools for other research areas: (i) speech therapy, by means of the rhythmic characterization of atypical speech (Liss et al. 2009, Goswami & Leong 2013); (ii) sociolinguistics, by means of the analysis of dialectal variation (Ghazali, Hamdi & Barkat 2002 for Arabic varieties, O'Rourke 2008 for Spanish varieties, Russo & Barry 2008 or Giordano & D'Ana 2010 for Italian varieties); (iii) music (PVI is used as a tool for the comparison of rhythm between speech and music and for the discrimination of musical rhythms across meters, genres and cultures – London & Jones 2011, Toussaint 2012); or even for other (iv) linguistic fields, such as L2 learning (by considering the possible transfer or use of rhythmic properties from an L1 to an L2 – Mok & Dellwo 2008, Kireva 2013, Robles-Puente 2013) or language acquisition and bootstrapping (if rhythm is correlated with phonological, morphological and syntactic properties of the language, and if newborns are sensitive to rhythm classes, then this sensitivity might be used to bootstrap other properties of the language being acquired – Grabe et al. 1999; Nespors, Shukla & Mehler 2011; Payne et al. 2012; Post, Schmidt & Payne 2013).

5.2. The correlates of rhythm: different proposals, different measures

Many speech signal properties have been measured in order to identify reliable acoustic characteristics for the rhythmic distinctions: (i) the proportion of vocalic intervals (%V) and the variability of vocalic (ΔV) and consonantal (ΔC) intervals within the sentence (Ramus, Nespors & Mehler 1999), (ii) the durational variability in successive vocalic and consonantal intervals, using *Pairwise Variability Indices* (PVI) (Grabe & Low 2002), (iii) the varcos (varcoV and varcoC), proposed in order to normalize the interaction between deltas and speech rate (Dellwo & Wagner 2003), and, more recently, (iv) the Control and Compensation Index (CCI), which measures the level of compression allowed in a language, i.e. how much the segments can be lengthened or shortened according to the context (Bertinetto & Bertini 2008).

According to Ramus, Nespors & Mehler (1999), %V, ΔV and ΔC reflect differences in syllable structure of languages. In this sense, stress-timed languages present a low %V and a higher ΔC than syllable-timed languages. For Grabe & Low (2002), and in contrast with Ramus, Nespors & Mehler's measures, PVIs capture the variability of successive pairs of

vocalic and consonantal intervals. The raw Pairwise Variability Index (rPVI) is not normalized for speech rate and is usually used for the consonantal intervals, while the normalized Pairwise Variability Index (nPVI) is used for the vocalic intervals since the authors argue that vocalic intervals are more prone to the influence of speech rate. In this sense, stress-timed languages present a higher nPVI than syllable-timed languages. Similar results are expected when applying Varcos as rhythmic measures, i.e. stress-timed languages show higher values of both VarcoC and VarcoV than syllable-timed languages. The Control and Compensation Index (CCI) is a modification of the rPVI, in the sense that the duration of each vocalic or consonantal interval is divided by the number of phonological segments included in it. Following this formula, Bertinetto & Bertini (2008) consider that ‘controlling languages’ allow for a low level of compression (and correspond to languages traditionally classified as syllable-timed languages), while ‘compensating languages’ allow for a high level of compression (and thus correspond to the traditionally called stress-timed languages).

Other measures have been proposed, based for instance on the measure of sonority (Galves et al. 2002), but this method is considered as being less precise (Nespor, Shukla & Mehler 2011).

Perceptual studies are considered as the strongest evidence in favour of rhythm classes, and timing (i.e. the relative variability of vocalic and consonantal interval durations) is seen as the greatest contributor for language discrimination. Metrics such as %V, ΔV , ΔC (Ramus, Nespor & Mehler 1999; Ramus, Dupoux & Mehler 2003) and Varco V together with %V (White & Mattys 2007, White et al. 2007) are predictive of listeners’ discrimination within and between languages. By contrast, the PVI, although shown as a better indicator of rhythmicity than ΔV and ΔC , leads to conclusions that go against perceptual evidence: e.g., Japanese is considered as more syllable-timed (Grabe & Low 2002). Recently, many studies have been developed with the major goal of comparing the results obtained with different rhythmic measures. Within these studies, and in an attempt to explain Grabe & Low’s (2002) results, Ramus (2002) calculates PVI scores for Ramus, Nespor & Mehler’s (1999) data and concludes that results are largely equivalent. Thus, the author argues that a controlled *corpus* is needed, which has failed in Grabe & Low’s (2002) analysis. Loukina et al. (2009), for instance, compare 15 different measures in 5 languages (Southern British English, Greek, Russian, French and Taiwanese Mandarin). They found that vocalic measurements are more successful in distinguishing languages of different rhythm properties than the consonantal measurements. The use of different *corpora* or speech styles is also under discussion in much work recently developed: Giordano & D’Anna (2010), for instance, compare three different speech styles (read speech, pre-planned speech – TV news –, and spontaneous speech –

task-oriented dialogues) and 15 regional varieties of Italian, by using %V, ΔV , ΔC and nPVI/rPVI metrics. The authors show that there is a wide-ranging variation of duration values in different speech styles and across the observed Italian varieties. It is also suggested that an interplay exists between the rhythmic structure and the intonational properties of the language, which cannot be captured by the rhythmic measures used. Arvaniti (2009, 2012a) and Arvaniti & Ross (2010) also compare ΔC , %V, PVI and Varcos in English, German, Greek, Italian, Korean and Spanish, considering three different elicitation methods (spontaneous speech, story reading and sentences reading). The authors show that rhythmic classifications are not consistent across metrics, that they are sensitive to different elicitation methods, and that inter-speaker variation is substantial. These results lead the authors to the suggestion that cross-linguistic differences captured by metrics are not robust. Furthermore, it has recently been pointed out that language discrimination is related with the interaction between other components of prosody. Prieto et al. (2012) examined three languages reported to belong to different rhythmic classes (English, Spanish and Catalan) and concluded that the rhythmic class distinctions found (English *versus* Spanish/Catalan) correlate with differences in the way these languages instantiate the durational marking of prosodic heads and pre-final lengthening at prosodic boundaries. Other prosodic cues such as F0 or speech rate are pointed out as being important cues to discriminate languages, which has not been detected earlier because they were eliminated from the signal or manipulated (Arvaniti 2012b; White, Mattys & Wiget 2012). For the authors, discrimination is not based on differences between rhythm classes. Dellwo (2010) also concludes that speech rate does have an effect on the acoustic correlates of speech rhythm.

5.3. Rhythmic properties of Portuguese: EP *versus* BP

Little is known about rhythmic properties of Portuguese: Frota & Vigário's (2000, 2001) work is the pioneer in the identification of rhythmic properties and their physical correlates. In Brazilian Portuguese, the earlier analysis of rhythm has been inconclusive, since the phonetic inspection of the duration of interstress intervals has not revealed whether BP is stress- or syllable-timed (Major 1981, Massini-Cagliari 1992). Moraes & Leite (1992) concluded that BP presents a mixed rhythm, although intra- and inter-speaker variability has been observed in the data.

More recently, Frota & Vigário (2000, 2001) have also analyzed rhythm in Brazilian Portuguese (BP) and in Standard European Portuguese (SEP), on the basis of Ramus, Nespor & Mehler's methodology and have explored the relation between these measures and the phonological properties of each Portuguese variety. Additionally to %V and ΔC , the authors

suggest two normalized measures for the interaction between durational variability and speech rate – $\Delta\%V$ and $\Delta\%C$ – and conclude that $\%V$ and $\Delta\%C$ support the rhythmic distinction between SEP and BP. A cross-comparison analysis between SEP and BP and the eight languages considered by Ramus, Nespors & Mehler (1999) shows that SEP clusters with stress-timed languages in the ΔC dimension and with syllable-timed languages in the $\%V$ dimension, while BP is closer to syllable-timed languages in the ΔC dimension and to mora-timed languages in the $\%V$ dimension, thus presenting both a mixed (not intermediate) rhythm, which gives support to the rhythm classes approach.

These results are clearly related to vowel reduction in SEP (and the consequent increase of consonantal sequences of variable duration) and vowel epenthesis in BP (thus breaking consonant clusters and promoting CV sequences). Frota, Vigário & Martins (2002a, b) applied perceptual experiments in order to confirm the results obtained from production data (Frota & Vigário 2001). The results showed that EP and BP are distinguished only when the F_0 contour is preserved, which confirms that durational properties *per se* are not enough to discriminate between languages/varieties, even when they are acoustically different (as observed by Frota, Vigário & Martins 2002a, b). However, it still remains to examine whether the sensitivity to intonation is a general property or a specific property of the European Portuguese native speakers' phonological system. Also still unexplored is the rhythmic characterization of varieties of European Portuguese, which is one of our goals.

5.4. Rhythm across European Portuguese varieties: the central-southern varieties

5.4.1. Production

The present research aims to explore the rhythmic properties of the central-southern varieties under analysis in EP. Our main goals are: (i) to observe whether the rhythmic measures that Frota & Vigário (2001) considered relevant to distinguish SEP and BP contribute for the characterization of the southern varieties, previously shown to be different from SEP in terms of intonational contours, phrasing patterns and pitch accent distribution (Cruz & Frota 2010a, b, 2011b, 2012b, 2013a, 2013b; Frota et al. in press; see also Chapters 3 and 4); (ii) to observe whether the use of different *corpora* across varieties leads to different rhythmic properties from the use of a common *corpus*; (iii) to observe whether the use of

different acoustic measures (Varcos are also calculated²²) leads to different results from the ones obtained by means of Ramus, Nespó & Mehler's (1999) metrics; (iv) to add to the debate on the organization of languages/varieties into rhythmic classes or along a rhythm continuum. Additionally, we aim to complement the analysis of production with perceptual experiments. Besides the goal of testing the discrimination between varieties, based on low-pass filtered sentences, we also want to test whether F0 helps listeners in the discrimination task and whether this cue is equally used by listeners from different varieties (section 5.4.2). In order to provide our contribution to the first analysis of rhythm across EP varieties, we have set up two experiments. The methodology applied in each experiment is described below.

Experiment 1 – Global comparison

The *corpus* of Ramus, Nespó & Mehler (1999), adapted by Frota & Vigário (2001) to Portuguese, was used in the present research: 54 sentences with different lengths in number of syllables (from 15 to 21 syllables, 8 sentences per length condition) were read twice, in random order, by 3 speakers per variety, aged between 20-45 years of age. Both renditions of one speaker per variety, whenever naturally produced, were considered in this preliminary analysis. A total of 216 sentences (54x2x2) were analyzed in Praat textgrids (Boersma & Weenink 2007), where vocalic and consonantal intervals were delimited on the basis of both auditory and acoustic cues, following standard criteria of segmentation (Turk et al. 2006, Frota & Vigário 2001) – see Figure 52. Data were then automatically extracted with *Correlatore* 2.1 (Mairano 2009) and manually cross-checked. Results from Ale and Alg were then compared with the overall results obtained for SEP and BP (Frota & Vigário 2000, 2001), which comprises the analysis of three different *corpora*: (i) an EP *corpus* analyzed with the purpose of establishing the prosodic and intonational structure of the data (*MAVig corpus*, from Vigário 1998), (ii) a comparative EP/BP *corpus* developed within the Project Rhythmic Patterns, Parameter Setting, and Language Change (Fapesp, Brazil) (*20F corpus*), and (iii) a comparative EP/BP *corpus* corresponding to the translation of the multi-language *corpus* used in Ramus, Nespó & Mehler (1999) (*Rm corpus*).

²² Since PVI metrics were shown to provide contradictory information on rhythmic properties of languages between production and perception experiments, we decided to disregard them from the present analysis.

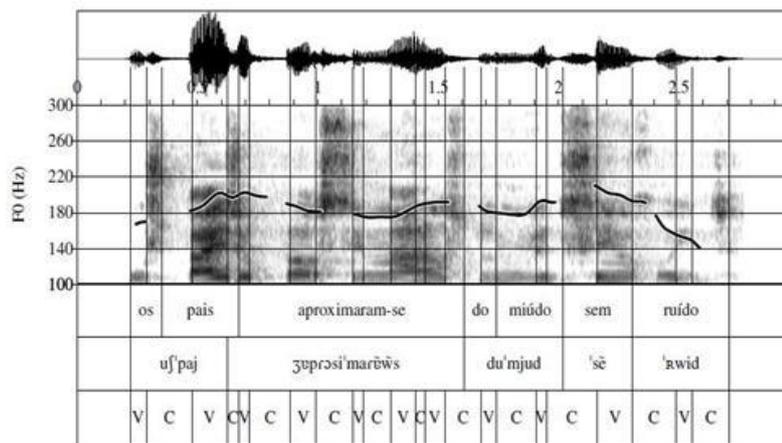


Figure 52 - Segmentation of vocalic and consonantal intervals, following the criteria from Turk et al. (2006) and Frota & Vigário (2001). ‘Os pais aproximaram-se do miúdo sem ruído’. (The parents approach the kid silently.).

Frota & Vigário (2000, 2001) show that %V and $\Delta\%C$ support the rhythmic distinction between SEP and BP. We thus decided to report the same metrics for Ale and Alg. However, ΔC is also useful if we want to establish a comparison between central-southern varieties of EP and the eight languages analyzed by Ramus, Nespór & Mehler (1999).

Our preliminary results, illustrated below in Table 14, show that both Ale and Alg present (i) higher scores of ΔC than SEP (64,2ms. in Ale and 73,9ms. in Alg, contra 54,6ms. in SEP), thus, clustering with stress-timed languages in this dimension, (ii) and even lower scores of %V than SEP (44% in Ale and 37,3% in Alg, contra 48% in SEP). The same conclusion can be extracted from the comparison between central-southern varieties and BP.

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

Table 14 - Three averaged acoustic measures across Portuguese varieties. Global results for SEP and BP from Frota & Vigário (2001). Gray color signals new data.

A more detailed inspection within central-southern varieties allows the observation that the %V dimension seems to distinguish between Ale and Alg, since Alg presents the lowest proportion of vocalic intervals (37% contra 44% in Ale) and the highest consonantal interval variability (73,9ms. contra 64,2ms. in Ale).

These results suggest that Ale is a mixed variety (as SEP), being syllable-timed in the %V dimension and stress-timed in the $\Delta\%C$ dimension, whereas Alg is a stress-timed variety in both dimensions.

However, these preliminary results are based on the acoustic analysis of data produced by only one speaker per variety. Furthermore, we are comparing different *corpora*. In order to avoid possible influences from these factors, we decided to conduct a second experiment by including data from more speakers per variety and by selecting exactly the same sentences used in the *Rm corpus* adapted for Portuguese by Frota & Vigário (2000, 2001). Additionally, we have considered other metrics (Varcos) in order to observe whether the use of different metrics have an impact on the results obtained, as reported for other languages by Arvaniti (2009, 2012a) and Arvaniti & Ross (2010).

Experiment 2 – Selective comparison

In this experiment, we used the same *corpus* as in Ramus, Nespors & Mehler (1999), adapted for Portuguese by Frota & Vigário (2000,2001). From this *corpus*, a selection was made, comprising sentences with 15 to 19 syllables (thus excluding sentences with 20 and 21 syllables long). Only one sentence per length condition was selected, thus, a total of 5 sentences were read twice, in random order, by 3 speakers per variety, aged between 20-45 years of age. A total of 60 sentences (5x2x3x2) were analyzed in *Praat* textgrids (Boersma & Weenink 2007), according to the annotation and segmentation criteria already mentioned in Experiment 1. The data obtained were then compared with the same selected data for SEP and BP (Frota & Vigário 2000, 2001) and with data for the eight languages analyzed by Ramus, Nespors & Mehler (1999).

As we have added two more speakers per variety, we decided to observe whether there is an effect of speaker in the data. In this sense, a MANOVA was run with *speaker* as a factor, with three levels for each variety (speaker 1, speaker 2, and speaker 3) and %V, ΔC and $\Delta\%C$ as dependent variables. A confidence interval of 99% was considered, thus results with a significance level below .01 ($p \leq .01$) are considered statistically significant. The analysis shows no effect of speaker either in Ale or Alg, similarly to SEP and BP (Frota & Vigário 2001) (Ale: for %V, $F(2,12)=1.12$, $p=.358$; for ΔC , $F(2,12)=0.78$, $p=.478$; for $\Delta\%C$, $F(2,12)=0.29$, $p=.750$. Alg: for %V, $F(2,12)=3.13$, $p=.081$; for ΔC , $F(2,12)=0.33$, $p=.727$; for $\Delta\%C$, $F(2,12)=1.17$, $p=.343$).

Our results from acoustic analysis, reported below in Table 15, show that both Ale and Alg present higher scores of ΔC than SEP (57,0ms. in Ale and 61,7ms. in Alg, contra 54,7ms. in SEP), thus, clustering with stress-timed languages in this dimension (as in Experiment 1).

However, differently from that observed in Experiment 1, Alg presents lower scores of %V than SEP (38,6% in Alg, contra 44,9% in SEP) and Ale presents higher scores than Alg and SEP (46,0% in Ale contra 38,6% in Alg and 44,9% in SEP). The same relation across varieties applies when considering the normalized measures $\Delta\%V$ and $\Delta\%C$.

	%V	$\Delta\%V$	ΔC	$\Delta\%C$
Alg	38,6	1,64	61,7	2,9
Ale	46,0	2,31	57,0	2,8
SEP	44,9	1,92	54,7	2,3
BP	53,2	2,30	55,7	1,7

Table 15 - Averaged acoustic measures across Portuguese varieties: same *corpus* across varieties. Selected results for SEP and BP from Frota & Vigário (2001). Gray color signals new data.

Nevertheless, as in Experiment 1 (Figure 53, left panel), the results from the acoustic analysis performed in Experiment 2 shows that Ale stays close to SEP in the %V dimension, thus being more syllable-timed, while %V in Alg points to stress-timing (Figure 53, right panel).

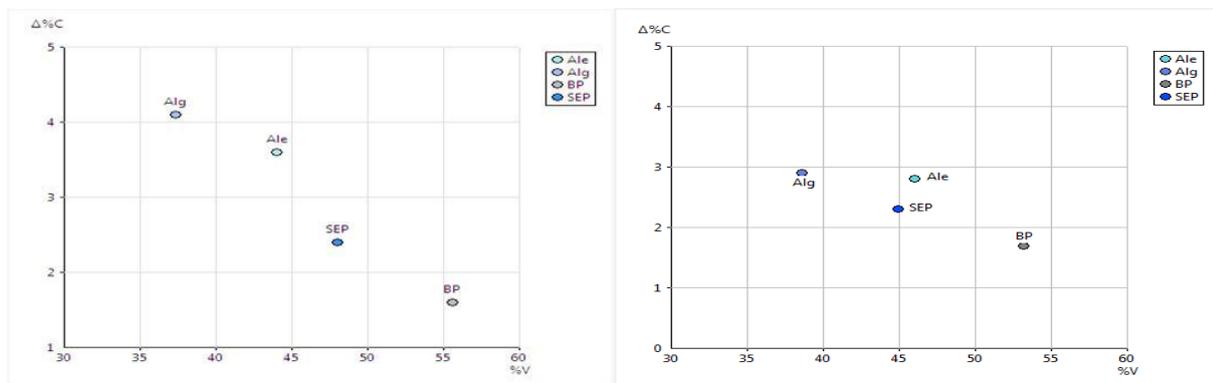


Figure 53 - $\Delta\%C$ vs. %V for Portuguese varieties. Data for SEP and BP from Frota & Vigário (2001). Left panel: whole adapted *corpus* for Portuguese (Experiment 1). Right panel: selected sentences for a cross-linguistic analysis (Experiment 2).

In sum, although we have selected a specific set of data for analysis in Experiment 2, we conclude that it does not have an impact on the overall results. This is confirmed by the MANOVAs run with *corpus* as a factor, with two levels for each variety (global, selected) and %V, ΔC and $\Delta\%C$ as dependent variables. A confidence interval of 99% was considered, thus results with a significance level below .01 ($p \leq .01$) are considered statistically significant. The analysis shows no effect of *corpus* either in Ale or Alg (Ale: for %V, $F(1,2)=0.33$,

$p=.626$; for ΔC , $F(1,2)=1.73$, $p=.319$; for $\Delta\%C$, $F(1,2)=4.44$, $p=.170$. Alg: for $\%V$, $F(1,2)=0.52$, $p=.840$; for ΔC , $F(1,2)=10.87$, $p=.081$; for $\Delta\%C$, $F(1,2)=5.62$, $p=.141$).

We thus may conclude that the rhythmic properties of each variety remain the same as in Experiment 1. Indeed, both Experiments show that the $\Delta\%C$ dimension allows us to classify Ale and Alg as stress-timed varieties and the $\%V$ dimension allows us to distinguish within central-southern varieties – stress-timing in Alg, but syllable-timing in Ale, as in SEP. Thus, Ale seems to display a mixed rhythm, similarly to SEP, while Alg is clearly stress-timed.

When we compare both panels of Figure 53, we also conclude that the organization of Portuguese varieties in rhythmic classes is clearer in the right panel (Experiment 2), i. e. when the same basic *corpus* is used across varieties.

The acoustic analysis on the basis of Varcos measures shows that SEP presents higher scores than Ale and Alg, thus showing a higher variability of the duration of both vocalic and consonantal intervals than Ale and Alg, as reported in Table 16.

	Varco V	Varco C
Alg	39,3	45,0
Ale	40,8	45,8
SEP	52,0	47,3

Table 16 - Averaged acoustic measures across European Portuguese varieties: same *corpus*.

These two central-southern varieties seem not to be rhythmically distinguished when we consider Varcos, which contrasts with the distinction between Ale and Alg when Ramus, Nespor & Mehler's metrics are considered (see ΔC column in Table 15). Thus, Ramus, Nespor & Mehler's metrics and Varcos metrics provide a different insight into the data. Furthermore, according to the Varcos, SEP presents a higher consonantal interval variability than the central-southern varieties. However, according to Ramus, Nespor & Mehler's metrics, the two central-southern varieties present a higher consonantal interval variability than SEP. These different interpretations following the two types of metrics are schematized in (1) *versus* (2), below.

(1) Ramus, Nespor & Mehler's metrics

Ale > $\%V$, $\Delta\%V$ than SEP

Alg < $\%V$, $\Delta\%V$ than SEP

Ale/Alg > ΔC than SEP

(2) Varcos metrics

Ale/Alg < Varco V than SEP

Ale/Alg < Varco C than SEP

Statistical analysis of both types of acoustic measures shows that neither of them allows distinguishing across EP varieties. Similarly to the analysis of Frota & Vigário (2001), a MANOVA was run with *variety* as a factor, with three levels (SEP, Ale, and Alg), and %V, $\Delta\%V$, $\Delta\%C$, Varco V, and Varco C as dependent variables. A confidence interval of 99% was considered, thus results with a significance level below .01 ($p \leq .01$) are considered statistically significant. Differently from the results obtained for EP *versus* BP, in which %V and $\Delta\%C$ were shown to distinguish between the two Portuguese varieties, our analysis shows no effect of EP varieties for each of the acoustic measures observed, i.e. there are no significant differences across these three EP varieties (%V: $F(2,12)=2.26$, $p=.147$; $\Delta\%V$: $F(2,12)=0.42$, $p=.671$; $\Delta\%C$: $F(2,12)=0.70$, $p=.516$; Varco V: $F(2,12)=2.24$, $p=.149$; Varco C: $F(2,12)=0.65$, $p=.938$)

These statistical results lead us to the preliminary conclusion that Ale and Alg thus belong to the same rhythmic class as SEP, in contrast with our previous predictions formulated on the basis of the acoustic analysis based on the metrics of Ramus, Nespór & Mehler (1999). In order to disentangle these differences, the integration of Ale and Alg in the traditional rhythm classes was tested through an ANOVA for each of the acoustic parameters (%V, ΔC), with rhythm class as a factor with three levels: syllable-timed, stress-timed, and mora-timed. A confidence interval of 99% was considered, thus results with a significance level below .01 ($p \leq .01$) are considered statistically significant.

According to our preliminary conclusion that Ale and Alg belong to the same rhythm class as SEP, we decided to classify the two central-southern varieties as syllable-timed in the %V dimension. A significant effect was found for %V, which means that there are at least two rhythm classes that are significantly different (%V: $F(2,9)=23.16$, $p=.000$). However, post hoc tests (Scheffé) show that syllable-timed and stress-timed languages do not differ significantly (%V: $p=.237$ for syllable-timed vs. stress-timed, *contra* $p=.001$ for syllable-timed vs. mora-timed, and $p=.000$ for stress-timed vs. mora-timed). This means that at least one of the two central-southern varieties is not syllable-timed in the %V dimension, like SEP. On the basis of the acoustic analysis, following the measures of Ramus, Nespór & Mehler (1999), we have concluded that Ale presents a higher score of %V than SEP, whereas Alg presents a lower score of %V than SEP. Thus, in a second attempt to integrate

central-southern varieties in the traditional rhythm classes, and based on the acoustic results schematized in (1), we decided to classify Alg as stress-timed in the %V dimension. Since Ale presents a higher vocalic space than SEP, we have maintained its integration as a syllable-timed variety. Once again, we found a significant effect for %V (%V: $F(2,9)=75.65$, $p=.000$), but now post hoc tests (Scheffé) show that all rhythm classes differ significantly (%V: $p=.002$ for syllable-timed vs. stress-timed, $p=.000$ for syllable-timed vs. mora-timed, and $p=.000$ for stress-timed vs. mora-timed). In sum, we conclude that the **%V dimension** allows us to classify the EP varieties under analysis as follows: (i) SEP: syllable-timed, (ii) **Ale: syllable-timed**, (iii) **Alg: stress-timed**.

For the ΔC dimension, a similar path was followed. Thus, based on the preliminary conclusion that Ale and Alg do not differ significantly from SEP, and given the results obtained from the acoustic analysis (higher scores of consonantal interval variability in Ale and Alg than in SEP), summarized in (1), we have classified the central-southern varieties as stress-timed in the ΔC dimension. The ANOVA shows a significant effect of ΔC , which means that syllable-timed and stress-timed languages differ significantly (ΔC : $F(2,9)=25.18$, $p=.000$). We thus conclude that the ΔC dimension allows to classify the EP varieties under analysis as follows: (i) SEP: stress-timed, (ii) **Ale: stress-timed**, (iii) **Alg: stress-timed**.

To conclude, the comparison between Portuguese varieties and the eight languages analyzed by Ramus, Nespór & Mehler (1999) confirms the proposed rhythmic classification of Ale and Alg as well as the organization of Portuguese varieties in rhythm classes, and not along a continuum (Figure 54).

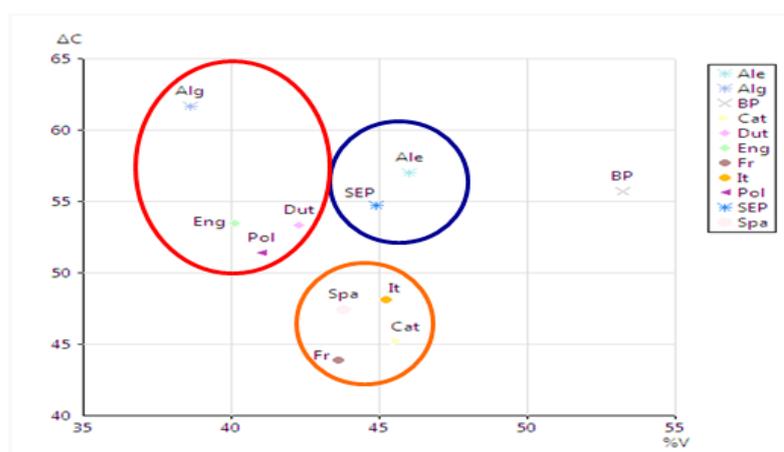


Figure 54 - ΔC vs. %V for Portuguese varieties (selected data), and the 8 languages from Ramus, Nespór & Mehler (1999). Data for SEP and BP were extracted from Frota & Vigário (2001). Circle in red is grouping stress-timed languages/varieties; circle in orange is grouping syllable-timed languages and circle in blue is grouping mixed EP varieties.

To summarize, the acoustic analysis performed in both Experiments allows the extraction of several important conclusions. First, and depending on the acoustic measures used (%V, ΔC , ΔV , $\Delta\%C$, $\Delta\%V$ or Varcos), Ale and Alg seem to present slightly different rhythmic properties, in line with previous studies showing that the use of different metrics do not provide consistent results (Arvaniti 2009, 2012a; Arvaniti & Ross 2010). Second, the use of different *corpora* does not affect the main results. Third, the fact that EP varieties *per se* are not considered statistically different does not mean that EP varieties are integrated in the same rhythm class. Indeed, the comparison with other languages revealed that EP varieties cannot be integrated in the same rhythm class. Thus, as suggested by Frota, Vigário & Martins (2002a, b), the contrast with a wider range of languages/varieties is needed in order to evaluate the distance between them. Finally, if EP varieties *per se* are not considered statistically different, we can hypothesize that Ale, Alg and SEP are not discriminated.

In order to test this hypothesis, we decided to run perceptual experiments. Another motivation for these perceptual experiments is the fact that, based on common sense, people are usually able to identify major speech differences between North, Centre and South.

5.4.2. Perception

Our perceptual experiments follow the methodological procedures of previous perceptual studies for Portuguese (Frota, Vigário & Martins 2002a, b).

According to Frota, Vigário & Martins (2002a, b), these discrimination experiments had two goals: (i) to test whether EP and BP are discriminated on the basis of prosodic information, and (ii) to investigate the perceptual weighting of %V and ΔC , and the perceptual distance between EP and other languages. The importance of intonation for language discrimination was also inspected. The results showed that adult participants were able to discriminate EP from BP on the basis of filtered sentences and this ability increases (the perceptual distance between the two Portuguese varieties, measured with d' – Kaplan, MacMillan & Creelman 1978 –, increases) when intonation is preserved (Experiment 1). Experiment 2 showed that EP and BP are discriminated from Dutch, thus providing evidence for the perceptual relevance of %V. Additionally, when contrasted with Dutch, EP and BP are no longer discriminated, suggesting that the distance between EP and Dutch is bigger than the distance between the two Portuguese varieties.

In the present study, we also aim to test whether adult participants from SEP are able to distinguish their native variety from each central-southern variety. Additionally, we want to inspect the perceptual distance between SEP, Ale, and Alg, by calculating d' scores. Following Frota, Vigário & Martins (2002a, b), intonation is also considered in order to

observe whether it is an important cue to discriminate EP varieties, as it is to discriminate EP from BP.

5.4.2.1. General methodological procedures

Sentences used in both perceptual experiments were selected from the production data analyzed in Experiment 2. We have selected two sentences per speaker, representative of the variety in terms of the acoustic parameters %V and $\Delta\%C$. Each sentence contains 15 and 17 syllables. The same two sentences were selected from two speakers per variety. Thus, a total of four sentences were selected per variety (2x2). Stimuli of SEP belong to Frota, Vigário & Martins (2002a, b).

All sentences were low-pass filtered at a frequency of 400Hz and then some of them were amplified in order to minimize quality differences between audio recordings. Two versions of each sentence were created: (i) simply low-pass filtered (with F0 contour preserved – ‘+F0’); (ii) low-pass filtered with additional flat F0 contour (‘-F0’).

Since we have two conditions per variety (+F0Ale, -F0Ale; +F0Alg, -F0Alg; +F0SEP, -F0SEP), four AX discrimination tasks were run. Each experiment contains 8 pairs with stimuli from the same variety, and 16 pairs combining stimuli from two different varieties (SEP-Ale or SEP-Alg). The stimuli in each pair were always uttered by two different speakers. All pairs were randomly presented three times. Thus, each experiment contains a total of 24 trials (8x3) with stimuli from the same variety, and 48 trials (16x3) with stimuli from two different varieties.

The AX discrimination tasks were performed by 40 participants, all SEP native speakers, mainly university students, with a mean age of 27 years. A group of 20 subjects performed two AX discriminations tasks with stimuli preserving the F0 contour (SEP-Ale +F0; SEP-Alg +F0), while another group of 20 subjects performed the AX discrimination tasks containing stimuli with a flat F0 contour (SEP-Ale -F0; SEP-Alg -F0). The presentation of the two tasks was counter-balanced within each group, i.e. half of the subjects (10x2) started the experiment by contrasting SEP-Ale, and the other half (10x2) started the experiment by contrasting SEP-Alg.

All participants were told that they would be listening to acoustically modified sentences of different exotic languages: Urdu and Punjabi in the SEP-Ale contrast, and Fonti and Lingala in the SEP-Alg contrast. Each task was preceded by a training phase, including acoustic modified sentences with a different length from the one considered for the stimuli to be tested: 16 and 18 syllables per sentence. The training phase consisted of 5 steps, following Frota, Vigário & Martins (2002a, b) methodology: (1) a set of sentences from Urdu/Fonti

(SEP/SEP), (2) a set of sentences from Punjabi/Lingala (Ale/Alg), (3) a set of AX pairs where X is the same as A, (4) a set of AX pairs where X is different from A, and (5) a set of AX pairs of both types presented in random order. In this last step, subjects were asked to answer after each pair, by clicking on ‘D’ if sentences are different (‘D’ stands for the Portuguese word ‘diferentes’ or on ‘I’ if sentences are the same (‘I’ stands for the Portuguese word ‘iguais’). Feedback was given only for incorrect answers, and only during the training phase. Since reaction time (RT) is also a measure considered for the analysis of perceptive results, subjects were asked to answer as quickly as possible. Both the training and the task lasted about 15 minutes per experiment, thus 30 minutes per participant.

In order to avoid the inclusion of data obtained from subjects that are not able to perform discrimination tasks with degraded stimuli, we decided to apply a rejection criterion. We thus excluded and replaced subjects that were not able to identify sentences belonging to the same variety as being the SAME above chance level. According to this criterion, a total of 12 participants were excluded: eight in the condition ‘-F0’, four in the condition ‘+F0’.

5.4.2.2. Results

In order to observe whether native participants from SEP are able to discriminate their variety from Ale and from Alg, we calculated the average percent scores of ‘different’ responses to DIFFERENT pairs (i.e. success in discrimination). Additionally, we followed the Signal Detection Theory (SDT) which provides a model for calculating the sensitivity (d' measure) to differences between stimuli (Kaplan, MacMillan & Creelman 1978; Boley & Lester 2009). ‘Different’ responses to DIFFERENT pairs were used as hit rate and the ‘different’ responses to the SAME pairs were considered as false alarms. Mean reaction times (RTs) were also computed. These results are summarized in Table 17, below.

	SEP vs. Ale		SEP vs. Alg	
	+F0	-F0	+F0	-F0
Percent scores	71	73	65	65
RTs	600	485	549	544
d' -scores	2.72	2.81	2.16	2.16

Table 17 –SEP versus Ale and SEP versus Alg: mean percent scores of discrimination, mean reaction times (RTs) and d' scores.

We thus observe that SEP participants are able to discriminate their native variety from both Ale and Alg. Interestingly, this result contradicts the acoustic analysis that shows that there are no significant differences across these three EP varieties. Furthermore, and on the

basis of the integration of Ale and Alg in the traditional rhythm classes, these results are unexpected. If Ale is a mixed variety and if Alg is a stress-timed variety, then we would expect high percent scores for the discrimination of SEP from Alg, and we would expect a non-discrimination between SEP and Ale. However, our results show the opposite: both central-southern varieties are discriminated from SEP and with slightly higher percent scores of discriminated pairs in Ale than in Alg. This means that the distance between SEP and Ale seems to be bigger than the distance between SEP and Alg, which is reflected in d' -scores: the distance between SEP and Alg is smaller ($d'=2.16$) than the distance between SEP and Ale ($d'=2.77$). We thus hypothesize that the ability to discriminate SEP from Ale is superior to the ability to discriminate SEP from Alg.

Since we have two groups of subjects (2x20), performing the same two discrimination tasks (SEP *versus* Ale, and SEP *versus* Alg), where the difference is the presence/absence of the F0 contour, two dependent t -tests were run, with the discrimination percent scores for both Ale and Alg as paired variables in each dependent t -test (+F0 and -F0). A confidence interval of 99% was considered. The analysis shows that independently of the group of subjects considered, discrimination scores obtained in the SEP *versus* Ale experiment do not differ significantly from the discrimination scores obtained in the SEP *versus* Alg experiment performed by the same group of subjects (+F0: $t(19)=1.32$, $p=.203$; -F0: $t(19)=1.42$, $p=.173$).

Reaction times (RTs) were also statistically inspected within subjects, for both groups. Two Wilcoxon signed-rank tests were run, with mean RT in Ale and mean RT in Alg as paired variables. A confidence interval of 99% was considered. Similarly to the percent scores, this analysis shows that independently of the group of subjects considered, mean RTs of responses in the SEP *versus* Ale experiment do not differ significantly from the mean RTs obtained in the SEP *versus* Alg experiment performed by the same group of subjects (+F0: $Z=-.52$, $p=.601$; -F0: $Z=-.64$, $p=.526$).

In sum, SEP participants are able to discriminate their native variety from Ale and from Alg and the discrimination rates in the two tasks are similar for both groups of subjects, which suggests that the ability to discriminate the three varieties is not significantly different.

As mentioned before in this section, we decided to inspect whether intonation is a relevant cue for rhythm. In this sense, we run two independent-samples t -test, with *F0 condition* as a grouping variable (+F0, -F0), and with the discrimination percent scores for both Ale and Alg as paired variables in each independent-samples t -test (+F0 Ale *versus* -F0 Ale; +F0 Alg *versus* -F0 Alg). A confidence interval of 99% was considered. The analysis reveals that the presence/absence of F0 seems to be irrelevant for the discrimination between SEP and Ale and between SEP and Alg. Indeed, the discrimination scores obtained in the SEP

versus Ale experiment preserving the F0 contour do not differ significantly from the discrimination scores obtained in the SEP versus Alg experiment with a flat F0 contour. The same applies to the SEP versus Alg experiments (+F0 Ale versus -F0 Ale: $t(38)=-.37$, $p=.714$; +F0 Alg versus -F0 Alg: $t(38)=-.04$, $p=.968$). These results are illustrated in Figure 55, corresponding to a clustered boxplot, which gives a general overview of the statistical analysis described above.

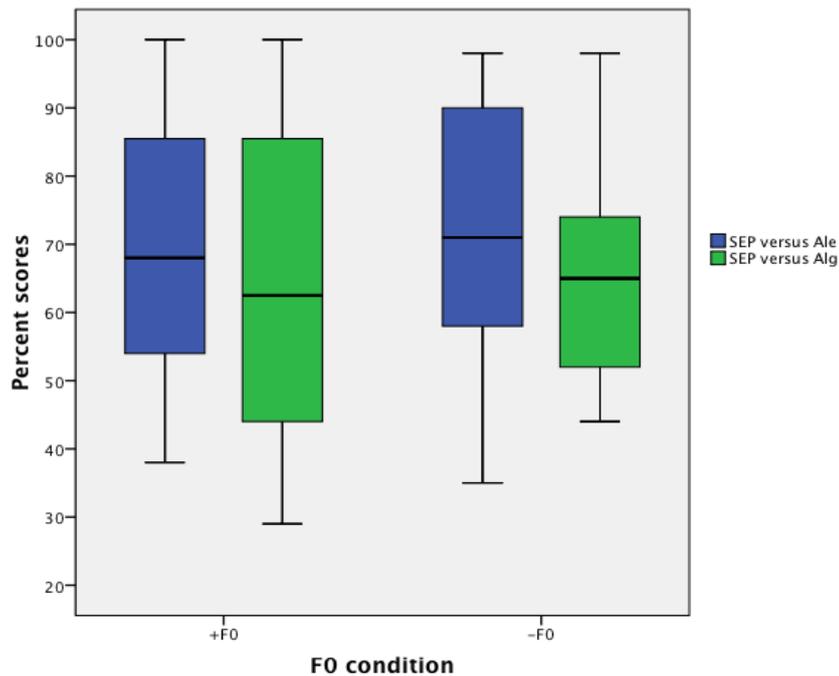


Figure 55 – Boxplot illustrating the discrimination scores in the tasks SEP versus Ale and SEP versus Alg (within-subjects), clustered according to the F0 condition (between-subjects).

Reaction times (RTs) were also statistically inspected between subjects. A Mann-Whitney U test was run, with *F0 condition* as a grouping variable (+F0, -F0), and with the mean RTs in SEP versus Ale tasks as test variables. A confidence interval of 99% was considered. The analysis reveals that mean RTs do not differ significantly depending on the presence/absence of F0 in the signal (+F0 Ale versus -F0 Ale: $Z=-.87$, $p=.387$), which is illustrated in Figure 56. The same was observed for the mean RTs in SEP versus Alg tasks. Since this variable presents a normal distribution ($D(40)=.130$, $p=.087$), an independent-samples *t*-test was run, with *F0 condition* as a grouping variable (+F0, -F0), and with the mean RTs in SEP versus Alg tasks as test variables (+F0 Alg versus -F0 Alg: $t(38)=-.07$, $p=.948$).

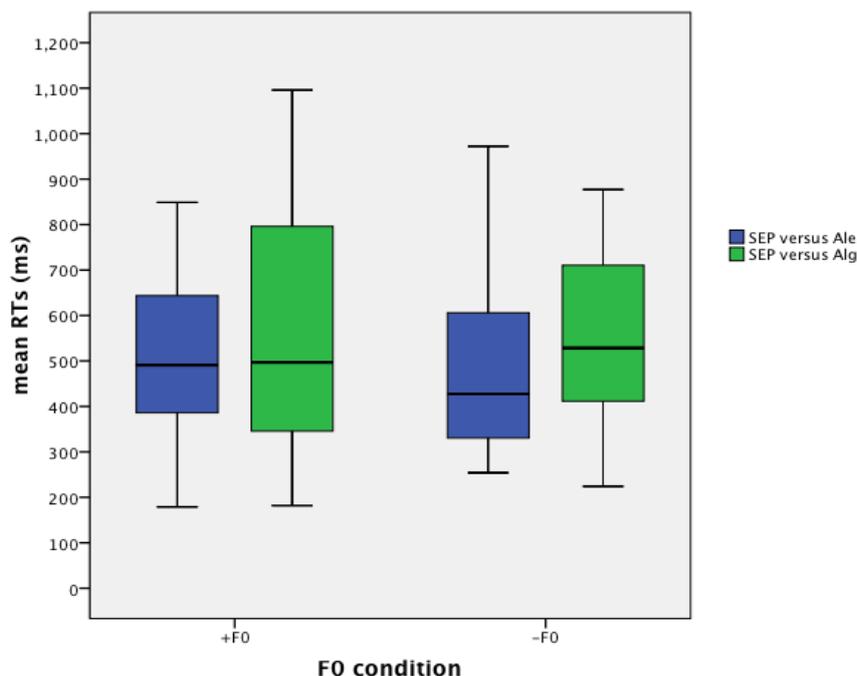


Figure 56 - Boxplot illustrating the mean Reaction Times (RTs) in milliseconds (ms) in the tasks SEP *versus* Ale and SEP *versus* Alg (within-subjects), clustered according to the F0 condition (between-subjects).

As illustrated in the clustered boxplot above, F0 does not play a relevant role for the discrimination between SEP and Ale and between SEP and Alg. In other words, mean RTs are similar whether F0 is preserved or not.

These results show that something in the signal is being interpreted by SEP participants as a cue to distinguish their variety from each central-southern variety. We already know that this cue cannot be the duration because there is a mismatch between production and perception results (EP varieties are not significantly different, in terms of the acoustic analysis of duration, but SEP participants show high percent scores of discrimination). Additionally, perceptual experiments reveal that F0 is also not being used as a cue, since SEP participants are able to discriminate their variety from Ale and Alg, independently of the presence/absence of this cue in the signal.

We suggest that speech rate might be cueing the discrimination between these EP varieties. In order to explore this factor, we decided to measure the average duration (in milliseconds) of the sentences selected for the perceptual experiments in the three varieties. Table 18 contains the values obtained.

	Ale	Alg	SEP
15 syllables	2546	2343	2395
17 syllables	2924	2448	2347

Table 18 – Average duration of sentences selected for the perceptual experiments.

We thus observe that the duration of sentences selected seem not to differ from each other. Nevertheless, we decided to compare the ranges of duration of the selected sentences with both 15 and 17 syllables for each variety. This is illustrated in Figure 57.

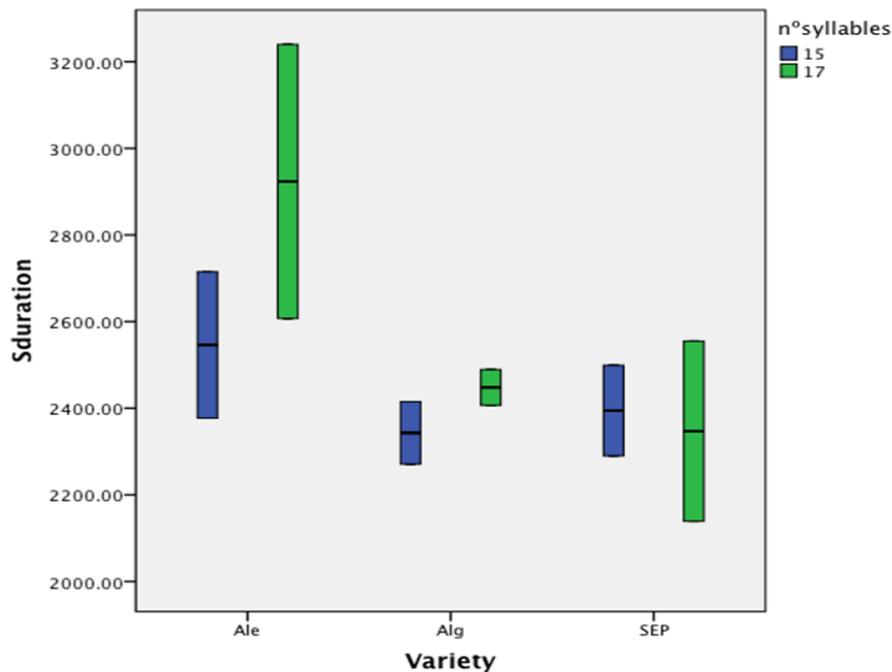


Figure 57 – Range of duration (ms.) of selected sentences with 15 and 17 syllables across varieties.

In Ale the sentences are longer than in Alg and in SEP: the lowest duration of sentences with 15 syllables in Ale is almost level with the highest duration of sentences with the same length in Alg and SEP. Similarly, the lowest duration of sentences with 17 syllables in Ale is even higher than the highest duration of sentences with the same length in Alg and SEP. This allows us to conclude that speech rate might explain the discrimination between varieties with similar rhythmic properties (Ale and SEP), which cannot be captured by the metrics used. However, it does not explain the discrimination between Alg and SEP. We thus hypothesize that participants from SEP used different cues in order to discriminate their native variety from each central-southern variety. We leave for future work a more detailed inspection of the effect of speech rate as a cue for languages/varieties discrimination, as well as of the correlation between other prosodic factors and rhythmic properties, in line with Prieto et al. (2012).

5.5. Final discussion and Conclusions

Several conclusions may be extracted from the analysis of rhythmic properties of central-southern varieties of EP. First, we have observed that the analysis of production data on the basis of two different metrics (%V and ΔC , and Varcos) leads to different perspectives

of the organization of central-southern varieties in the traditional rhythm classes. Indeed, Ale and Alg seem to belong to the same rhythm class (stress-timed) if Varcos measures are considered. However, if Ramus, Nespor & Mehler's (1999) metrics are taken into account, Ale and Alg belong to different rhythm classes (mixed for Ale, as for SEP, and stress-timed for Alg). This duality reflected on the use of different metrics is not novel. Arvaniti (2009, 2012a) and Arvaniti & Ross (2010) have also compared ΔC , %V, PVI and Varcos in several languages (see details in section 5.2), and concluded that their rhythmic classification is not consistent across metrics.

The organization of these EP varieties in rhythm classes, instead of along a continuum, is clearly observed from the acoustic analysis of production data, and is confirmed by the discrimination tasks. We have observed that SEP participants are able to discriminate their native variety from both Ale and Alg, although the statistical analysis based on acoustic measures has led to the conclusion that EP varieties are not significantly different. However, the comparison with other languages revealed that EP varieties cannot be integrated in the same rhythm class. As suggested by Frota, Vigário & Martins (2002a, b), the contrast with a wider range of languages/varieties is needed in order to evaluate the distance between them. Another explanation can be put forward for the absence of distinction between EP varieties on the basis of the acoustic analysis: durational properties *per se* might not actually be enough to discriminate varieties, as suggested by Frota & Vigário (2001).

According to these authors, intonation plays an important role for the distinction between EP and BP varieties of Portuguese. However, the inspection of the F0 contour as a cue to discriminate across EP varieties shows that in contrast with Frota & Vigário's (2001) beliefs, sensitivity to intonation does not seem to be a general property of the European Portuguese native speakers' phonological system. As we have observed in the discrimination tasks run with native participants from SEP, the presence or absence of the F0 contour in the stimuli does not motivate the discrimination. In both F0 conditions, SEP participants are able to discriminate their native variety from both Ale and Alg, and both discrimination scores and reaction times are not significantly different. We thus believe that other prosodic components preserved in the signal, such as speech rate, might be responsible for the discrimination between EP varieties, namely between varieties shown to be included in the same rhythm class (SEP and Ale). We leave the inspection of these parameters for future work, as well as a set of other discrimination tasks within Portuguese varieties (Ale perceiving Alg, and Alg perceiving Ale) or testing the rhythmic classification of Portuguese varieties by including typical stress-timed or syllable-timed languages in the experiment.

6. Conclusion

In the present chapter, we summarize the main findings of this research as well as the discussion of their implications for the understanding of prosodic variation in EP with respect to prosodic phrasing, intonation and rhythm. In addition, we put forward a first attempt to map prosodic variation. However, since few EP varieties have been analyzed so far, this cartographic representation is necessarily a very preliminary contribution to one of the major goals of the *InAPoP* Project (Frota & Cruz, Coords. 2012-2014 - <http://www.fl.ul.pt/laboratoriofonetica/InAPoP/>): to capture the relationships between varieties by using a geographic quantificational model. A parallel with the cartographic representation of segmental and syntactic aspects is also considered, and areas of convergence/divergence are proposed. Finally, some directions for future research will be suggested within each prosodic aspect explored in this thesis.

6.1. Phrasing

In Chapter 3, we examined phrasing in central-southern varieties of EP, based on both segmental and suprasegmental cues.

We observed two different segmental phenomena. First, we focused our analysis on one of the most well-studied sandhi phenomena in EP – Fricative Voicing –, in order to see whether this phenomenon (i) is, as in SEP, sensitive to phonological phrasing, and (ii) provides evidence for a prosodic constituent other than the Intonational Phrase (in which case, the central-southern varieties will differ from SEP). We also inspected a phenomenon that has been described as characteristic of the South – Paragoge –, in order to observe (i) whether word-final Vowel Epenthesis in the central-southern varieties is sensitive to prosodic structure (as in the case of Fricative Voicing for SEP); and (ii) if so whether it cues the Intonational Phrase, as in SEP, or other prosodic domains.

We concluded that both Fricative Voicing and word-final epenthesis in Ale and Alg are sensitive to prosodic phrasing, and signal the Intonational Phrase domain. However, Fricative Voicing is a domain span phenomenon that is blocked at the IP-edge, whereas Paragoge is a domain limit phenomenon, as the paragogic vowel is inserted only at the IP-edge. If the prosodic properties of Fricative Voicing in the central-southern varieties do not differ from those observed in SEP, the same is not valid for word-final epenthesis: in the South, epenthesis is not used as a strategy of tune-text accommodation, unlike in SEP where vowel epenthesis was reported to be motivated by tune-text accommodation factors. Finally, both phenomena also provide evidence of prosodic compounding in structures with parentheticals (as observed in the analysis of Fricative Voicing) and topics (as observed in the analysis of

word-final epenthesis). If Fricative Voicing occurs across the internal edge of the Compound IP (IP^{min}), but not across IP^{max}, word-final epenthesis may co-occur at both edges (at IP^{min} and IP^{max} boundaries).

These results show that prosodic phrasing in Ale and Alg has similar properties to prosodic phrasing in SEP in the sense that segmental phenomena cluster around the Intonational Phrase domain. Moreover, these results confirm the relevance of the Compound Prosodic Domain account of intonational phrasing. In fact, Fricative Voicing is bounded by the IP, and the paragogic vowel is an IP-edge phenomenon. Under the Compound Domain account, it is thus predicted that fricative voicing is only blocked by the outer IP boundary (since IP^{min} is within a bigger IP), whereas Paragoge is expected to occur at any IP-edge, whether internal to the compound IP or at the limit of the Compound IP. Our findings match nicely with these predictions. The alternative view that either IP^{min} or IP^{max} is a different type of constituent would not account for the prosodic distribution of paragoge. Thus, along the lines of Frota's (1995, 2000) proposal, our results provide additional evidence to support that (i) compound IP-domains are empirically more adequate than the hypothesis of a new phrase type, and that (ii) the Compound IP layers may differ in strength but not in nature.

Besides segmental evidence for phrasing, we also analyzed the effects of syntactic/prosodic complexity and prosodic weight in terms of length/size of prosodic phrases on the patterns of intonational phrasing.

Basic phrasing choices were found to distinguish between central-southern varieties: in Ale, as previously reported for NEP (Frota & Vigário 2007), there is a preference for the (S)(VO) phrasing pattern, contrasting with the predominance of (SVO) in Alg, similarly to SEP (Elordieta et al. 2003; D'Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Frota et al. 2007). These intonational phrasing differences are depicted in Figure 58, where we used the method of the probabilistic *Huff model*. It generates spheres of influence of a given variable. Among the available possibilities of representing a geographical distribution of a given quantitative variable, the *Huff model* fits our purposes within the *InAPoP* Project because it allows us to predict, on the basis of a few selected geographical points per district, how much a given factor can spread to adjacent points.

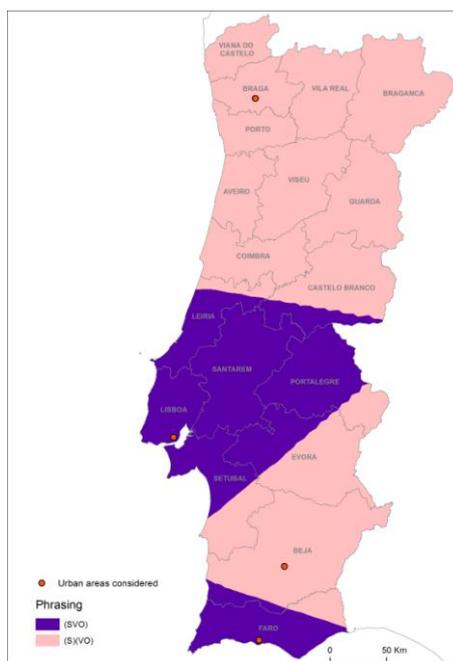


Figure 58 – Dominant phrasing patterns across EP varieties (Reading Task). Only four urban regions were analyzed for this prosodic aspect (red dotted geo points). Data from SEP (Lisbon) and NEP (Braga) from Frota et al. (2007).

These results show that varieties reported to be identical on the basis of their segmental phonetics and phonology, such as the varieties from the Interior Centre and South (Cintra 1971, Segura & Saramago 2001), do not necessarily share the same prosodic properties, and varieties reported to be different on the basis of their segmental phonetics/phonology may share similar prosodic properties.

Second, our findings show that both syntactic complexity and length (in number of syllables) were found to constrain intonational phrasing although with differences across varieties. In Ale, as in NEP (Frota & Vigário 2007), (S)(VO) is favored by syntactic/prosodic branching and length. However, syntactic branching is the most relevant factor in NEP, whereas length plays the most important role in Ale. In Alg, syntactic/prosodic branching is the trigger of (S)(VO). In SEP, length is the crucial factor behind (S)(VO) intonational phrasing (Elordieta et al. 2003; D’Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Frota et al. 2007).

As in SEP (Frota 1995, 2000), we have not found segmental evidence for the Phonological Phrase domain in the central-southern varieties. However, and similarly to other Romance languages such as Italian or French (Grice 1995, Post 1999), there is suprasegmental evidence for the Phonological Phrase level in the central-southern varieties studied. However, this evidence is not related with length or branching effects. Instead, the

PhP domain receives its visibility in Ale from an intonational perspective: (i) it is signaled by an initial low boundary tone and (ii) all the heads of PhPs bear a pitch accent. The latter property is also shared by Alg.

In sum, a comparison across varieties of EP leads to two general conclusions: (i) the same prosodic dimensions of variation seem to be relevant to characterize EP varieties, but may play different roles in each variety (in Alg, branchingness constrains prosodic phrasing; in Ale, both length and branchingness are important factors); (ii) the analysis of prosodic phrasing in Ale and Alg shows that these two regions previously classified as belonging to the same variety, on the basis of segmental phenomena (Interior Centre and South), may display different prosodic properties. This suggests that these two central-southern varieties do not fully share the same prosodic grammar as far as intonational phrasing patterns are concerned which would be reflected in the proposal of distinctive prosodic isoglosses for these two regions within the Interior Centre and South. However, further work is needed in order to provide a detailed prosodic description of EP varieties that would promote a global cartographic vision of prosodic phrasing variation in EP.

6.2. Intonation

Our findings on nuclear contours, prosodic focus and pitch accent distribution in the central-southern varieties of EP (described in Chapter 4) point to similarities and differences between the two varieties.

The analysis of nuclear contours in neutral sentences shows that there are no differences across speech styles. Both in the reading task and in the DCT, declaratives are produced with a falling nuclear contour (H+L*) followed by a low boundary tone (L%), as in SEP. In Ale, as in NEP, the tune L* L% is also possible in declaratives. The analysis of the difference between neutral yes-no questions and declaratives across varieties shows that this difference does not always lie on the same intonational units of the tune: (i) in SEP, it lies on the boundary tone type (L% in declaratives; LH% in yes-no questions), and the nuclear pitch accent is the same (H+L*); (ii) in Ale, similarly to SEP, it also lies on the boundary tone type (L% in declaratives; H% in yes-no questions), and the nuclear pitch accent is the same (L*); (iii) in Alg, all the nuclear configuration changes (H+L* L% in declaratives; L*+H H% in yes-no questions). This suggests that varieties of the same language may use different intonational strategies to produce the same sentence types. Similarly to declaratives, but differently from yes-no questions, wh-questions, requests, commands and calling contours were found to be produced with the same nuclear contour across the varieties under analysis: H+L* L% for wh-question, as for declaratives (in Ale L* L% is also frequent); L* L% for

request; H*+L L% for command (the nuclear pitch accent L*+H is also possible in early focus cases); (L+)H* !H% for greeting call; (L+)H* L% for insistent call.

Prosodic focus, as in SEP (Frota 2000), was conveyed by the H*+L pitch accent in declaratives produced in Ale and Alg. In yes-no questions, different strategies are used within the central-southern varieties: (i) in Ale, two different strategies were used for each speech style (in the reading task, a rising nuclear pitch accent L*+H followed by a falling boundary tone (HL%) in late focus cases or a rising boundary tone (LH%) in early focus cases; in the DCT, a falling nuclear pitch accent H+L* followed by a falling boundary tone (HL%)); (ii) in Alg, there is a different phonetic implementation of the same tune (L*+H H%), with a larger pitch range in narrow focus. Interestingly, while for SEP L*+H functions as a focus marker, for both Ale and Alg, it may be the nuclear pitch accent in both neutral and focused yes-no questions.

In early focus cases, as previously reported for SEP (Frota 2000, in press), we have observed that post-focal material in both declaratives and yes-no questions produced in Ale and Alg show a falling contour with compressed range (H+L*), which suggests that post-focal subordination is a general characteristic of Portuguese (it was also observed in several Brazilian varieties – Frota et al. in press).

Tune-text accommodation strategies are another domain in which varieties of EP do not seem to differ. The analysis of calling contours and yes-no questions shows that, like in SEP and other varieties of EP (Frota 2000, 2002a, in press, Frota et al. in press), both in Ale and Alg the segmental string is extended to cope with tonal realization, when the tune is complex enough for the extension of the segmental string. Thus, differently from truncation or compression languages, European Portuguese presents text-tune accommodation strategies.

Besides the description of the main nuclear contours by sentence type, tonal marking of prosodic edges was also examined. The analysis of tonal marking of prosodic phrase edges revealed a phenomenon specific to Ale. Differently from SEP and Alg, where only the IP gets an edge tone, the analysis of Ale provided evidence for another phrasal level that also requires tonal edge marking – the Phonological Phrase. In Ale, the left edge of the last Phonological Phrase of the IP is signalled with a low edge tone. This suggests that the PhP (or to be more specific, the rightmost PhP within a given IP) is a relevant domain for intonation in Ale, which contrasts with SEP and Alg. Second, the fact that this is specific of Ale adds to the prosodic differences within central-southern varieties.

Finally, pitch accent distribution was examined and the results obtained were expressed in terms of tonal density. The findings on tonal density on the basis of read speech materials showed that Ale and Alg, similarly to NEP (Vigário & Frota 2003) present a higher tonal

density than SEP, and that declaratives present more pitch accents in IP-internal PWs than interrogatives. The analysis based on the DCT materials provided evidence for similar patterns of tonal density, which are depicted in Figure 59: Ale and Alg present a higher tonal density than SEP, and are closer to the variety spoken in Oporto, a Northern variety analyzed by Frota et al. (2011, in press).

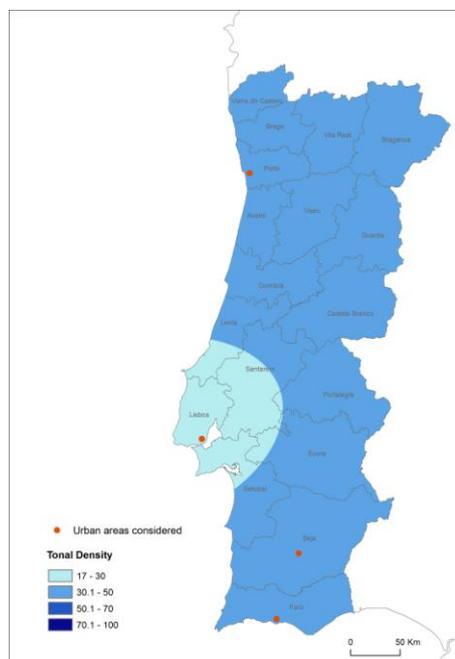


Figure 59 – Tonal density across EP varieties (DCT). Four urban regions were analyzed (red dotted geo points). Data for the variety spoken in Oporto (Por), from Frota et al. (2011, in press).²³

Pitch accent distribution was also computed by sentence type. We have observed that pitch accent distribution in *wh*-questions in central-southern varieties was almost reduced to the nuclear contour, thus presenting the sparse pitch accent distribution characteristic of all sentence types in SEP, which contrasts with the higher tonal density in *wh*-questions found in the Northern variety of Oporto by Frota et al. (in press) (Figure 60).

²³ For the representation of tonal density (here organized in a scale with four classes), and differently from the previous cartographic representation, we used the *Inverse Distance Weighting (IDW)* method. By using a known scattered set of points, in this method the unknown points are calculated with a weighted average of the values available at the known points.

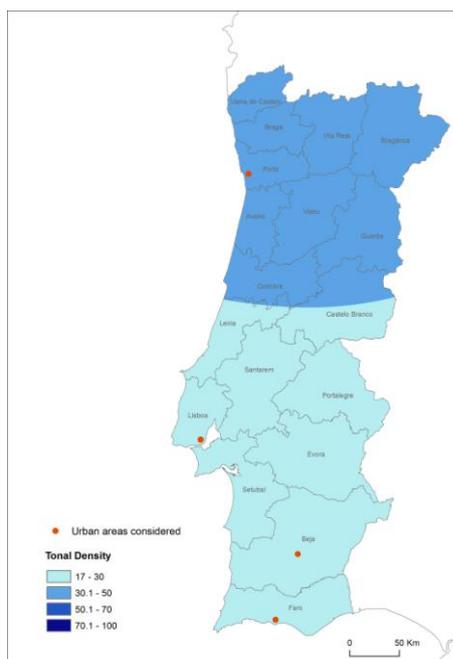


Figure 60 - Tonal density in wh-questions produced across EP varieties (DCT). Four urban regions were analyzed (red dotted geo points). Data for the variety spoken in Oporto (Por), from Frota et al. (in press).

The relation between pitch accent distribution and intonational phrasing reveals that the hypothetical correlation between these prosodic factors observed in SEP and NEP (Vigário & Frota 2003, Frota & Vigário 2007) is not a general property of the prosodic grammar of Portuguese: in Ale, as in NEP, there are more phrases, as the dominant phrasing pattern is (S)(VO), and a dense pitch accent distribution; in Alg, however, the dominant phrasing pattern is similar to the one of SEP (SVO), but differently from SEP, Alg presents a dense pitch accent distribution, as observed in Ale.

To conclude, we have observed that there are important dimensions of variation within EP, such as the domain for pitch accent distribution. Indeed, in contrast with SEP, but similarly to NEP (Vigário & Frota 2003), the Phonological Phrase is the relevant domain, since all the heads of PhPs bear a pitch accent. When considering the relation between and within varieties, we conclude that the two central-southern varieties may present (i) similarities across varieties, (ii) a different behaviour from SEP, but similar internal properties, and (iii) internal prosodic differences. Some prosodic aspects were found not to vary across varieties, such as the basic intonational structure: (i) a nuclear pitch accent at the right edge of the IP, (ii) similar tunes for each sentence type, independently of the speech style, (iii) post-nuclear subordination, (iv) absence of deaccenting, (v) the extension of the segmental string to cope with tonal realization. The differences between Ale/Alg and SEP are reflected, for example, in tonal density. Indeed, the two central-southern varieties present a

dense pitch accent distribution, similarly to NEP, but in contrast with the sparse pitch accent distribution in SEP (Vigário & Frota 2003). Finally, prosodic differences within central-southern varieties were also found, for example in the relation between pitch accent distribution and intonational phrasing: in Ale, these two prosodic factors correlate, as in SEP and NEP (Vigário & Frota 2003, Frota & Vigário 2007), but not in Alg, where there is a preference for an intonational phrasing pattern similar to SEP (SVO), but a dense pitch accent distribution as in Ale and NEP. These findings allow us to conclude that prosodic variation presents a certain degree of discontinuity in a geographical perspective, not only in the sense that central-southern varieties are similar to NEP, but also due to the internal variation in the Interior Centre and South.

6.3. Rhythm

Together with prosodic phrasing and intonation, rhythm was another prosodic dimension examined in this thesis. This was the first attempt to describe the organization of EP varieties on the basis of their rhythmic properties. Based on prior studies of rhythm across varieties (Ghazali et al. 2002, for Arabic varieties; O'Rourke 2008, for Spanish varieties; Giordano & D'Anna 2010, for 15 varieties of Italian), as well as on the previous inspection of rhythm in Portuguese (Frota & Vigário 2001), we established the following goals: (i) to observe whether the rhythmic measures that Frota & Vigário (2001) considered relevant to distinguish between SEP and BP were also relevant for the characterization of central-southern varieties, previously shown to be different from SEP in terms of intonational phrasing patterns, pitch accent distribution, and certain tune types (Cruz & Frota 2010a, b, 2011b, 2012b, 2013a, b; Frota et al. in press; see also Chapters 3 and 4); (ii) to observe whether the use of different *corpora* across varieties had an impact on the results of rhythmic measures when compared with the use of a common *corpus*; (iii) to observe whether the use of different acoustic measures led to different results from the ones obtained by means of Ramus et al.'s (1999) metrics; (iv) to inspect whether rhythmic differences were perceived; and (iv) to add to the debate on the organization of languages/varieties into rhythmic classes or along a rhythm continuum.

We concluded that, depending on the acoustic measures used (%V, ΔC , ΔV , $\Delta \%C$, $\Delta \%V$ or Varcos), Ale and Alg seem to present slightly different rhythmic properties, in line with previous studies showing that the use of different metrics do not provide consistent results (Arvaniti 2009, 2012a; Arvaniti & Ross 2010). The use of different *corpora* was shown not to affect the main results. The comparison with other languages revealed that EP varieties cannot be integrated in the same rhythm class. Thus, as suggested by Frota, Vigário

& Martins (2002a, b), the contrast with a wider range of languages/varieties is needed in order to evaluate the distance between them.

Based on previous perception studies (Frota, Vigário & Martins 2002a, b), we also ran several experiments in order to test (i) whether adult participants from SEP are able to distinguish their native variety from each central-southern variety at a time, and (ii) the perceptual distance between SEP, Ale, and Alg, by calculating d' scores. Intonation was also considered in order to observe whether it is an important cue to discriminate EP varieties, as it is to discriminate EP from BP. We concluded that: (i) SEP participants are able to discriminate their native variety from both Ale and Alg; (ii) although the task SEP *versus* Alg presents lower discrimination scores and lower d' -scores than the task SEP *versus* Ale, suggesting that Alg is closer to SEP than Ale, statistic analysis of discrimination scores and mean Reaction Times shows that these differences are not significant; (iii) intonation does not play a significant role in the discrimination tasks.

The results from the acoustic analysis of rhythm suggested that the following aspects should be taken into account in an investigation of rhythmic properties. First, different acoustic measures should be used, and results should be interpreted in conjunction with other phonological properties of the language/variety under analysis (in the line of Dasher & Bolinger 1982, and Dauer 1983). As Arvaniti (2009, 2012a) and Arvaniti & Ross (2010) observed in several languages by comparing the results obtained with different metrics (ΔC , %V, PVI and Varcos), we also concluded that different metrics point to different rhythmic classifications of Ale and Alg.

Second, the fact that central-southern varieties were not found to be statistically different from each other, and from SEP, on the basis of the acoustic data does not necessarily mean that EP varieties are integrated in the same rhythm class or space. As suggested by Frota, Vigário & Martins (2002a, b), the contrast with a wider range of languages/varieties may be needed in order to evaluate the distance between them, and the relation between acoustic and perceptual differences may not be linear. Indeed, the comparison with other languages revealed that EP varieties cannot be integrated in the same rhythm class/space: in particular, while Ale may share the same rhythmic space as SEP, Alg is clearly a more stress-timed variety.

Third, we may conclude that rhythmic properties cannot be directly deduced from other prosodic aspects: the fact that Alg presents a mixed pattern when considering the relation between pitch accent distribution (dense) and prosodic phrasing choices (long phrases) does not imply that this variety shows rhythmic properties between Ale (also with a dense pitch accent distribution but short phrases) and SEP (with long phrases and a sparse distribution).

Actually, Alg is clearly stress-timed, while both Ale and SEP present mixed properties (syllable-timed in the %V dimension, and stress-timed in the ΔC dimension).

Finally, we can speculate about the relevance of intonation as a cue to rhythm. Frota, Vigário & Martins (2002a, b) showed that when F0 was absent from the auditory stimuli, EP and BP were not discriminated, unlike when F0 was preserved. Our findings on the perception of Ale and Alg as different from SEP suggest that intonation does not play a significant role in the discrimination of EP varieties, although both Ale and Alg show a dense distribution of pitch accents, unlike SEP. It is thus possible that sensitivity to intonation is not a general property of Standard European Portuguese native speakers' perception of rhythm (as was suggested by Frota & Vigário 2001), or that the intonational features that impact on the perception of rhythm go beyond pitch accent distribution. In addition, if it is not F0 (as shown by the perception results) or the general durational properties captured by the metrics (as suggested by the acoustic analysis) that are behind the discrimination results, this suggests that something else in the signal is cueing the differences between these three EP varieties, and particularly between the two varieties that were closer in the acoustic data, SEP and Ale. A strong candidate is speech rate, which was found to be slower in Ale than in Alg or SEP. We leave for future work the inspection of speech rate, a component of prosody already pointed out as possible a cue for the discrimination of rhythm across languages/varieties (Arvaniti 2012b; White, Mattys & Wiget 2012; Prieto et al. 2012).

By and large, the current preliminary findings for production and perception, taken together suggest that the rhythm of EP varieties exhibits more stress-timed properties towards the Southern varieties, and that the varieties analysed exhibit rhythmic differences that are perceptually salient. Studies of more EP varieties are required, especially of Northern varieties, to establish whether the drift towards stress-timing from Lisbon to the South is supported or not. Other perception studies within EP varieties are also needed, as well as perception studies including typical stress-timed and/or syllable-timed languages in the experiment, additionally to EP varieties (as in Frota, Vigário & Martins 2002a, b). Such studies would allow a better understanding of the rhythmic distance between the different EP varieties and between these and prototypical stress-timed and syllable-timed languages. These studies would also provide critical information for the debate on the organization of languages/varieties into rhythmic classes or along a rhythm continuum.

A valuable cartographic representation for rhythm was still not found. In contrast with the other prosodic aspects analysed, the organization of languages/varieties in the rhythm space is usually based on two quantitative variables (e.g., %V and ΔC), which requires a

simultaneous representation of two dimensions with different weights for each variety. We hope to address this issue in future research.

6.4. Mapping prosodic variation: areas of convergence/divergence with segmental variation

Mapping variation is not a trivial task. Goebel (2006, 2007), Maguire & McMahon (2011), *inter alia*, discuss several difficulties in mapping variation in English. Among the usual obstacles, the following questions arise: (i) how to quantify relations between dialects, (ii) how many features are needed to define a dialectal area, (iii) how to delimit isoglosses when two non-contiguous varieties share similar features.

In addition to these difficulties, the results obtained in the present research are not enough to propose areas of prosodic variation or to draw prosodic isoglosses. This is a goal that can only be reached within a major research project like *InAPoP* (Frota & Cruz, coords. 2012-2014), which covers various prosodic features in an array of varieties throughout Portugal. Nevertheless, on the basis of the prosodic analysis of central-southern varieties of EP, and also considering previous descriptions of NEP (Braga) and SEP (Vigário & Frota 2003; Elordieta, Frota & Vigário 2005; Frota & Vigário 2007; Frota et al. 2007), we present our very preliminary proposal of areas of prosodic variation in EP.

In order to map areas of prosodic variation, we superimposed two maps, one representing the general tendencies of phrasing choices (Figure 58) and the other representing tonal density (Figure 59). We have chosen these two prosodic features, since variation in intonational nuclear contours is difficult to represent in a single map and rhythmic properties, as mentioned above (section 6.3), involve the representation of two dimensions simultaneously, raising a different methodological problem. The results of the geographical distribution of phrasing and tonal density are given in Figure 61 (right panel). We compared our mapping of prosodic variation with the traditional classification of EP varieties (Cintra 1971, Segura & Saramago 2001) based on segmental variation (Figure 61, left panel), in order to observe areas of convergence/divergence between segmental and prosodic variation in EP.

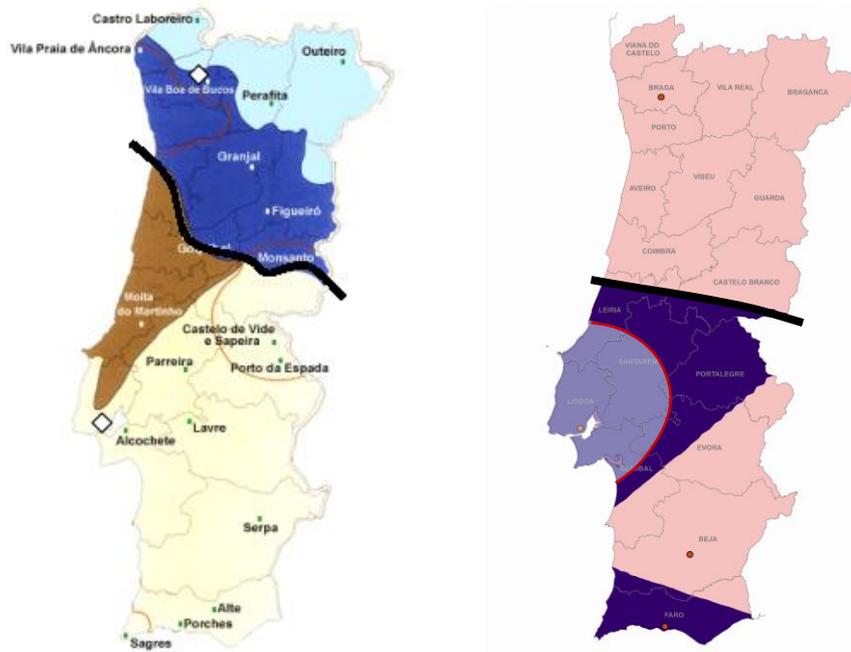


Figure 61 – Left panel: European Portuguese dialects, according to Cintra (1971), adapted by Segura & Saramago (2001). The black solid line splits the Northern varieties (in light and dark blue) from the Central-Southern ones (in brown and white). The red thinner lines signal regions with peculiar linguistic features. Right panel: areas of prosodic variation, on the basis of two prosodic features (intonational phrasing and tonal density).

As can be observed above (Figure 61, right panel), two major areas can be considered, when the representations of intonational phrasing and tonal density are superimposed: the North, and the Centre and South. The pink color covering the North represents the preference for the (S)(VO) phrasing pattern, also visible in Ale; the geographical distribution of the preference for the (SVO) phrasing pattern is represented in purple. The area in violet, surrounded by a red line corresponds to the geographical coverage of the sparse pitch accent distribution. All the other areas present a high tonal density.

Interestingly, as in segmental phonetic-phonological variation, the Northern varieties are separated from most Central-Southern ones by the proposed isoglosse for phrasing. This black solid line separates the preference for the (S)(VO) phrasing pattern in the North (in pink) from the preference for the (SVO) phrasing pattern in the Interior Centre and South (in purple). The pink area in the South signals a region where there is a preference for the dominant phrasing pattern of the North. This is a provisional proposal based on the results obtained in this research. As mentioned above, more data is needed in order to establish general tendencies. So far, we only know that Ale (in Beja district) and Alg (in Faro district) present different phrasing patterns and that SEP is closer to Alg than to Ale in this prosodic aspect. However, at this moment, we still do not know how far these phrasing patterns spread. The proposed map was built on the basis of a probabilistic model that projects from the few data points currently available.

The area signaled by a red line corresponds to the geographical delimitation of sparse pitch accent distribution area, that is SEP (Lisbon), which contrasts with the high tonal density found elsewhere in both the North and the Interior Centre and South.

On the one hand, the proposed isoglosse for phrasing reinforces the delimitation of the two major areas of segmental variation, according to Cintra (1971): Northern varieties *versus* Central-Southern varieties as areas of possible convergence for both segmental and prosodic variation. On the other hand, it is important to note that unlike in the case of segmental variation, prosodic variation is non-contiguous and geographical distant varieties may share similar features. In particular, Ale shows a preference for the (S)(VO) phrasing pattern found in the North. Interestingly, data from Carrilho & Pereira (2011) show that this same region is characterized by a specific non-standard syntactic structure. Further investigation is needed to examine whether any relation might be established between these so far unrelated observations.

The split within central-southern varieties on the basis of segmental variation encounters a similar division on the prosodic map on the basis of tonal density. Indeed, sparse pitch accent distribution is restricted to the region of Lisbon.

These preliminary observations strengthen the view that much further work is needed, not only in the phonetics and phonology of prosody, but also in the syntax-prosody interface, before an insightful description of prosodic variation in European Portuguese can be achieved.

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Appendix I

Previous *Corpora* (Reading Task)

(list of sentences)

- **Intonation contours per sentence type and pragmatic meaning:**

- Frota 2003 -> initial peaks

1. [(O MAR)] enroLAvA-se na areia.
2. [(O MAR) (enroLAdo)] provocou o naufrágio.
3. [(O MAR)] da EuROpa é frio e escuro.
4. [(O MAR)] de LuANda era revolto.
5. [(O MAR) (NORte)] ilumina os quadros de Goya.
6. [(O MÁrio)] ilumiNOU a sala.
7. [(O MÁRmore)] amareLOU com facilidade.
8. [(O MÁRmore) (amareLAdo)] é barato.
9. [(O MÁRmore) (Ágata)] é difícil de encontrar.
10. [(O MÁRmore)] em África é fácil de encontrar.
11. [(O MÁRmore aBERto)] não serve para nenhuma aplicação.
12. [(A MaRIa)] ilumiNOU a festa.
13. [(A MaRIa)] ilumiNOU a festa.
14. [(A MariAna)] ilumiNOU a sala.
15. [(A MouraRia)] ilumiNOU a cidade.
16. [(A MouraRia) (ilumiNAda)] é uma dança de luzes.
17. [(A MouraRia) (MÃE)] é o coração da cidade.
18. [(O marMElo)] amadureCEU demais.
19. [(O marMElo) (maDUro)] dá uma ótima geleia.
20. [(O marMElo) (amaRElo)] é o mais doce de todos.
21. [(O marMElo)] de LuANda apodrecia facilmente.
22. [(O marMElo)] da EuROpa é pouco saboroso.
23. [(O marMElo)] da Ásia não tem sabor nenhum.
24. [(O marMElo) (LOUro)] tem o melhor sabor.
25. [(A LÂmina) (amaREla)] era a mais cortante de todas.
26. [(A LÂmina)] da MaRIa partiu-se.
27. [(A LÂmina) (LONga)] é mais eficaz.
28. [(A minha LÂmina) (NOva)] corta bastante bem.
29. [(A minha LÂmina)] CORta todo o tipo de materiais.

- Frota 2000, Chapter 5+Appendix IVA -> topic/focus/neutral declarative contours

Core set

1. [C: Disseeram-me ontem:]
As angolanas ofereceram especiarias aos jornalistas.
2. [C: Quem ofereceu especiarias aos jornalistas?]
As angolanas ofereceram especiarias aos jornalistas.
3. [C: Foram as moçambicanas que ofereceram especiarias aos jornalistas?]
As angolanas ofereceram especiarias aos jornalistas.

4. [C: A quem é que as angolanas ofereceram especiarias?]
As angolanas ofereceram especiarias aos jornalistas.
5. [C: Foi aos artistas que as angolanas ofereceram especiarias?]
As angolanas ofereceram especiarias aos jornalistas.
6. [C: Angolanas e moçambicanas exiladas em Portugal resolveram presentear os jornalistas com ofertas provenientes dos seus países. Quanto às moçambicanas, trouxeram plantas exóticas.]
As angolanas, ofereceram especiarias aos jornalistas.
7. [C: Jovens africanas a estudar em Portugal apresentaram ontem as suas ofertas a jornalistas portugueses.]
As angolanas ofereceram especiarias, aos jornalistas.

Topic control set

1. [C: Entre as ofertas havia vários tipos de flores. Sabes o que se passou com as rosas?]
As rosas, as alunas ofereceram ao monitor.
2. [C: Havia imensa gente a receber ofertas de jovens angolanas radicadas em Portugal. Sabes se os jornalistas foram presenteados?]
Aos jornalistas, as angolanas ofereceram especiarias.
3. [C: Tu sabes o que é que as angolanas fizeram?]
Ofereceram especiarias aos jornalistas, as angolanas.

Focus/neutral control set

1. O galã anda de porsche.
2. [C: Naquele filme é o vilão que anda de porsche?]
O galã anda de porsche.
3. O galã andava de porsche.
4. [C: No filme que tu viste, o bandido andava de porsche?]
O galã andava de porsche.
5. O pintor retratou uma manhã âmbar.
6. [C: Foi uma tarde âmbar que o pintor retratou?]
O pintor retratou uma manhã âmbar.
7. O poeta cantou uma manhã angelical.
8. [C: Foi uma noite angelical que o poeta cantou?]
O poeta cantou uma manhã angelical.

- Frota 2002, Probus -> neutral/focus questions contours

III (question rises, basic)

1. [C: Não sei o que se passou.]
As angolanas ofereceram especiarias aos jornalistas?

2. [C: Não sei nada sobre esse filme.]
O galã anda de porsche?
3. [C: Ainda não vi a exposição.]
O pintor retratou uma manhã âmbar?
4. [C: Gostava de conhecer esses poemas.]
O poeta cantou uma manhã angelical?
5. [C: Não sei nada sobre esse filme.]
Quem anda de porsche?
6. [C: Ainda não vi a exposição.]
Quem pintou uma manhã âmbar?
7. [C: Gostava de ouvir esse disco.]
Quem cantou uma manhã angelical?
8. [C: Não sei o que se passou.]
Quem ofereceu especiarias aos jornalistas?
9. [C: Eu não sei o que é que tu pretendes fazer.]
Queres ver o João?
10. [C: Não faço ideia do que aconteceu.]
Ela foi ver o mar?
11. [C: Não faço ideia do que aconteceu.]
Ela foi ver a Maria?
12. [C: Não faço ideia do que aconteceu.]
Ela foi ver a Marina?
13. [C: Não faço ideia do que aconteceu.]
Ela foi ver o Mário?
14. [C: Gostaria de saber o que se passou.]
Os rapazes compraram lâminas?

IV (questions rises, focus)

1. [C: Não sei se é o João ou outra pessoa que tu queres ver.]
Queres ver o João?
2. [C: Quero saber se ela foi até ao mar ou o outro sítio diferente.]
Ela foi ver o mar?
3. [C: Não sei se ela foi visitar a Maria ou uma outra pessoa amiga.]
Ela foi ver a Maria?

4. [C: Não sei se ela foi visitar a Marina ou uma outra pessoa amiga.]
Ela foi ver a Marina?
 5. [C: Quero saber se ela foi ter com o Mário e não com outro dos seus amigos.]
Ela foi ver o Mário?
 6. [C: Gostaria de saber se foram mesmo lâminas que eles compraram e não outro objecto qualquer.]
Os rapazes compraram lâminas?
 7. [C: Eu vi esse filme mas já não me lembro quem anda de porsche.]
O galã anda de porsche?
 8. [C: Vi esse quadro na exposição mas não me recordo se o motivo era uma manhã ou um entardecer âmbar.]
O pintor retratou uma manhã âmbar?
 9. [C: Li o poema a que te referes mas não sei se é a manhã ou a noite que o poeta considera angelical.]
O poeta cantou uma manhã angelical?
- Frota in press -> imperative, request and calling contours

Requests

1. [C: És assessora para a imprensa e estás a tentar convencer o director a falar com a comunicação social]
Receba os jornalistas.
2. [C: O teu filho tem uma colecção de carros que não gosta de emprestar a ninguém. Estás a pedir-lhe um dos carros para o teu sobrinho poder brincar com ele.]
Dá-lhe um porsche.
3. [C: Gostarias de ver uma determinada imagem de cores num quadro e por isso pedes a um pintor amigo:]
Pinta uma manhã âmbar.
4. [C: Gostavas de ouvir cantar sobre a temática de um dos teus poemas favoritos e pedes a um intérprete ter conhecido:]
Canta uma manhã angelical.
5. [C: Estão a distribuir presentes de natal a crianças e o teu filho ganhou um carro, mas não o que ele queria. Estás a pedir a quem está a distribuir os brinquedos:]
Dê-nos um porsche
6. [C: Um amigo teu, pintor, gostaria de te oferecer um quadro pelo Natal e tu pediste-lhe:]
Pinta uma manhã âmbar
7. [C: Um colega teu, cantor lírico, está a treinar a expressão de sensações através do canto. Tu tens um pedido a fazer-lhe:]
Canta uma manhã angelical.

8. [C: És advogada de defesa e estás a tentar convencer o teu cliente, suspeito de corrupção, a falar com a imprensa.]
Receba os jornalistas.
9. [C: O teu pai, que sempre viveu na costa, regressou de uma longa estadia no interior da Alemanha. Apesar de ele estar muito ocupado, tu tens um pedido que pensas ser do seu agrado:]
Anda ver o mar.
10. [C: O teu irmão zangou-se com o seu melhor amigo, que, entretanto, adoeceu. Tu estás a tentar convencê-lo a ir visitá-lo.]
Anda ver o Mário.
11. [C: O teu filho pequeno conseguiu ter acesso a objectos perigosos e estás a tentar convencê-lo a devolver o que tem na mão:]
Dá-me as lâminas.

Vocatives (Greeting call and insistent call)

1. [C: O João não te viu e tu precisavas mesmo de falar com ele. Estás a tentar chamá-lo:]
João
2. [C: A Maria está do outro lado da rua e não sabes se vais conseguir chamá-la:]
Maria
3. [C: Queres que a Marina venha para que o jantar possa ser servido.]
Marina
4. [C: Um amigo que não vias há muito está no topo das escadas. Resolves chamá-lo:]
Mário
5. [C: Gostarias de falar com o teu colega mas ele está afastado e não sabes se te vai ouvir:]
Miguel
6. [C: A tua empregada acabou de sair e esqueceu-se de levar o pagamento da semana. Decides chamá-la:]
Mariana
7. [C: Um aluno saiu da sala sem levar a sua mala. A professora tenta ainda apanhá-lo:]
Maximiliano
8. [C: Um amigo do teu filho esqueceu-se do telemóvel em tua casa. Ele acabou de sair e tentas ainda ir a tempo:]
Valdemar

• **Sandhi phenomena**

- Frota 2000, Chapter 2+Appendix IA

1. As alunas ofereceram canetas aos amigos.
2. Todas as alunas ofereceram canetas aos amigos.

3. As oito alunas ofereceram canetas aos amigos.
4. As duas alunas ofereceram canetas aos amigos.
5. As alunas africanas ofereceram canetas aos amigos.
6. As alunas dos Açores ofereceram canetas aos amigos.
7. As alunas até ao nono ano organizaram uma manifestação.
8. As alunas apenas ofereceram pijamas aos amigos.
9. As alunas oraram pouco na missa.
10. As alunas ouviram mal o espectáculo.
11. As alunas ofereceram pijamas amarelos aos amigos.
12. Todos nós oferecemos orquídeas às idosas.
13. Todos nós oferecemos orquídeas claras às idosas.
14. Todos nós oferecemos oito orquídeas às idosas.
15. As alunas, até onde sabemos, obtiveram boas avaliações.
16. A aluna africana ofereceu flores às colegas japonesas.
17. A aluna aceitou o emprego no restaurante chinês.
18. A aluna apenas ofereceu flores ao professor de Português.
19. A aluna, após o exame, foi para a discoteca.
20. A caneta âmbar foi vendida ontem.
21. A tábula âmbar foi vendida ontem
22. A aluna ama o professor de matemática.
23. A astróloga ama o professor de matemática.
24. A aluna ama muito o irmão mais novo.
25. A astróloga ama muito o irmão mais novo.
26. A aluna, antes de partir, falou com os colegas.
27. A astróloga, antes de partir, falou com os colegas.
28. O galã africano enviou uma carta à cantora.
29. O galã afoito enviou uma carta à cantora.
30. O galã aceitou o papel de bandido.
31. O galã aceita o papel de bandido.
32. O galã apenas enviou flores à bailarina.
33. O galã apanhou sempre o melhor papel.
34. O galã, até partir, não revelou a sua identidade.
35. O galã, ameaçado pelo rival, revelou a sua identidade.
36. O músico africano cantou várias canções.
37. O músico aceitou o emprego no restaurante.
38. O músico apenas dedicou a canção à mãe.
39. O músico, após a audição, saltou para a plateia.
40. O vestido âmbar foi vendido ontem.
41. O púlpito âmbar foi leiloado ontem.
42. O músico ama a bailarina russa.
43. O dançarino ama a bailarina russa.
44. O músico anda sempre de limusine preta.
45. O bailarino anda sempre de limusine preta.
46. O músico, antes de partir, falou com os amigos.
47. O bailarino, antes de partir, falou com os amigos.
48. Ouvi apenas, não cheguei a ver.
49. Ouvi apitar, mas não cheguei a ver o carro.
50. Ontem vi antenas de televisão à venda.
51. Ontem vi aparelhos de televisão à venda.
52. Ontem vi apenas rapazes na festa.
53. Ontem vi animais domésticos na festa.
54. Vi, após o tiro, um vulto a fugir.

55. Vi, afrontando o bandido, um grupo de crianças.
56. O meu pai herdou um campo poluído.
57. O meu avô deixou-me um campo poluído para recuperar.
58. O campo poluído que herdei não é cultivável.
59. O meu avô deixou-me um campo pouco fértil.
60. Um campo pouco fértil foi leiloado ontem.
61. O campo perdia-se de vista até ao horizonte.
62. O campo podia estender-se até ao ribeiro.
63. O campo, poluído mas recuperável, foi uma boa aquisição.
64. O campo, porque foi leiloado, rendeu algum dinheiro.

• **Phrasing (syntactic/prosodic structure and phrase length)**

- Frota 2000, Chapter 2+Appendix IB/C -> constituents length, phrasing and IP boundaries

1. As alunas estrangeiras nos Açores, até onde sabemos, aceitaram vir.
2. A aluna, cansada mas divertida, andou mais cinco quilómetros.
3. O músico, após o conflito, abandonou a sala.
4. Espera sentada. A Maria vai demorar.
5. O músico compôs uma opereta. Ela inspirou-o.
6. [C: Quem ofereceu as rosas ao monitor?]
As alunas ofereceram as rosas ao monitor.
7. [C: O que é que as alunas ofereceram ao monitor?]
As alunas ofereceram as rosas ao monitor.
8. [C: A quem é que as alunas ofereceram as rosas?]
As alunas ofereceram as rosas ao monitor.
9. [C: O que é que as alunas fizeram ao monitor?]
As alunas ofereceram as rosas ao monitor.
10. [C: A quem é que a velhota deu as ágatas?]
A velhota deu as ágatas à garota.
11. [C: Ouvi dizer:]
Os cartógrafos entregaram as ânforas às arqueólogas.
12. [C: Foram os mergulhadores que entregaram as ânforas às arqueólogas.]
Os cartógrafos entregaram as ânforas às arqueólogas.
13. [C: Foram os mapas que os cartógrafos entregaram às arqueólogas.]
Os cartógrafos entregaram as ânforas às arqueólogas.
14. [C: Foi ao antiquário que os cartógrafos entregaram as ânforas.]
Os cartógrafos entregaram as ânforas às arqueólogas.
15. [C: Ouvi dizer:]
As americanas ofereceram a enciclopédia ao jornalista.
16. [C: Foram as africanas que ofereceram a enciclopédia ao jornalista.]
As americanas ofereceram a enciclopédia ao jornalista.
17. [C: Foi o dicionário que as americanas ofereceram ao jornalista.]
As americanas ofereceram a enciclopédia ao jornalista.

18. [C: Foi ao escritor que as americanas ofereceram a enciclopédia.]
As americanas ofereceram a enciclopédia ao jornalista.

- RLD *corpus* (Elordieta et al. 2003; D’Imperio et al. 2005; Elordieta, Frota & Vigário 2005; Prieto et al. 2006; Frota et al. 2007)

1. NON-BRANCHING (S=3 σ ; L=5 σ), 8 cases

SSS A loura mirava morenos
LLL A boliviana memorizava uma melodia
SLL A loura memorizava uma melodia
SSL A loura falava do namorado
LSS A boliviana mimava velhinhas
LLS A boliviana memorizava dilemas
SLS A loura memorizava dilemas
LSL A boliviana falava do namorado

2. SHORT BRANCHING SUBJECT/OBJECT (N+PP=5 σ ; N+AP=5 σ) (24 cases)

BRANCHING SUBJECT

N+AP SS A nora loura mimava meninos
N+AP LL A nora loura memorizava uma melodia
N+AP SL A nora loura falava do namorado
N+AP LS A nora loura memorizava dilemas

N+PP SS A nora da mãe mimava meninos
N+PP LL A nora da mãe memorizava uma melodia
N+PP SL A nora da mãe falava do namorado
N+PP LS A nora da mãe memorizava dilemmas

BRANCHING OBJECT

SS N+AP A nora mirava velhinhas lindas
LL N+AP A boliviana maravilhava velhinhas lindas
SL N+AP A nora maravilhava velhinhas lindas
LS N+AP A boliviana mirava velhinhas lindas

SS N+PP A mulher levava liras na mala
LL N+PP A boliviana manuseava liras na mala
SL N+PP A mulher manuseava liras na mala
LS N+PP A boliviana levava liras na mala

BRANCHING SUBJECT AND OBJECT

N+AP S N+AP A nora loura mirava velhinhas lindas

N+AP S N+PP	A nora loura levava liras na mala
N+PP S N+AP	A nora da mãe mirava velhinhas lindas
N+PP S N+PP	A nora da mãe levava liras na mala
N+AP L N+AP	A mulher loura maravilhava velhinhas lindas
N+AP L N+PP	A mulher loura manuseava liras na mala
N+PP L N+AP	A nora da mãe maravilhava velhinhas lindas
N+PP L N+PP	A nora da mãe manuseava liras na mala

3. LONG BRANCHING SUBJECT/OBJECT (N+PP=10 σ ; N+AP=10 σ) (24 cases)

BRANCHING SUBJECT

N+AP SS	O boliviano mulherengo mirava morenas
N+AP LL	O boliviano mulherengo memorizava uma melodia
N+AP SL	O boliviano mulherengo gravava uma melodia
N+AP LS	O boliviano mulherengo maravilhava morenas
N+PP SS	O boliviano da brasileira mirava morenas
N+PP LL	O boliviano da brasileira memorizava uma melodia
N+PP SL	O boliviano da brasileira gravava uma melodia
N+PP LS	O boliviano da brasileira maravilhava morenas

BRANCHING OBJECT

SS N+AP	A loura gravava uma melodia maravilhosa
LL N+AP	A boliviana memorizava uma melodia maravilhosa
SL N+AP	A loura memorizava uma melodia maravilhosa
LS N+AP	A boliviana gravava uma melodia maravilhosa
SS N+PP	A loura gravava uma melodia do lagareiro
LL N+PP	A boliviana memorizava uma melodia do lagareiro
SL N+PP	A loura memorizava uma melodia do lagareiro
LS N+PP	A boliviana gravava uma melodia do lagareiro

BRANCHING SUBJECT AND OBJECT

N+AP S N+AP	O boliviano mulherengo gravava uma melodia maravilhosa
N+AP S N+PP	O boliviano mulherengo gravava uma melodia do lagareiro
N+PP S N+AP	O boliviano da brasileira gravava uma melodia maravilhosa
N+PP S N+PP	O boliviano da brasileira gravava uma melodia do lagareiro
N+AP L N+AP	O boliviano mulherengo memorizava uma melodia maravilhosa
N+AP L N+PP	O boliviano mulherengo memorizava uma melodia do lagareiro
N+PP L N+AP	O boliviano da brasileira memorizava uma melodia maravilhosa
N+PP L N+PP	O boliviano da brasileira memorizava uma melodia do lagareiro

4. DOUBLE BRANCHING SUBJECT/OBJECT (20 cases)

SHORT DOUBLE BRANCH (3+3+3=9σ)

N-AP-PP SS A nora morena da velha levava marmelos
N-AP-PP LL A nora morena da velha memorizava uma melodia
N-AP-PP SL A nora morena da velha gravava uma melodia
N-AP-PP LS A nora morena da velha maravilhava meninos

SS N-AP-PP O homem mirava a nora morena da velha
LL N-AP-PP O namorado maravilhava a nora morena da velha
SL N-AP-PP O homem maravilhava a nora morena da velha
LS N-AP-PP O namorado mirava a nora morena da velha

N-AP-PP S N-AP-PP A nora morena da velha levava dinheiro libanês na mala
N-AP-PP L N-AP-PP A nora morena da velha manuseava dinheiro libanês na mala

LONG DOUBLE BRANCH (5+5+5=15σ)

N-AP-PP SS O namorado megalómano da brasileira mirava morenas
N-AP-PP LL O namorado megalómano da brasileira memorizava uma melodia
N-AP-PP SL O namorado megalómano da brasileira gravava uma melodia
N-AP-PP LS O namorado megalómano da brasileira maravilhava morenas

SS N-AP-PP A loura gravava uma melodia maravilhosa do lagareiro
LL N-AP-PP O namorado memorizava uma melodia maravilhosa do lagareiro
SL N-AP-PP A loura memorizava uma melodia maravilhosa do lagareiro
LS N-AP-PP O namorado gravava uma melodia maravilhosa do lagareiro

N-AP-PP S N-AP-PP O namorado megalómano da brasileira gravava uma melodia
maravilhosa do lagareiro
N-AP-PP L N-AP-PP O namorado megalómano da brasileira memorizava uma melodia
maravilhosa do lagareiro

- Romance extended -> proper names and compounds

Extended 1 (Vigário & Fernandes-Svartman 2010)

Short branching SU (5syl)

- SSS A Nina Veiga mimava meninos (5-3-3)
- SLL A Paula Moura memorizava uma música (5-5-5)
- SSL A Lara Braga falava do namorado (5-3-5)
- SLS A Mila Fraga memorizava dilemas (5-5-3)

Short branching O

- SSS O livro falava de Mila Fraga (3-3-5)
- LLS Os brasileiros maravilham a Nina Veiga (5-5-5)

- SLS As docas maravilhavam a Lara Braga (3-5-5)
- LSS O brasileiro gostava da Paula Moura (5-3-5)

Short br. SU and O

- SSS A Lara Braga falava do Pedro Frota (5-3-5)
- SSS O Neno Veiga gostava da Paula Moura (5-3-5)
- SLS A Nina Braga colaborava com Lara Veiga (5-5-5)
- SLS O Mauro Prata maravilhava Marisa Fraga (5-5-5)

Note: here we have two sentences for the same condition; thus, one of these can be eliminated.

Long branching SU

- LSS A Margarida Gregoriano mimava meninos (10-3-3)
- LLL A Madalena Vitoriana memorizava uma música (10-5-5)
- LSL A Belarmina Florenciano falava do namorado (10-3-5)
- LLS A Florentina Sebastiano memorizava dilemas (10-5-3)

Long branching O

- SSL O livro falava de Belarmina Florenciano (3-3-10)
- LLL Os brasileiros maravilhavam a Margarida Gregoriano (5-5-10)
- SLL As docas maravilhavam a Belarmina Florenciano (3-5-10)
- LSL O brasileiro gostava da Florentina Sebastiano (5-3-10)

Long br. SU and O

- LSL A Margarida Gregoriano falava do Marcelino Romaniano (10-3-10)
- LSL O Adelino Graciliano gostava da Florentina Sebastiano (10-3-10)
- LLL A Belarmina Florenciano colaborava com a Firmina Vitoriano (10-5-10)
- LLL O Bernardino Romaniano rivalizava com Madalena Firminiano (10-5-10)

Note: here we have two sentences for the same condition; thus, one of these can be eliminated.

Extended 2 (Vigário & Fernandes-Svartman 2010)

Short br. SU

O além-vida dislumbra videntes
 O além-vida potenciava charlatanices
 As mini-jóias encantam as empregadas
 As mini-jóias enlouqueciam as jovens

Sort br. O

As amas temiam o além-vida
 As amas acreditavam no além-vida

O trabalhador montava mini-empresas
O trabalhador desmantelava mini-empresas

Short br SU e O

O luso-francês adora mini-empresas
O luso-francês imaginava as mini-jóias

Long br. SU

O latino-asiático mirava morenas
Os ibéro-italianos memorizavam as melodias
O latino-asiático gravava umas músicas
O ibéro-italiano maravilhava morenas

Long br. O

Os homens temiam o macro-endividamento
As viaturas interessaram os ibéro-italianos
Os carros interessaram os ibéro-italianos
A brasileira falava do macro-endividamento

Long br. SU e O

O ibéro-italiano falava do macro-endividamento
Os recém-endinheirados maravilhavam as ibéro-italianas

• **Rhythm**

- Ramus, Nespór & Mehler 1999 (translated and adapted by Frota & Vigário 2001)

I-15

1. Um quadro de grande valor foi leiloado ontem.
2. Inteiraram-se da notícia naquele jornal.
3. A rádio deu essa notícia no domingo.
4. Quando não se sabe, o mais rápido é perguntar.
5. O miúdo levantou-se cedo para ver o sol.
6. Tem havido inundações graves neste Outono.
7. Os miúdos saiem todos os dias às três horas.
8. Nunca lhe deram a hipótese de se exprimir.

II-16

1. A loja está aberta durante todo o dia.
2. O ladrão fugiu com a pulseira de ouro do meu pai.
3. O novo presidente será eleito em Outubro.
4. Nesta pastelaria fazem-se os melhores pastéis.
5. Para isso precisávamos de muito mais dinheiro.
6. Os pais aproximaram-se do miúdo sem ruído.
7. Tiveram de ir buscá-lo o mais depressa possível.
8. Houve uma manifestação no centro da cidade.

III - 17

1. As lojas fecham particularmente cedo ao sábado.
2. Os artistas foram sempre atraídos pelas cidades.
3. Deu o seu último concerto no teatro municipal.
4. Passaram catorze minutos desde que o metro chegou.
5. Os recentes acontecimentos foram escandalosos.
6. Os vizinhos dos meus avós são gente muito agradável.
7. Parece que vamos ter muito sol na costa atlântica.
8. Quando começa a chover, o céu tem uma cor escura.

IV - 18

1. A reconstrução da cidade começou no ano passado.
2. Os países ocidentais não vão sair da crise actual.
3. Encontrar um emprego não é fácil no presente contexto.
4. Os sindicatos perderam parte da sua influência.
5. As raparigas saiem cada vez mais cedo de casa dos pais.
6. A última exposição universal foi em São Francisco.
7. Muita gente tem vindo celebrar a vitória connosco.
8. A descida das taxas de juro foi muito elogiada.

V - 19

1. Chove muito durante todo o ano nos países tropicais.
2. A pintura contemporânea tem cada vez maior êxito.
3. A inflação subiu cerca de cinco pontos no ano passado.
4. Não percebi nada do livro que me emprestaste da outra vez.
5. Os deputados votaram pela condenação à morte do rei.
6. Este castelo é um monumento histórico importante.
7. O director disse que a situação estava sob controlo.
8. O orçamento do ministério da cultura baixou muito.

VI - 20

1. A esposa do cabeleireiro vai sair para ir ao mercado.
2. A *Consagração da Primavera* tem feito escândalo em Paris.
3. Aqueles leões refastelaram-se a comer um grupo de cristãos.
4. Mais vale ser de esquerda e bonito que feio e de direita.
5. A corrente ecológica cresceu bastante na classe média.
6. A música deste compositor é muito hermética para mim.
7. No Verão, as grandes cidades europeias enchem-se de turistas.
8. Parece-me que se tu o fizeres desta maneira saís-te melhor.

VII - 21

1. Se os idiotas tivessem asas, nunca mais se podia ver o sol.
2. A casa deste camponês é a mais alta de toda a povoação.
3. Uma nova galeria de arte vai abrir no centro comercial.
4. Deus, ciente de que não era possível vigiar todos, criou as mães.
5. Há alturas em que me apetece ficar em casa sem fazer nada.
6. As probabilidades de ter SIDA são maiores do que há dez anos.

- Frota & Vigário 2001 (EP/BP)

Corpus made by Marina Vigário, Sónia Frota and Charlotte Galves.

1. A modernização foi satisfatória.
2. A autoridade do governador diminuiu.
3. O investigador já devolveu o dinheiro.
4. O organizador apresentou a catalogadora.
5. A falta de modernização é catastrófica.
6. O trabalho da pesquisadora foi publicado.
7. O professor também o descreveu aos alunos.
8. O governador aceitou a modernização.
9. A falta de autoridade foi alarmante.
10. O investigador já lhe devolveu o dinheiro.
11. A catalogadora compreendeu o trabalho da pesquisadora.
12. A professora discutiu a gramaticalidade.
13. A inteligência da catalogadora foi determinante.
14. O investigador já ofereceu dinheiro.
15. A procura da gramaticalidade é o nosso objectivo.
16. A pesquisadora perdeu autoridade.
17. O professor também descreveu os alunos.
18. A autoridade cabe ao governador.
19. O investigador já me ofereceu dinheiro.
20. A gramaticalidade das frases foi conseguida.

Appendix II

New Corpora (Set for the South)

(list of sentences)

a) word-final <-r> (verbs)

- 1- Podes **cantar**]PhP no palco. (4 síl.)
- 2- A Lina pediu ao António para **cantar**.]IP
- 3- **Cantar** sempre]PhP dá alegria. (4 síl.)
- 4- C: A Lina e o António foram a uma festa. Sabes o que a Lina disse ao António?
A Lina pediu para **cantar**,]IP [ao António]IP
- 5- Vamos **correr**]PhP na festa.
- 6- O Miguel pede à cadela para **correr**.]IP
- 7- **Correr** muito]PhP dá músculo.
- 8- C: O Miguel leva a cadela a passear. Sabes o que o Miguel diz à cadela?
O Miguel pede para **correr**,]IP [à cadela.]IP
- 9- Podes **dormir**]PhP na tenda.
- 10- O Nuno pediu à madrinha para **dormir**.]IP
- 11- **Dormir** pouco]PhP dá cansaço.
- 12- C: O Nuno foi passar a tarde a casa da madrinha. Sabes o que o Nuno disse à madrinha?
O Nuno pediu para **dormir**,]IP à madrinha.]IP
- 13- Deves **dar**]PhP com amor. (3 síl.)
- 14- A Carla pede à Marina para **dar**.]IP
- 15- **Dar** quatro]PhP é compaixão. (3 síl.)
- 16- C: Há crianças pequenas a pedir, na rua em que a Carla e a Marina passam. Sabes o que a Carla diz à Marina?
A Carla pede para **dar**,]IP [à Marina.]IP
- 17- Vamos **ler**]PhP no jardim.
- 18- O Lucas pediu ao professor para **ler**.]IP
- 19- **Ler** sempre]PhP dá prática.
- 20- C: O Lucas é um aluno que gosta muito de participar nas aulas. Sabes o que o Lucas disse ao professor?
O Lucas pediu para **ler**,]IP [ao professor.]IP
- 21- Podes **rir**]PhP na aula.
- 22- O rapaz disse à menina para **rir**.]IP
- 23- **Rir** muito]PhP dá saúde.
- 24- C: O rapaz caiu e a menina conteve-se. Sabes o que o rapaz sugeriu à menina?
O rapaz disse para **rir**,]IP [à menina.]IP

b) word-final <-r> (nouns)

- 1- Aquele **sabor**]PhP ficava na memória. (5 síl.)
- 2- A cozinheira inventou outro **sabor**.]IP
- 3- O **sabor** frutado]PhP enjoa. (6 síl.)
- 4- C: A cozinheira daquele restaurante é muito criativa. Sabes o que inventou a cozinheira?
Inventou outro **sabor**,]IP [a cozinheira.]IP
- 5- Aquele **flor**]PhP secava num instante. (4 síl.)

- 6- O jardineiro plantava uma **flor**.]IP
7- A **flor** vermelha]PhP murchava. (5 síl.)
8- C: Aquele jardim está a ser plantado por uma só pessoa. Sabes o que plantava o jardineiro?
Plantava uma **flor**,]IP [o jardineiro.]IP
9- Aquele **radar**]PhP detecta os recantos.
10- O viajante usava esse **radar**.]IP
11- O **radar** manual]PhP parava.
12- C: Sempre que ia de viagem, ele precisava de um instrumento de orientação. Sabes o que usava o viajante?
Usava esse **radar**,]IP [o viajante.]IP
13- Aquele **mar**]PhP rolava na areia.
14- O marinheiro navega nesse **mar**.]IP
15- O **mar** calminho]PhP encanta.
16- C: O Mar Vermelho está revoltado, mas o marinheiro ignora este facto. Sabes o que faz o marinheiro?
Navega nesse **mar**,]IP [o marinheiro.]IP

c) word-final <-l>

- 1- Aquele **jornal**]PhP critica o governo. (5 syl.)
2- O fotógrafo acusa esse **jornal**.]IP
3- O **jornal** búlgaro]PhP encerrou. (6 syl.)
4- C: O fotógrafo foi alvo de difamação por esse jornal. Sabes o que faz o fotógrafo?
Acusa esse **jornal**,]IP [o fotógrafo.]IP
5- Aquele **papel**]PhP forrava a parede.
6- A impressora rejeita este **papel**.]IP
7- O **papel** brilhante]PhP ofusca.
8- C: Não consigo imprimir estes documentos. Sabes o que acontece à impressora?
Rejeita este **papel**,]IP [a impressora.]IP
9- Aquele **sal**]PhP reforça o tempero. (4 syl.)
10- O cozinheiro usava esse **sal**.]IP
11- O **sal** marinho]PhP esgotou. (5 syl.)
12- C: Esta comida tem um sabor especial. Sabes que condimento o cozinheiro usava?
Usava esse **sal**,]IP [o cozinheiro.]IP
13- Aquele **mel**]PhP sabia a melaço.
14- A Margarida comia esse **mel**.]IP
15- O **mel** caseiro]PhP acabou.
16- C: A Margarida nunca se constipava. Sabes o que a Margarida fazia?
Comia esse **mel**,]IP [a Margarida.]IP

d) word-final [E]

- 1- Aquele **café**]PhP desperta os sentidos. (5 syl.)
2- O presidente tomava esse **café**.]IP
3- O **café** português]PhP lidera. (6 syl.)
4- C: O café verde é delicioso. Sabes o que o presidente tomava?
Tomava esse **café**,]IP [o presidente.]IP

- 5- Aquele **boné**]PhP parece um barrete.
 6- A vendedora sugere este **boné**.]IP
 7- O **boné** cinzento]PhP factura.
 8- C: Há vários bonés giros na loja. Sabes o que a vendedora sugere?
 Sugere este **boné**,]IP [a vendedora.]IP
 9- Aquela **sé**]PhP fechava as portadas. (4 syl.)
 10- O sacerdote erguia esta **sé**.]IP
 11- A **sé** romana]PhP domina. (5 syl.)
 12- C: O povo queixava-se porque não havia sé. Sabes o que o sacerdote fazia?
 Erguia esta **sé**,]IP [o sacerdote.]IP
 13- A nossa **fé**]PhP condena o pecador.
 14- Os peregrinos bradavam a **fé**.]IP
 15- A **fé** profunda]PhP conforta.
 16- C: Os peregrinos foram a pé a Fátima. Sabes o que os peregrinos proclamavam?
 Bradavam a **fé**,]IP [os peregrinos.]IP

e) word-final [a]

- 1- O outro **sofá**]PhP cabia na carrinha. (5 syl.)
 2- Os vendedores adoram este **sofá**.]IP
 3- O **sofá** velhote]PhP magoa. (6 syl.)
 4- C: Naquela loja de mobílias, os vendedores recomendam sempre aquilo de que gostam.
 Sabes do que gostam os vendedores?
 Adoram este **sofá**,]IP [os vendedores.]IP
 5- Aquele **crachá**]PhP decora o casaco.
 6- Os vencedores exibem este **crachá**.]IP
 7- O **crachá** dourado]PhP sobressai.
 8- C: Havia um prémio para todos os vencedores. Sabes o que os vencedores mostram?
 Exibem este **crachá**,]IP [os vencedores.]IP
 9- Aquele **chá**]PhP coopera na digestão. (4 syl.)
 10- Os produtores produzem esse **chá**.]IP
 11- O **chá** vermelho]PhP acalma. (5 syl.)
 12- C: O chá vermelho está a ter muita saída. Sabes o que fazem os produtores?
 Produzem esse **chá**,]IP [os produtores.]IP
 13- Aquela **pá**]PhP riscava o soalho.
 14- Os operários fabricam essa **pá**.]IP
 15- A **pá** manchada]PhP repugna.
 16- C: A pá em formato quadrado está a ser muito procurada. Sabes o que fazem os operários?
 Fabricam essa **pá**,]IP [os operários.]IP

f) word-final [O]

- 1- A nossa **avó**]PhP bordava as cortinas. (5 syl.)
 2- A professora recebe uma **avó**.]IP
 3- A **avó** paterna]PhP ressona. (6 syl.)
 4- C: O director quer falar com a professora. Sabes o que a professora está a fazer?
 Recebe uma **avó**,]IP [a professora.]IP

- 5- O nosso **trenó**]PhP desflora a colina.
- 6- O desportista prefere este **trenó**.]IP
- 7- O **trenó** castanho] parava.
- 8- C: Há vários acessórios para a neve nessa loja. Sabes o que o desportista prefere?
Prefere este **trenó**,]IP [o desportista.]IP
- 9- Aquela **mó**]PhP rodava com rapidez. (4 syl.)
- 10- O carpinteiro conserta esta **mó**.]IP
- 11- A **mó** novinha]PhP funciona. (5 syl.)
- 12- C: O moinho parou e o carpinteiro foi para lá. Sabes o que o carpinteiro está a fazer?
Conserta esta **mó**,]IP [o carpinteiro.]IP
- 13- Aquele **nó**]PhP fechava a sacola.
- 14- O marinheiro enlaça este **nó**.]IP
- 15- O **nó** pequeno]PhP aperta.
- 16- C: A corda partiu-se. Sabes o que o marinheiro está a fazer?
Enlaça este **nó**,]IP [o marinheiro.]IP

g) word-final morphologic/non-morphological [S]

- 1- Nunca **vês**]PhP pouca poluição. (3 syl.)
 - 2- O menino pensa que nunca **vês**.]IP
 - 3- Nunca **vês** tudo]PhP dessa posição. (5 syl.)
 - 4- C: Como não dizes nada, sabes qual é a opinião do menino?
Pensa que nunca **vês**,]IP [o menino.]IP
 - 5- Desta **vez**]PhP poupo dinheirinho. (3 syl.)
 - 6- A senhora passa a tua **vez**.]IP
 - 7- É a **vez** certa]PhP para terminar. (5 syl.)
 - 8- C: Se não estiveres a horas, sabes o que a senhora faz?
Passa a tua **vez**,]IP [a senhora.]IP
 - 9- Este **rapaz**]PhP trouxe caramelos. (4 syl.)
 - 10- O polícia prendeu aquele **rapaz**.]IP
 - 11- Este **rapaz** forte]PhP veste macacão. (6 syl.)
 - 12- C: Houve um assalto no supermercado. Sabes o que o polícia fez?
Prendeu aquele **rapaz**,]IP [o polícia.]IP
 - 13- Esses **sofás**]PhP trazem almofadas. (4 syl.)
 - 14- O cliente comprou catorze **sofás**.]IP
 - 15- Estes **sofás** pretos]PhP ficam horríveis. (6 syl.)
 - 16- C: Como gostou de tudo, sabes o que o cliente fez?
Comprou catorze **sofás**,]IP [o cliente.]IP
- word-final nasal [~e], in stressed position
- 1- Este **vintém**]PhP vale pouquito. (4 syl.)
 - 2- Este bacalhau custava um **vintém**.]IP
 - 3- Um **vintém** furado]PhP não vale nada. (6 syl.)
 - 4- C: Hoje vendiam bacalhau na praça. Sabes se este bacalhau era caro?
Custava um **vintém**,]IP [este bacalhau.]IP
 - 5- O **além**]PhP fica distante. (3 syl.)
 - 6- Este desenho mostrava o **além**.]IP

- 7- **Além** daquilo]PhP não pediu nada. (5 syl.)
8- C: A exposição tinha quadros interessantes. Sabes o que este desenho representava?
Mostrava o **além**,]IP [este desenho.]IP
- 9- Todo o **bem**]PhP deve persistir. (4 syl.)
10- Este príncipe pratica o **bem**.]IP
11- O **bem** fervoroso]PhP não pode faltar. (6 syl.)
12- C: Há príncipes muito egoístas. Sabes qual é a atitude deste príncipe?
Pratica o **bem**,]IP [este príncipe.]IP

- word-final <-e>, in unstressed position

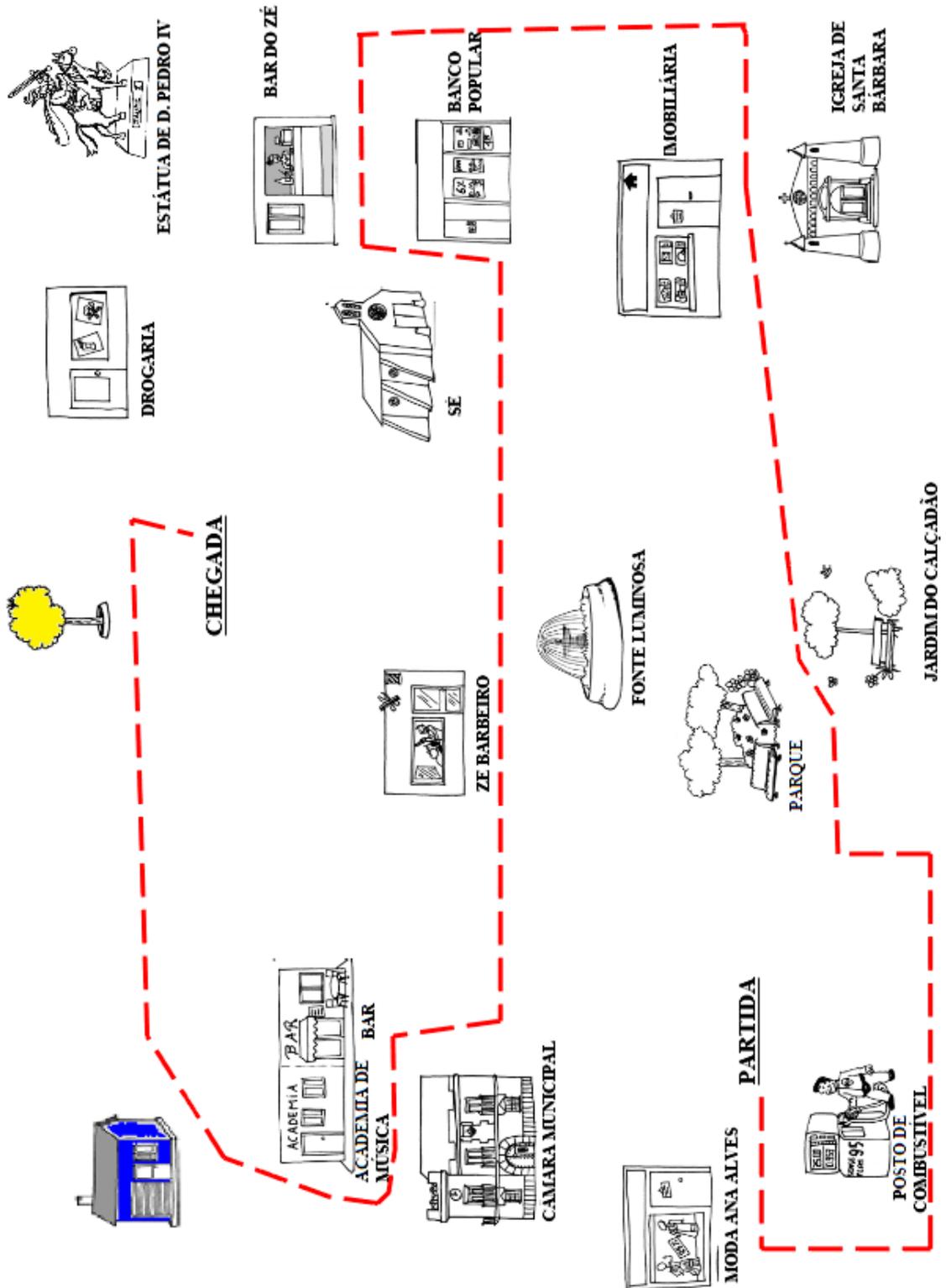
- 1- Aquela **fonte**]PhP parece um riacho. (5 syl.)
2- O empreiteiro recupera essa **fonte**.]IP
3- A **fonte** velhota]PhP estancou. (6 syl.)
4- C: A fonte da aldeia rachou. Sabes o que o empreiteiro está a fazer?
Recupera essa **fonte**,]IP [o empreiteiro.]IP
- 5- Aquela **ponte**]PhP separa as aldeias.
6- O viajante circula nessa **ponte**.]IP
7- A **ponte** recente]PhP encerrou.
8- C: Esta noite vai haver fogo de artifício nessa ponte, o que afectará a circulação. Sabes onde anda o viajante?
Circula nessa **ponte**,]IP [o viajante.]IP

Appendix III

Map Task

also available at InAPoP - <http://www.fl.ul.pt/laboratoriofonetica/InAPoP/methodology>

(Giver's map)



Appendix IV

Discourse Completion Test (DCT)

(<http://www.fl.ul.pt/laboratoriofonetica/InAPoP/methodology>)

1. ENTOAÇÃO DECLARATIVA - STATEMENTS

1.1. Neutra - Neutral

1. Sabes o que aconteceu a estes dois que encontrámos no outro dia?



Casaram

2. Olha para o desenho e diz o que (é que) a mulher faz.



Bebe uma limonada

3. Este é o galã da novela. Diz que o galã anda de porsche.



O galã anda de porsche

Enumeração - Enumeration

4. Diz os meses do ano.

Janeiro, Fevereiro...

5. Diz de que frutas gostas mais.

Maçã, banana, pêra...

1.2. Não neutra – Not neutral/Marked

Focalização contrastiva – Contrastive focus

6. E então, o que é que aconteceu aos donos do restaurante? Separaram-se?



Casaram

Exclamativa - Exclamative

7. Entrás numa padaria e agrada-te o cheiro. Exclamas que o cheiro a pão é tão bom.

Que cheiro a pão tão bom!

Declarativa categórica – Contradiction Statement

8. Estás a falar com a Júlia sobre os vossos amigos que vão viver para o estrangeiro. Tu tens a certeza de que vão para Lima, mas a tua amiga pensa que vão para Bogotá. Diz-lhe que não, que vão para Lima.

Não, eles vão para Lima!

Declarativa dubitativa – Uncertainty Statement

9. Pediram-te para comprar uma lembrança para alguém que não conheces muito bem e tens receio de não ter feito a compra certa. Diz a quem te pediu esse favor que a pessoa pode não gostar do que lhe compraste.

Ela pode não gostar da lembrança que lhe comprei.

Declarativa óbvia – Statement of the obvious

10. Estás com uma amiga e contas-lhe que a Maria, uma amiga comum, está grávida. Ela pergunta-te se é do Guilherme e tu ficas admirada porque todos sabem que é dele, o seu namorado de sempre. Diz-lhe que sim, claro, do Guilherme!

Sim, claro, do Guilherme!

2. INTERROGATIVAS ABSOLUTAS – YES-NO QUESTIONS

2.1. Neutra – Information-seeking

Oração de uma unidade tonal – Question with one tonal unit

11. Entras numa loja e perguntas ao lojista se tem compota:

Tem compota?

- 11b. Saíste de casa e viste a rua molhada. Perguntas se choveu: [ADDED]

Choveu?

Disjunção – Disjunctive Yes-No Question

12. Não sabes o que a tua amiga vai querer para sobremesa. Pergunta-lhe se quer laranja ou gelatina.

Queres laranja ou gelatina?

Enumeração – Enumeration

- com disjunção – with disjunction

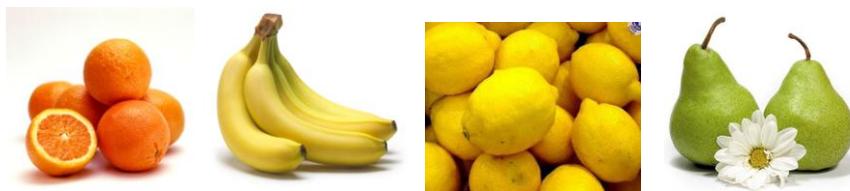
13. Não sabes que fruta a tua amiga vai querer comprar. Perguntas se quer laranjas, bananas, limões ou pêras:



Queres laranjas, bananas, limões ou pêras?

- com coordenação – with coordination

13b. Foste às compras com a tua irmã, mas já não te lembras que frutas ela queria comprar. Perguntas-lhe se quer laranjas, bananas, limões e pêras:



Queres laranjas, bananas, limões e pêras? [ADDED]

2.1. Não neutra – Not neutral/Marked

Pergunta confirmatória – Confirmation-seeking Yes-No Question

14. Sabes que lá fora está muito frio. Uma pessoa agasalhada entra e confirmas se tem frio.

Tens frio?

Pergunta confirmatória (com tag) – Confirmation-seeking Yes-No Question (with tag)

15. Já tinhas convidado a tua prima para ir hoje jantar a tua casa. Com receio de que ela não se lembre, perguntas, em jeito de confirmação, se ela vem jantar:

Vens jantar, certo?

15b. Encontraste o teu vizinho no centro comercial. Como sabes que ele só ali entra para ir ao cinema, perguntas, em jeito de confirmação, se foi ao cinema:

Foste ao cinema, não foste? [ADDED]

Pergunta imperativa – Imperative Yes-No question

16. Os teus netos fazem muito barulho e não te deixam ouvir a televisão. Pedes-lhes para se calarem.

Calam-se?

16b. Os teus netos fazem muito barulho e não te deixam ouvir a televisão. Pedes-lhes para se calarem. [ADDED]

Podem calar-se?

17. Pergunta aos teus sobrinhos se querem caramelos.

Querem caramelos?

3. INTERROGATIVAS PARCIAIS – Wh-Questions

3.1 Neutra – Information-Seeking

Orações de uma unidade tonal – Questions with one tonal unit

18. Pergunta que horas são.

Que horas são?

19. Tens de ir a Paris e queres comprar um presente a uma pessoa que não conheces bem. Pedes um conselho a um amigo. Pergunta que lhe daria.

Que lhe darias?

19b. Soubeste que estive a falar muito tempo com a Maria. Pergunta-me o que me contava. [ADDED]

Que te contava?

Oração de mais de uma unidade tonal com coordenação – Question with more than one tonal unit with coordination

20. Vês que a tua amiga Maria vai embora, e perguntas-lhe onde vai e quando voltará:

Onde vais e quando voltarás?

3.2 Não neutra – Not neutral/Marked

Perguntas imperativas – Imperative wh-questions

21. Pedes ao teu filho que pinte a casa, mas não acreditas que ele o faça tão depressa, até porque não é a primeira vez que pedes. Pergunta-lhe, com ar aborrecido, quando o fará.

Quando o farás?

22. Gostavas que uns amigos viessem almoçar a tua casa. Meio suplicante (porque eles já te disseram que não podem) perguntas-lhes por que não vêm:

Por que não vêm?

4. PERGUNTAS ECO – Echo Questions

4.1. Não neutra – Not neutral/Marked

Pergunta eco absoluta – Neutral Yes-No Echo Question

23. Dizem-te as horas, mas não percebes bem. Pensas que te disseram que são nove.
Confirma se são nove.

(Que disseste, que) são nove?

Pergunta eco parcial – Neutral wh-echo question

24. Perguntaram-te onde vais, mas não sabes se percebeste bem. Confirma se te perguntaram isso.

(Que perguntaste,) onde vou?

Disjunção – Disjunctive echo question

25. Parece-te que te perguntaram por onde vieste, mas não sabes se, na realidade, te perguntaram por onde entraste. Confirma se te perguntaram uma coisa ou outra.

(Que me perguntaste,) por onde vim ou por onde entrei?

4.2. Não neutra – Not neutral/Marked

Absoluta anti-expectativa - Counterexpectational yes-no echo question

26. Um amigo teu diz-te que um colega vosso, o Mário, vai concorrer para Presidente do clube da terra. Ficas muito surpreendido e voltas a perguntar, ao teu amigo, sem acreditar, se ele está a dizer que o Mário vai concorrer para Presidente.

Estás a dizer que o Mário vai concorrer para Presidente?!

- 26b. Ao contrário do que se esperava, o Manel está a aparecer à frente em todas as sondagens para a presidência da Câmara. Tu reages e perguntas, muito admirado, se o Manel vai ser Presidente: [ADDED]

O Manel vai ser Presidente?!

Parcial anti-expectativa - Counterexpectational wh-echo question

27. A tua vizinha conta-te que foi almoçar a um restaurante e pediu coelho à caçador. Ela diz que lhe deram porco em vez de coelho. Não acreditas. Pergunta-lhe (com admiração) que diz que lhe deram:

Que dizes que te deram?!

5. ENTOAÇÃO IMPERATIVA - IMPERATIVES

Ordem - Command

28. Estás no parque com a tua neta, e ela afasta-se. Manda-a vir, por favor, para junto de ti.

Vem cá, faz favor!

Pedido - Request

29. Queres ir ao cinema com um amigo. Ele diz-te que tem de trabalhar, mas tu sabes que ele pode deixar o trabalho para mais tarde. Queres convencê-lo:

Vá lá, vem!

6.VOCATIVOS - VOCATIVES

30. Queres que a Marina venha para que o jantar possa ser servido. Chama-a:

Marina!

31. Passaram dez segundos e ela ainda não veio. Volta a chamá-la:

Marina!!!

Appendix V

Annotation conventions

SAMPA for Portuguese (SAMPA Homepage: <http://www.phon.ucl.ac.uk/home/sampa/portug.htm>)

Consonants

plosives

Symbol	Word	Transcription
p	pai	"paj
b	barco	"barku
t	tenho	"teJu
d	doce	"dos@
k	com	ko~
g	grande	"gr6nd@

fricatives

f	falo	"falu
v	verde	"verd@
s	céu	"sEw
z	casa	"kaz6
S	chapéu	S6"pEw
Z	jóia	"ZOj6

nasals

m	mar	"mar
n	nada	"nad6
J	vinho	"viJu

liquids

l	lanche	"l6nS@
L	trabalho	tr6"baLu
r	caro	"karu
R	rua	"Ru6

Vowels and diphthongs

i	vinte	"vint@	
	lápiz	"lapiS	
e	fazer	f6"zer	
E	belo	"bElu	
a	falo	"falu	
6	cama	"k6m6	
	madeira	m6"d6jr6	
O	ontem	"Ont6~j~	
o	lobo	"lobu	
u	jus	"ZuS	
	futuro	fu"turu	
@	felizes	f@"liz@S	
i~	fim	"fi~	
e~	emprego	e~"pregu	
6~	irmã	ir"m6~	
o~	bom	"bo~	
u~	um	u~	
aw	mau	"maw	etc.: iw, ew, Ew, (ow)
aj	mais	"majS	etc.: ej, Ej, Oj, oj,
6~j~	tem	"t6~j~	etc.: e~j~, o~j~, u~

