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The yes-no question contour in Brazilian Portuguese: a geographical *continuum*

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The main goal of this paper is to provide a phonological analysis of neutral yes-no questions in Brazilian Portuguese in seven varieties (Paraíba, Sergipe, Bahia, Minas Gerais, Rio de Janeiro, Santa Catarina and Rio Grande do Sul), most of them along the Atlantic Coast. The analysis followed the autosegmental-metrical framework (Ladd, 2008), and the P-ToBI system for intonational labeling (Frota et al. 2015a). The distribution of the nuclear contour indicates a geographical *continuum*, where a rising contour is found in the North and a rising-falling contour in the Center-Southern regions.

Keywords: intonation, yes-no question, dialect *continuum*, Brazilian Portuguese.

1. Introduction

Across languages, the intonation of yes-no questions is characterized by the use of diverse intonational features (Jun, 2005; Ladd, 2008; Frota, Butler & Vigário, 2014, a.o.), such as final pitch (high/rising, e.g. Dutch, Standard Italian, Japanese, or low/falling, e.g. Chickasaw, Palermo Italian, Greek), peak alignment in the nuclear syllable (e.g. Neapolitan Italian), peak

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height (e.g. Russian), or register expansion and reduction of downdrift (e.g. Wollof, Danish). A similar amount of variation has been reported within languages, as yes-no questions have been found to be among the sentence types that display more intonational variation across varieties of a given language (see Savino, 2012 for Italian, Prieto et al., 2015 for Catalan, and Frota et al., 2015a for Portuguese).

Studies have reported that Brazilian Portuguese (BP) and European Portuguese (EP) varieties can differ in several intonational dimensions, such as the tonal inventory, phrasing and the distribution of pitch accents (Frota et al., 2015a). The yes-no question sentence type is characterized by a considerable range of variation in Portuguese (Crespo-Sendra, Cruz, Silva & Frota, 2014; Frota et al., 2015a; Frota et al., 2015b). The rising contour is the most frequent interrogative configuration in EP, nevertheless this configuration shows a discontinuous geographical distribution compared to other possible contours, such as falling-rising or all falling. On the other hand, BP varieties seem to display a geographically consistent *continuum* from the North, (characterized by a rising nuclear contour), to the South, characterized by a rising-falling nuclear contour (Silva, 2011; Cunha & Silva, 2015; Crespo-Sendra, Cruz, Silva & Frota, 2014).

This chapter analyzes the nuclear contours of yes-no questions in seven BP urban varieties, as spoken in João Pessoa (Paraíba), Aracaju (Sergipe), Salvador (Bahia), Belo Horizonte (Minas Gerais), Rio de Janeiro

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(Rio de Janeiro), Florianópolis (Santa Catarina) and Porto Alegre (Rio Grande do Sul), most of them along the Atlantic Coast. The phonological analysis follows the Autosegmental Metrical model of Intonational Phonology (Jun, 2005; Ladd, 2008; Frota, 2002, 2014), that proposes a phonological organization for tunes, based on the relation between the tonal string and the prosodic structure of a given language. The across languages analysis under this theory has shown that there is not necessarily a biunivocal relation between surface melodic shape and tonal phonological organization. Equal tunes can have different phonological structures and equal phonological structures can be realized as different phonetic shapes, as well, depending on the association of the tones to the stressed positions of the segmental grid (Frota, to appear). Specifically, our research investigates the nuclear contour of neutral yes-no questions, taking into consideration (1) the alignment of tonal events with the segmental string and (2) its relation to the prosodic structure in terms of the phonological association of the tones to the head and edge of the Intonational Phrase (IP). Developed within the Project *Interactive Atlas of the Prosody of Portuguese (InAPoP)*, the present research aims at contributing to the knowledge of the BP intonational system, as well as to the understanding of intonational variation across Brazilian varieties.

The present paper is organized as follows. Section 2 reviews previous studies of intonational variation in Portuguese, particularly in the case of

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Brazilian varieties and focusing on the phonological contour of yes-no questions. In section 3, we explore the phonological analyses of the rising-falling contour, describing the different phonological structures that may underlie this melodic shape across languages. In section 4, we describe the methodology of our work, namely the criteria for the selection of varieties and speakers, the tasks and the procedures of data analysis. In section 5, the phonological analysis of the nuclear contour of yes-no questions in Brazilian varieties is presented. Finally, we discuss the geographical distribution of the intonation of yes-no questions along the Atlantic Coast.

2. Previous studies on intonational variation in Portuguese

The Brazilian and European Portuguese intonational systems contrast in a number of features, such as the intonational inventory, pitch accent distribution and the phonetic implementation of intonation (Frota et al. 2015a). Considering this amount of variation, the yes-no question contour contributes to intonational variation in Portuguese, given the different nuclei that in the tonal inventory of Portuguese convey this sentence type.

In EP, there are various nuclear contours in yes-no questions (such as H+L* LH%, L*+H H%, or H+L* L%), which appear to be distributed in a

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geographically non-contiguous way (Crespo-Sendra et al., 2014; Frota et al., 2015a). In BP, yes-no questions are characterized by a rising and rising-falling configuration in reading and semi-spontaneous speech (Silva, 2011; Castelo & Frota, 2015). In Northern varieties (Paraíba, Sergipe and Bahia), a rising nuclear contour is found (L^*+H H% or L^* H%), whereas Central and Southern varieties are characterized by a rising-falling contour (L^*+H L%, in Rio de Janeiro and Minas Gerais; L^* HL%, in Santa Catarina and Rio Grande do Sul), independently of the pragmatic meaning (Crespo-Sendra et al., 2014; Frota et al., 2015a; Frota et al., 2015b).

The *contiguous* distribution of yes-no question contours in BP confirms the results of a previous study based on the speech of 25 urban locations, which uses the *corpus* of the project Atlas Linguístico do Brasil – AliB (Silva, 2011). This study, grounded on a phonetic analysis, describes a rising pattern mainly found in the North and Northeast varieties, and a rising-falling contour that is spread by all the territory but is mainly found in Southeast and Southern varieties.

3. The phonological analysis of nuclear contours across languages: the rising-falling contour

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The phonological structure of intonation contours is not always necessarily mirrored by their realization, as observed on the surface pitch patterns (Frota, to appear). The phonetic implementation of tones is constrained by a number of factors, which are related to the alignment and accommodation of tones in the segmental chain.

Association and alignment are the two main phenomena related to the interaction between the metric and tonal layers, which show phonological and phonetic properties, related to the intonation structure of each system. Association is an abstract property that establishes the relationship of the underlying tone entities with the segmental string. Alignment, in turn, is a phonetic property, measured by the relative distance of the melodic event to the segmental string (Ladd, 2008). Therefore, the observation of temporal relations between the melodic events and the segmental string may reveal the phonological representation of intonation contours. Variation in alignment phenomena has been extensively observed in several languages. These studies have identified that alignment reflects both phonetic (see, e.g., Atterer & Ladd, 2004, for German and Vigário & Frota, 2003, for Portuguese) and phonological (see Frota, 2002, for Portuguese) differences in languages.

Observations of the underlying structure of the rising-falling contour (LHL) related to temporal alignment issues were developed for several languages, such as Swedish (Bruce, 1978), Palermo Italian (Grice, 1995),

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Eastern European Languages (Grice et al., 2000) and European Portuguese (Vigário & Frota, 2003). One of the first phonological approaches to the LHL contour was proposed by Bruce (1978) in his analysis of word accents in Swedish. In this study, the author identifies two word accent types: accent I and accent II. Accent I consists of a falling contour with the peak aligned with the pretonic syllable, whereas accent II exhibits a later alignment with the peak aligned with the stressed syllable (Bruce, 2005).

In Palermo Italian interrogatives (Grice, 1995) the LHL contour is discussed on the basis of two analyses: (i) the high tonal target is associated to a nuclear pitch accent or (ii) the high tonal target is associated to an intermediate phrase and there is an interaction between the prosodic phrasing and tonal layer instantiated by peripheral association of the high target. The author suggests that the second analysis explains better the phonological features of the interrogative LHL contour in Palermo Italian, given that the association of the high tone to the phrase edge (and its phrase accent nature) captures the instability of the alignment of the high tonal target in the tonal tier.

Variation in the behavior of the high tone in the rising-falling contour was also observed in yes-no questions in Eastern European languages, such as in Greek and Hungarian (Grice et al., 2000). A secondary association of the high tone, understood as a phrase accent, to the accented syllable is determined by language-specific association rules. In cases of final nuclear

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accents, the phrase accent is aligned with the penultimate syllable in Standard Hungarian and Transylvanian, or with the last syllable in Standard and Cypriot Greek. However, in early focus contexts, the alignment of the peak is kept the same in final prosodic words, as in Standard Hungarian, or can be found between accented and unaccented syllables, as in Transylvanian, Hungarian and Cypriot Greek. Moreover, the alignment of the tones in the LHL contour is also arranged according to the position of lexical stress. In Standard Hungarian, for instance, if the last syllable is stressed, the three tones are realized in this single syllable.

In EP, the rising-falling yes-no question contour was first described in the variety spoken in Braga (Vigário & Frota, 2003). The authors discuss the following phonological analyses for this contour: (i) the presence of a complex boundary (HL%), anchored to the IP edge, or (ii) the presence of a high phrase accent (H-), anchored to the phonological phrase, followed by a low boundary L%, anchored to the IP edge. Both analyses have positive and negative phonological implications. On the one hand, the introduction of the phrase accent in the second analysis avoided a new complex tonal boundary HL% that had not been found in the phonological inventory of Portuguese for neutral yes-no questions (note, however, that this complex boundary has been described for focused yes-no questions in several varieties of Portuguese – Frota, 2002; Frota et al., 2015a). On the other hand, the absence of a phrase accent in the intonational system of EP has been widely

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argued for (e.g. Frota 2000, 2002; Frota et al., 2015a). A comparison between neutral and focus interrogatives leads to the conclusion that the focus marking is conveyed by the pitch accent and the interrogative function by a complex boundary. Therefore, the phrase accent is not a phonologically productive category in this language.

In BP, the phonological features of the rising-falling nuclear contour have been also discussed in the literature. The first phonological descriptions for the Rio de Janeiro variety are based on descriptions of the realization of the peak in the last stressed syllable, taken to indicate the association of the high tone to the nuclear syllable - L+H* (Moraes, 2008; Silva, 2011). Subsequent descriptions proposed a new approach to the nuclear pitch accent, based on other fine detailed alignment evidence, namely, the observation of a valley in the first half of the syllable, that indicates the presence of a L*+H pitch accent in Rio de Janeiro, São Paulo and Minas Gerais varieties (Crespo-Sendra et al., 2014). The analysis proposed by Frota & Moraes (2016), for Rio de Janeiro, considers only the nuclear rising configuration (L+H), without committing to a specific phonological association of tones. A common trait of all these analyses is that the LH part of the LHL contour is captured by a rising pitch accent, and the final L corresponds to a low boundary tone. Only for the varieties of Santa Catarina and Rio Grande do Sul, in the South, a monotonal low

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nuclear accent followed by a bitonal falling boundary has been proposed (Crespo-Sendra et al., 2014).

This brief review of the literature presented in the previous two sections shows not only intonational variation in the yes-no question contours across varieties of Portuguese, but also the presence of various phonological analyzes proposed for the LHL nuclear contours across languages. In the following sections, which constitute the second part of this paper, we focus on yes-no questions in BP, and describe the methodology and *corpus* of the present research, as well as the phonological analysis. We conclude with a discussion of our findings.

4. Methodology

The present study was developed within the Interactive *Atlas of the Prosody of Portuguese (InAPoP)* project - <http://labfon.letras.ulisboa.pt/InAPoP>), which aims to map the prosodic, rhythmic and intonational variation in European, Brazilian and African varieties of Portuguese. All the materials were collected *in loco*, and are cross-linguistically comparable in terms of methodology and theoretical approach. The empirical basis of the research consists of a *corpus* of 34

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interrogative utterances (Frota, 2002; Castelo, in progress). The stress pattern of the sentence final word, i.e., the nuclear word, was varied (e.g. **mar**, **Marina**, **lâminas**), in order to observe the effects of tonal alignment depending on the distance between the stressed syllable and the prosodic boundary.

The data were collected in seven urban locations mainly localized along the Atlantic Coast, belonging to the three geographical areas listed below:

Northeast (henceforth Northern area): João Pessoa, in Paraíba; Aracaju, in Sergipe; Salvador, in Bahia (thus including the ‘Nordestino’ and ‘Baiano’ varieties, from Nascentes 1953);

Southeast (henceforth Center area): Rio de Janeiro, in Rio de Janeiro and Belo Horizonte, in Minas Gerais (thus comprising the varieties of ‘Mineiro’ and Fuminense, from Nascentes 1953);

Southern (henceforth South area): Florianópolis, in Santa Catarina and Porto Alegre, in Rio Grande do Sul (included in the ‘Sulista’ variety, from Nascentes 1953)¹.

¹ We do not use the reference to the official geopolitical division of Brazil, but the division in three major areas: the North, Center and South, as adopted within the InAPoP Project.

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Four educated women, all native speakers between 20 and 45 years of age were interviewed for each variety. The utterances were elicited via the presentation of written contexts. The data is composed of 1904 neutral yes-no questions (34 sentences x 2 randomizations x 4 speakers x 7 regions). The sounds were extracted from the recording files (using Zoom, H4nex - Handy Recorder 200m), and the audio files were segmented by utterance and labeled.

The tonal analysis followed the Autosegmental Metrical framework, and the annotation was made according to the P-ToBI system for intonational labeling (Frota, 2014; Frota et al., 2015a). The utterances were analyzed using Praat 5.1.31 (Boersma & Weenink, 2010), with three tiers of annotation (see Figure 1): (1) Tones: a point tier, in which the local melody is annotated; (2) Orthography: an interval tier, in which the sentence is segmented in orthographic words; (3) Boundaries (BI): a point tier, in which the boundary level is annotated. The intonation analysis was revised by two other specialists in intonation.

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Figure 1: Example of segmentation and annotation in Praat.

5. Results

5.1 The phonological analysis

5.1.1 On alignment

The yes-no question nuclear contour is characterized by a rising or a rising-falling (LHL) nuclear contour, but a close look at the alignment of tonal targets with respect to the segmental string reveals systematic

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similarities and differences across varieties, especially in what concerns the LHL contour. It is important to clarify that Northern varieties display a large amount of variation in the type of nuclear configuration.

The rising contour in the North is composed by a low pitch accent associated to the nuclear syllable (L*), followed by a high boundary tone (H%). This association of the low tone to the nucleus displays a consistent alignment of a low stretch in the stressed syllable, immediately followed by a rising movement (see Figure 2).

Figure 2: Yes-no question "O aluno encontrou um manual técnico?" (Did the student find a technical manual?), produced by a speaker from Paraíba.

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The Bahia variety is a singular case. It shares the rising configuration of the Northern Varieties, but it also exhibits a rising-falling contour. The rising configuration is composed by a bitonal nuclear pitch accent (L*+H), followed by a high boundary tone (H%). The association of the L*+H pitch accent to the nucleus is revealed by a consistent alignment of a rising contour with the last stressed syllable, that continues until the end of utterance (see Figure 3). The presence of either rising or rising-falling contours, with the predominance for the former, suggests a geographical *continuum* from the Northern areas to the Center-Southern areas, that is going be discussed in section 5.2.

Figure 3: Yes-no question "Ela vai ter uma gramática?" (Is she going to have a grammar?), produced by a speaker from Bahia.

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In Bahia, and in the Center varieties of Rio de Janeiro and Minas Gerais, a rising contour in the nuclear syllable (L*+H) is found. However, in the Center varieties it is characterized by an early alignment of the rise in relation to the other varieties. The low tone is consistently aligned with the first half of the stressed syllable (see Figure 4 and 5). The alignment of the high tone, on the other hand, shows variation across speakers, being realized on the second half of the stressed syllable or on the beginning of the poststressed syllable. Thus, the rising movement may be realized in the stressed syllable with the low tone mostly realized in the consonant and the high tone realized on the right edge of the stressed syllable (Figure 4). Another pattern shows the low tone penetrating the stressed vowel and the high tone occurring after the offset of the stressed syllable (Figure 5)

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Figure 4: Yes-no question "Os rapazes compraram lâminas?" (Did the boys buy blades?), produced by a speaker from Rio de Janeiro.

Figure 5: Yes-no question "Ela foi ver a Débora?" (Did she go to see Débora?), produced by a speaker from Rio de Janeiro.

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In some instances, phonetic variation in tonal alignment patterns becomes ambiguous as evidence for the phonological analysis of the nuclear pitch accent, since it can be interpreted either as L*+H or L+H*. Two features could argue for the L+H* nuclear pitch accent: (1) the rising along the tonic, and (2) the alignment of the high tone to the edge of the tonic. The variation in the alignment of peak in the rising-falling contour in the varieties from the Center area was reported in previous work. In a recent study (Frota & Moraes, 2016), the association pattern of the rising-falling contour in interrogatives produced by speakers of the Rio de Janeiro variety is not phonologically specified. In our data, the L*+H analysis is adopted. This option for the rising bitonal pitch accent with a low starred tone (L*+H) is based on the following arguments: (i) the consistent presence of a low tone necessarily aligned with the nuclear syllable, between its onset and the vowel nucleus; (ii) the variation in the behavior of the trailing tone, strongly suggesting that, unlike the low tone, it is not attached to a strong syllable in the metrical grid (as observed, for example, for Palermo Italian - Grice, 1995); (iii) the presence of a low nuclear tone for interrogatives in the other Brazilian varieties (from the Northern and South areas) further supports our option for the L*+H L% nuclear contour. The compared analysis of the nuclear contour of the varieties from the Center with that found in other varieties strongly argues for the L*+H L% pattern. On the

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one hand, the nuclear configuration displays a stable low target in the nucleus, that accounts for the phonological specification of this sentence type in BP. On the other hand, it shows an unstable high trailing tone, that plays a role in the continuum displayed by the nuclear pattern of this sentence type, that gradually changes from North to South, along and close to the Atlantic Coast.

Indeed, the Southern varieties of Santa Catarina and Rio Grande do Sul also show a rising-falling contour. This contour is characterized by a low tone associated to the IP nuclear syllable, which is always realized in the nuclear vowel (L*), followed by a rising-falling boundary (HL%). Nevertheless, the attachment of HL in the post-stressed stretch occurs in two ways, a contrast that clearly emerges in cases with antepenultimate stress in the nuclear word. In one of them, the high tone is aligned with the last post-stressed syllable, the stressed syllable is all-low and the rising movement starts right after the offset of the stressed syllable, and is then followed by a fall (see Figure 6). In the other, the high tone can be realized in the first post-stressed syllable, similar to Center varieties, and the rising movement starts before the offset of the stressed syllable, being immediately followed by a fall (see Figure 7). These facts suggest the presence of a floating tone from the boundary to the accented syllable, which indicates, in our data, a secondary association of the high boundary tone to the nuclear position. In

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our annotation, this feature is represented by a high tone in brackets (L*
 (+H) L%).

Figure 6: Yes-no question "Os rapazes compraram lâminas?" (Did the boys buy blades?), produced by a speaker from Santa Catarina.

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Figure 7: Yes-no question " Os rapazes compraram lâminas?" (Did the boys buy blades?), produced by a speaker from Santa Catarina.

A similar variation to that found in the temporal alignment of the high peak in Santa Catarina was also observed in Eastern European languages (Grice et al., 2000). The analysis of the rising-falling yes-no question contour from Eastern European languages includes the presence of a high phrase accent (H-) with different possibilities of alignment driven by secondary association rules. In the final nuclear accent, for instance, the high tone is attached to the penultimate syllable in Standard Hungarian and Transylvanian, or to the last syllable in Standard Greek and Cyprus Greek.

The temporal alignment of the rising-falling contour Santa Catarina raises interesting questions. In Santa Catarina the variable alignment of the

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H tone in the stretch between the stressed syllable and the boundary syllable points to a secondary association of H boundary tone to the pitch accent. Interestingly, in Northern varieties (e.g., Sergipe) a rising-falling contour may also be found together with the all-rising contour described above. However, in Northern varieties, the H tone is consistently aligned with the final syllable and is thus part of the boundary tone (HL%).

Furthermore, we have seen that two types of phonological targets can underlie the rising-falling contour at post-nuclear position: (i) a bitonal boundary tone (HL%) associated to the IP edge or (ii) a sequence of a phrase accent and a low boundary tone (H- L%), as proposed for Eastern European languages. The fact that most Romance languages in general (Frota & Prieto, 2015) do not show a phrase accent in their intonational systems is a cross-linguistic argument that strengthens the HL% analysis in Portuguese.

The differences in tonal alignment across varieties were examined by means of a statistical analysis in order to test the effect of region in tonal alignment. The hypothesis raised from observation of the acoustic data was that the alignment of the high tone is later in the North and South, since this tone is phonologically specified as an IP boundary tone in both regions, whereas in Center varieties an earlier alignment is expected, since the high tone is associated to the nucleus. As for the low tone, in the North and South, given the monotonal pitch accent L*, it is expected that its alignment

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is later than in the Center areas and Bahia, which have a bitonal pitch accent (L*+H). Two statistical measures were considered: the temporal distance from the onset of the stressed syllable relative to the low tone and the temporal distance from the offset of the stressed syllable to the high tone (see also, Crespo-Sendra et al. 2014). Given the results of the Kolmogorov-Smirnov and Shapiro-Wilk tests for normal data distribution, we applied two statistical tests for data analysis: (i) the t-test in the case of high tone alignment, comparing, in pairs, Northern areas, Center areas and South; (ii) the nonparametric Mann-Whitney test for low tone alignment (following a similar pairwise procedure). The effect of the region in alignment was significant. For the high tone, the Northern areas are different from the Center ($t = 6.518$, $p < 0.05$) and from the South ($t = 3.042$, $p < 0.05$). Additionally, the Center is different from the South ($t = 7.068$, $p < 0.05$). These results confirmed the Center as the region where peak alignment is earlier, given its accentual status. At the same time, the results also pointed to a difference between Northern areas and the South, supporting the variable peak alignment found in the South, which was captured by a secondary association analysis. For the low tone, the Northern areas are different from the Center ($Z = -5.176$, $p < 0.05$) and from the South ($Z = -3.466$, $p < 0.05$), and the Center is also different from the South ($Z = -2.434$, $p < 0.05$). Importantly, the major difference in alignment is between the Northern and the Center areas, where L* clearly contrasts with L*+H (in the

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South, the secondary association of the peak to the stressed syllable may induce earlier alignment of L*, thus yielding a pattern that is also significantly different).

The statistical differences between regions confirm the presence of different underlying structures, i.e., the presence of a bitonal pitch accent implies early alignment in the Center varieties, while in the extreme varieties, two different facts contribute to late alignment: the presence of a low nuclear pitch accent and the presence of a high-low boundary tone.

According to Ladd (2008), alignment may consist of phonetic/gradual differences as well as phonological/categorical differences. In the Northern areas, the L* H%, L*+H H% and also L* HL% contours display a late alignment of the LH tonal targets, observed through a greater distance in the alignment of tones from their respective landmarks. In the Center, the association of H tone to the nuclear syllable (L* + H L %) triggers earlier alignment and a shorter distance between the high and the low tone. In the South, as in the North, the high tone is associated to the boundary (L* HL%), however the secondary association of the high tone to the nucleus (L* (+H) L%) explains why the alignment of low and high tones display an intermediary (and distinctive) pattern.

In sum, the intonational analysis here put forward identified three different phonological nuclear contours for neutral yes-no questions in BP (see Figure 8). Northern varieties show a rising nuclear contour, composed

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by a low pitch accent (L^*), associated to the nucleus, and a high boundary tone ($H\%$). Center varieties show a bitonal pitch accent (L^*+H) characterized by a low tone, associated to the stressed syllable, followed by a high trailing tone and a low boundary tone ($L\%$). Southern varieties show a monotonal pitch accent (L^*) associated to the nucleus and a complex boundary tone ($HL\%$), in which the high boundary tone has a secondary association to the stressed syllable.

Figure 8: Phonological representation of the neutral yes-no question nuclear contour in Northern, Center and Southern varieties of BP.

5.1.2 On text-tune accommodation

Complex nuclear configurations, such as rising or rising-falling contours, may show different implementations across languages and their varieties depending also on segmental constraints. Languages have been divided into two main groups in terms of accommodation patterns: compression languages, such as English, which tend to bear more than one

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tone on the last nuclear syllable, and truncation languages, such as German (Grabe, 1998; Ladd, 2008), which tend to delete the tone when there is no space available for hosting it. Recent studies show that accommodation strategies vary in dialects of the same language. English, typically known as a compression language (Ladd, 2008; Grabe, 1998), shows variation across British varieties in terms of the accommodation of the boundary tone in the nuclear contour of interrogative utterances (H* L%). The varieties of Cambridge and Newcastle use the compression strategy, while the varieties of Belfast and Leeds use the truncation strategy (Grabe, 2004).

The variation in accommodation strategies for Portuguese has been studied in detail in Frota et al. (2015b) and reveals an opposition between PE and PB with respect to the preferred accommodation pattern. EP stretches the segmental string to accommodate the tones, using different strategies such as epenthetic vowel or blocking of final schwa deletion. Brazilian varieties, by contrast, tend to delete the boundary tone, in the absence of a post-stressed syllable to bear it. In the previous sections of this chapter, the analysis was fully based on materials with post-stressed syllables to allow a full realization of the phonological contour. In the current section, we will briefly mention the kinds of tune-text accommodation strategies that occurred in our data, across varieties.

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By and large, the tendency shown in previous studies for BP was confirmed by our data. Truncation was found in all varieties (see Figure 9), with a few cases of lengthening, mainly in the South.

Figure 9: Yes-no question "Ela foi ver o mar?" (Did she go to see the sea?), produced by a speaker from Rio de Janeiro.

The Santa Catarina variety displays more variation in tune-text accommodation. Despite truncation being the predominant strategy, a lengthening strategy was found for all speakers, confirming previous results for this variety (Nunes, 2011). Some speakers produced the nuclear rising-falling contour L * HL% in the stressed syllable, albeit with a compressed pitch range (See Figure 10). On the other hand, other speakers resorted to an early implementation of the L* HL% nuclear contour together with

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lengthening, due to the proximity of the right boundary of the IP² (see Figure 11).

Figure 10: Yes-no question "Quer ver o João?" (Do you want to see João?), produced by a speaker from Santa Catarina.

² These cases were phonetically annotated as (> L *), as used in Greek (Arvaniti, 2005) where the earlier implementation of the L*+H pitch accent is explained by the proximity of the internal IP boundary.

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Figure 11: Yes-no question "O cantor cantou uma manhã angelical?" (Did the singer sing a angelical morning?"), produced by a speaker from Santa Catarina.

5.2 The geographical distribution

The maps below (Figures 12 and 13) are based on interpolation (Tobler, 1970) and interaction (Huff, 1963) models and are part of the geographical mapping developed within the InAPoP project. These models use Brazilian states as a geographical reference for the mapping. The interpolation method was used to represent the existing linguistic *continuum* of interrogative intonational patterns. This method uses algorithms to calculate an estimate of values based on existing data to determine a trend of the relevant phenomenon in areas that have not yet been observed. The

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interaction model is used to map our proposal of phonological analysis of the contours that occur in a given region, based on areas of influence.

The dialectal variation of the interrogative nuclear contour found in the data is captured in Figure 12, which shows the geographical basis of the change in configuration between rising and rising-falling. The distribution of the interrogative contour configuration is represented in a scale from rising melodic contours in the North (signaled by blue color) to rising-falling contours in the Center-South (signaled by yellow color). The gradual change in color scale represents a linguistic *continuum*. The darker shades of blue represent a higher frequency of rising contours in the far Northern Atlantic Coast, which gradually decreases, going through a transition zone in the Bahia region until the rising-falling pattern is predominant in Minas Gerais and the other Center-South regions. Interestingly, the model shows what can be interpreted as a spreading of LHL contour towards the Northern Atlantic Coast, which spreads up to the region of Bahia and gradually decreases its strength further to the North. This *continuum* confirms the geographical distribution of the general (phonetic) configuration of yes-no question contours in semi-spontaneous speech, based on corpora of the *Atlas Linguístico do Brasil* (Silva, 2011; Cunha, Silva & Silvestre, 2014).

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Figure 12: Intonational variation in yes-no questions in BP, represented by an interpolation method (Tobler, 1970).

In Figure 13, the geographical change in the phonological constituency of the melodic contours is depicted. The map shows three

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dialectal regions: North (yellow), Center (orange) and South (red). The predominance of L* H% contour in Paraíba and Sergipe is represented by yellow. In Bahia, the rising and rising-falling contours strongly co-exist. The rising-falling contour in Central-Southern varieties is divided into two groups: the L*+H L% is represented by orange in Minas Gerais and Rio de Janeiro; and the L* HL%, is represented by red in Santa Catarina and Rio Grande do Sul.

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Figure 13: Intonational variation in phonological patterns of neutral yes-no questions represented by a spatial interaction method (Huff, 1963).

The distribution outlined by these maps has, however, a considerable margin of error, given the continental dimensions of Brazil. Nevertheless, the models reflect the tendency to a *continuum* that might be justified, by

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and the large, by historical and social factors. In historical terms, it is known that the “general language” used by Indians, Africans and Europeans to communicate throughout the 18th Century was largely disseminated along the Atlantic Coast. Furthermore, it had uniform characteristics (Ilari & Basso, 2006). In cultural synchronic terms, it is also known that there is an intense cultural exchange among Brazilian varieties from different regions caused by immigration, among other factors. Importantly, the use of the linguistic features from Rio de Janeiro and São Paulo varieties is widely spread along the Brazilian territory by different levels of cultural exchange promoted by media. These facts may have contributed to the existence of a geographical continuum in BP, which will be further discussed in final section of this chapter.

6. Conclusions

In this chapter we pursued a linguistic variation approach within the formal study of prosody. The knowledge of a linguistic system implies analyzing its features, also according to its territorial extension, and not being restricted to the features of the standard variety (Barbiers, 2009). The variations in the system motivated by geographical space, as well as by

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social space, lead to a more complete understanding of the grammar under study (Britain, 2007). Therefore, the contribution of the knowledge of prosodic variation for formal theories needs to be acknowledged, bearing in mind that variation and change are inherent features in any language since languages evolve in space and time.

Furthermore, and according to Rossi (1967: 104), “it is necessary, however, to never forget that dialectology is essentially contextual: the features found in a geographical area only make sense if compared to other corresponding features – or to their absence - at another point or another area”.³ Thus, the present study fulfills its initial goal of presenting an analysis of the intonation of neutral yes-no questions taking into account a dynamic model that represents the distribution of the phonological patterns along the space.

The dialectological analyses indicate that the phonological behavior found in the varieties of BP points to a spreading of rising-falling contours from the Center-South to the North of Brazil, a view that is coherent with the spatial distribution of this type of configuration in the varieties along the Atlantic Coast. In addition, the variation of phonological properties found in

³ Original quote of Nelson Rossi (1967), in Portuguese: “Convirá, porém, nunca esquecer que a dialectologia é essencialmente contextual: o fato apurado num ponto geográfico ou numa área geográfica só ganha luz, força e sentido documentais na medida em que se preste ao confronto com o fato correspondente – ainda que por ausência – em outro ponto ou outra área.”

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both configurations (rising-falling and rising) confirms the trend of the rising-falling contour spreading to the North, given that the Center-South nuclear pattern L*+H, common to the rising-falling contour (L*+H L%) in Rio de Janeiro and Minas Gerais, is also found upper North in the rising contour of Bahia (L *+H H%), which is a clear intermediate dialectal area. Our results confirm the predictions of Nascentes (1953) that Bahia's variety is intermediate between the North and the South groups, a fact that has also been confirmed by segmental studies regarding the realization of pretonic vowels (Cardoso, 1999).

These results argue for a synchronic analysis with speech samples from different age groups in order to investigate whether the linguistic dynamics revealed by the current findings consists of phenomena in constant variation across speakers and age groups, or of an ongoing linguistic change. In addition, studies of rural varieties would also be insightful to confirm the suggested geographical distribution of these intonational features and their role in the characterization of intonational variation in BP.

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References

- Arvanite, A & Baltazani, M. (2005). Intonational analysis and prosodic annotation of Greek. In: Sun-Ah Jun. *Prosodic Typology - The Phonology of Intonation and Phrasing*. Sun-Ah Jun (ed.). Oxford: Oxford University Press, 362- 389.
- Atterer, M. & Ladd, D. R. (2004). On the phonetics and phonology of “segmental anchoring” of F0: evidence from German. *Journal of Phonetics*, 32, 177–197
- Barbies, S. (2009). Locus and limits of syntactic microvariation. Amsterdam: Elsevier, *Língua* 119, 1607–1623

Castelo & Frota (to appear). The yes-no question contour in Brazilian Portuguese: a geographical *continuum*. In P. Barbosa, C. Paiva & C. Rodrigues (eds.), *Studies on Variation and Change in Varieties of Portuguese*. Amsterdam/Philadelphia: John Benjamins.

Authors' manuscript. April, 2016

Barros, N. (2014). *Fraseamento prosódico em português: uma análise entoacional de construções parentéticas e tópicos em duas variedades do português europeu*. Unpublished Master dissertation in linguistics, University of Lisbon.

Boersma, P., Weenink D. (2010). *Praat – doing phonetics by computer*. Versão 5.1.31

Bolinger, D. (1978). Intonation across languages. Universal of human language. In: J. Greenberg (ed.). *Phonology*, vol ii. Palo Alto, ca: Stanford University Press.

Britain, D. (2007). Space and spatial diffusion. In: *The handbook of language variation and change*. Chambers, J. K., Trudgill, P. and Estes, N. (eds). Blackwell Publishing, 2003. Blackwell reference online. 31 december.

Bruce, G. (2005). Intonational Prominence in Varieties of Swedish Revisited. In: Sun-Ah Jun (ed.). *Prosodic Typology - The Phonology of Intonation and Phrasing*. Oxford: Oxford University Press, 410-429.

Bruce, G. & Garding, E. (1978). A prosodic typology for Swedish dialects. In Garding, E., Bruce, G & Bannert, R. (eds.). *Nordic prosody*, Department of linguistics, Lund University, 219-228.

Cardoso, S. (1986). *Tinha Nascentes razão?*. In: Scheinowitz, C. e Cardoso, S. *Estudos linguísticos e literários*. Salvador: Universidade Federal da Bahia, vol. 5, 47-59

Cardoso, S. (1999). A dialectologia no Brasil: perspectivas. *DELTA* Vol. 15, N.º Especial, 233-255.

Castelo, J. (in progress). A entoação dos enunciados declarativos e interrogativos: uma análise fonológica em variedades do Nordeste, Sudeste e Sul do Brasil (PhD Thesis). University of Lisbon, Portugal.

Castelo, J. & Frota S. (2015). Variação entoacional no Português do Brasil: uma análise fonológica do contorno nuclear em enunciados declarativos e

Castelo & Frota (to appear). The yes-no question contour in Brazilian Portuguese: a geographical *continuum*. In P. Barbosa, C. Paiva & C. Rodrigues (eds.), *Studies on Variation and Change in Varieties of Portuguese*. Amsterdam/Philadelphia: John Benjamins.

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interrogativos. In: Moreno, A.; Silva, F., Veloso, J. *Textos Seleccionados do XXX Encontro da Associação Portuguesa de Linguística*, Braga: APL, 113-131.

Crespo-Sendra, V., Cruz, M., Silva, J. & Frota, S. (2014). Asking questions across Portuguese varieties. Talk presented at the 6th International Conference on Tone and Intonation in Europe (TIE). Netherlands: University of Utrecht.

Cruz, M. & Frota, S. (2013). Correlação entre fraseamento prosódico e distribuição de acentos tonais? Evidências da variação no Português Europeu. In: *Textos Seleccionados do XXVIII Encontro Nacional da Associação Portuguesa de Linguística*. Lisboa: Associação Portuguesa de Linguística.

Cunha, C., Silva J., Silvestre, A. (2014). Atlas Linguístico do Brasil - Map F07 P2 - Entoação dos enunciados interrogativos totais. Londrina: EDUEL, 2014 (Map of Atlas Linguístico do Brasil).

Cunha, C. & Silva, J. (2015). Variação entoacional nos enunciados interrogativos. In: Abraçado, J. & Martins M. (eds.). *Mapeamento Sociolinguístico do Português Brasileiro*. São Paulo: Contexto, 79-108.

Frota, S. (2002). Nuclear falls and rises in European Portuguese: a phonological analysis of declarative and question intonation. *Probus* 14, 113-146.

Frota, S. (2014). The intonational phonology of European Portuguese. Sun-Ah Jun (ed.) *Prosodic Typology II*. Oxford: Oxford University Press, 6-42.

Frota, S. (to appear). Surface and structure: transcribing intonation within and across languages. *Laboratory Phonology*.

Frota, S., Butler, J. & Vigário, M. (2014). *Infants' perception of intonation: Is it a statement or a question? Infancy*, 1-19.

Castelo & Frota (to appear). The yes-no question contour in Brazilian Portuguese: a geographical *continuum*. In P. Barbosa, C. Paiva & C. Rodrigues (eds.), *Studies on Variation and Change in Varieties of Portuguese*. Amsterdam/Philadelphia: John Benjamins.

Authors' manuscript. April, 2016

Frota, S. & Prieto, P. (2015). Intonation in Romance: systemic similarities and differences. In Frota, S. & Prieto, P. (eds). *Intonation in Romance*. Oxford: Oxford University Press, 392-418.

Frota, S., Cruz, M., Fernandes-Svartman, F., Collischonn, G., Fonseca, A., Serra, C., ... & Vigário, M. (2015a). Intonational variation in Portuguese: European and Brazilian varieties. In: S. Frota & P. Prieto (eds). *Intonation in Romance*. Oxford: Oxford University Press, 235-283

Frota, S.; Castelo, J.; Cruz, M.; Barros, N.; Crespo-Sendra, V.; Silvestre, A. & Vigário M.; (2015b). Melodia ou texto? Estratégias de acomodação entre melodia e texto no Português. In: Serra, C. & Cunha, c.. UFRJ: *Diadorim*, 17(2), 12-33.

Frota, S. & Moraes, J. (2016) Intonation of European and Brazilian Portuguese. In Wetzels, W. L., Menuzzi, S. & Costa, J. (eds.) *The Handbook of Portuguese Linguistics*, First Edition. John Wiley & Sons, Inc., 141-166.

Grabe, E. (1998). Comparative intonational phonology: *English and German*. MPI Series 7. Wageningen: Ponsen et Looien.

Grabe, E. (2004). Intonational variation in urban dialects of English spoken in the British Isles. In: Peter, G.; Peters, J. (Ed.) *Regional variation in intonation*. Tübingen: Niemeyer, 9-32.

Grice, M. (1995). The intonation of interrogation in Palermo Italian: Implications for intonation theory. Tübingen: *Niemeyer*.

Grice, M, Ladd, D. R., Arvaniti, A. (2000). On the place of phrase accent in intonation phonology. *Phonology* 17, 143-185

Grice, M, D' Império, M., Savino, M., Avesani, C. (2005). Strategies for intonation labelling across varieties of Italian. In: Sun-Ah Jun (ed.). *Prosodic Typology - The Phonology of Intonation and Phrasing*. Oxford: Oxford University Press, 362- 389.

Castelo & Frota (to appear). The yes-no question contour in Brazilian Portuguese: a geographical *continuum*. In P. Barbosa, C. Paiva & C. Rodrigues (eds.), *Studies on Variation and Change in Varieties of Portuguese*. Amsterdam/Philadelphia: John Benjamins.

Authors' manuscript. April, 2016

Hellmuth, S. (2007). The relationship between prosodic structure and pitch accent distribution: evidence from Egyptian Arabic. *The Linguistic Review*, 24 (2), 289-314.

Huff, D. L. (1963). A Probabilistic Analysis of Consumer Spatial Behaviour. In W. S. Decker (Ed.), *Emerging Concepts in Marketing*. Chicago: *American Marketing Association*, 443-461.

Ilari, R & Basso, R. (2006). *O português da gente*. São Paulo: Contexto.

Jun, S. (ed.) (2005) *Prosodic Typology II*. Oxford: Oxford University Press.

Ladd, R. (2008). *Intonational Phonology*. 2nd ed. Cambridge: Cambridge University Press.

Moraes, J. (2008). The Pitch Accents in Brazilian Portuguese: analysis by synthesis In: *Proceedings of the Speech Prosody*. Campinas: Unicamp.

Nascentes, A. (1953). *O linguajar carioca*. Rio de Janeiro: Organização Simões.

Nunes, V. (2011). *Análises entonacionais de sentenças declarativas e interrogativas totais nos falares florianopolitano e lageano*. Unpublished Master dissertation in Linguistics. Florianópolis, UFSC.

Prieto, P.; Borràs-Comes, J.; Cabré, T.; Crespo-Sendra, V.; Mascaró, I; Roseano, P.; Sichel-Bazin, R. & Vanrell, M. (2015). Intonational phonology of Catalan and its dialectal varieties. In: Sónia Frota & Pilar Prieto (eds.). *Intonational Variation in Romance*. Oxford: Oxford University Press, 9-62

Rossi, N. (1967). *A dialectologia*. ALFAL, 11: 89-116.

Savino, M. (2012). The intonation of polar questions in Italian: where is the rise? *Journal of the International Phonetic Association*, vol. 42, 23-48.

Silva, J. (2011). *Caracterização prosódica dos falares brasileiros: as orações interrogativas totais*. Master dissertation in Portuguese Language. Rio de Janeiro, Faculdade de Letras, UFRJ.

Castelo & Frota (to appear). The yes-no question contour in Brazilian Portuguese: a geographical *continuum*. In P. Barbosa, C. Paiva & C. Rodrigues (eds.), *Studies on Variation and Change in Varieties of Portuguese*. Amsterdam/Philadelphia: John Benjamins.

Authors' manuscript. April, 2016

Tobler, W. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography* 46. Supplement: *Proceedings of the International Geographical Union*. Commission on Quantitative Methods, 234-240.

Vigário, M. & Fernandes-Svartman, F. (2010). A atribuição tonal em compostos no Português do Brasil. In: Brito, A. , Silva, F., Veloso, J. & Fiéis, A. (eds.) *XXV Encontro Nacional da Associação Portuguesa de Linguística. Textos seleccionados*. Porto: Associação Portuguesa de Linguística, 769-786.

Vigário, M. & Frota, S. (2003). The intonation of standard and Northern European Portuguese: a comparative intonational phonology approach. *Journal of Portuguese Linguistics*, 115-117.