

Prosody of declarative and interrogative modalities in Salvador, Fortaleza, and Rio de Janeiro varieties

Prosódia de enunciados declarativos e interrogativos totais nas variedades de Salvador, Fortaleza e Rio de Janeiro

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Abstract: This work seeks to describe the differences between the dialectal varieties of Portuguese spoken in Salvador, Fortaleza, and Rio de Janeiro, Brazil, in both the declarative and interrogative modalities. Analyses of prosodic parameters (fundamental frequency, duration, intensity) are proposed on the final nucleus of oxytonic, paroxytonic, and proparoxytonic sentences. Systematic prosodic changes between modalities (declarative and interrogative) are described – with a higher / rising F0 in the interrogative nucleus, while a lower / falling F0 is found for declaratives. The interrogative nuclei are also longer and stronger than the declaratives. Dialectal variations are also observed. The accentual

patterns H + L*L% for declaratives and L + H*L% for interrogatives, proposed by Moraes (2008), are observed within Rio de Janeiro speakers – the latter being truncated (or compressed) in oxytonic sentences due to a lack of post-tonic material. However, in the Salvador and Fortaleza varieties, interrogatives may also be performed with an L + H*H% pattern. More syllable elisions are also observed in Fortaleza speakers.

Keywords: prosody; intonation; declarative sentences; yes/no questions; Portuguese dialects of Salvador, Fortaleza, Rio de Janeiro.

Resumo: Este trabalho tem como objetivo descrever diferenças entre variedades dialetais do português falado em Salvador, Fortaleza e Rio de Janeiro, Brasil, tanto nas sentenças declarativas quanto nas interrogativas. A análise de parâmetros prosódicos (frequência fundamental, duração, intensidade) é feita no núcleo final de sentenças oxítonas, paroxítonas e proparoxítonas. Há diferenças prosódicas sistemáticas entre as duas modalidades (declarativa e interrogativa): um tom alto ou subida de F0 no núcleo das interrogativas e, ao contrário, um tom baixo ou descida de F0 no núcleo das declarativas. O núcleo das interrogativas também é mais longo, em termos de duração, e mais forte, em termos de intensidade, do que o núcleo das declarativas. Variações dialetais também são observadas. Os acentos tonais nucleares H + L*L% para as declarativas e L + H*L% para as interrogativas, propostos por Moraes (2008), são observados nos falantes do Rio de Janeiro – sendo este último truncado ou comprimido em sentenças oxítonas, devido à falta do material postônico. Entretanto, nas variedades de Salvador e Fortaleza, as interrogativas também podem ser realizadas com um padrão L + H*H%. Maior elisão de sílabas é observada nos falantes de Fortaleza.

Palavras-chave: prosódia; entoação; sentenças declarativas; sentenças interrogativas totais; variação dialetal.

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1 Introduction

The purpose of this work is to describe and compare prosodic elements in yes-no questions and declarative utterances from the experimental AMPER (Multimedia Atlas of Prosodic Patterns of the

Romance Languages) corpus¹ for Brazilian Portuguese: project AMPER-Por (Brazil). The data analyzed in this paper refer to three collection points, two state capitals in the Northeast Region of Brazil – Salvador and Fortaleza – and one state capital in the Southeast Region of Brazil – Rio de Janeiro. The intonational pattern and the implementation of the acoustic parameters of fundamental frequency (F0), duration, and intensity were analyzed in the nucleus and prenucleus of the following utterances: “*O Renato gosta do Renato*” (“Renato likes Renato”), “*O pássaro gosta do pássaro*” (“The bird likes the bird”), “*O bisavô gosta do bisavô*” (“The great-grandfather likes the great-grandfather”), in their declarative and interrogative (yes/no answers) modalities.

Based on preceding studies conducted on Brazilian Portuguese (BP), and particularly on the varieties from Salvador, Fortaleza, and Rio de Janeiro, this study discusses the results obtained from these three varieties, linked to changes in the melodic patterns of their declarative and interrogative utterances.

One of the major problems in comparative studies is the disparity of methodological choices. AMPER data are obtained from controlled, experimental, or laboratory speech. The study of speech segmentation and hierarchization prosodic functions is based on constructed sentences, so as to systematically vary their morpho-syntactic structures, which enables contrasting a specific trait between two sentences that have otherwise comparable structures (RILLIARD, 2011). This speech marking and segmentation function is a classical hypothesis about prosodic functions that have been described by Rossi (1987), Reis (1995), Vaissière (1997), or Ladd (2008), and this study is built on such theoretical approaches. The data collected and analyzed within the framework of AMPER-Por (Brazil), in the three state capitals (Rio de Janeiro, Fortaleza, and Salvador), may be considered to be read or acted speech data, due to

¹ The AMPER (Atlas Multimédia Prosodique de l’Espace Roman – Multimedia Atlas of Prosodic Patterns of the Romance Languages) project is coordinated by Michel Contini from the Center for Dialectology at Grenoble University, France, and is designed to address Romance languages, such as Italian, French, Spanish, Galician, as well as the European Portuguese (EP) and Brazilian Portuguese (BP) varieties. The research on the prosodic variation in Portuguese is coordinated by Lurdes de Castro Moutinho, from the Center for Investigation of Languages and Cultures at Aveiro University: <http://pfonetica.web.ua.pt/AMPER-POR.htm>.

the conditions of utterance production, and according to the theoretical conceptualizations of read, acted, or spontaneous speech.

According to Gomes da Silva (2014, p. 55-56), the first characteristic of a spontaneous text is, as Blanche Benveniste (1998) suggests, that it is never a completed production and that its oral expression reveals its production stages. The second characteristic is that spontaneous speech reveals comments on the lexical choice and the difficulty in finding the appropriate word. The third characteristic is that, in this type of discourse, lexical attempts are preserved, as it is not possible to erase what has just been said. Spontaneous speech may reveal hesitation, repetitions, and false starts. Spontaneous speech, in addition to not having a linear, syntagmatic sequence, or a selection in absence, consists of paradigmatic, exposed relations, in presence. The speaker goes back and forth, on previously presented phrases, whether to correct or to complete them, adding comments or aspects that are deemed relevant, in a manner we could define as an online mode, or “*sobre la marcha*”, as it was translated in Spanish. It is a production simultaneous to its oral expression, and this is its difference from read or acted speech.

As opposed to spontaneous speech, in read or acted speech, experimental or not, the text is ready and is expressed orally a posteriori. In acted speech, the text is memorized and practiced to lead to an interaction performance with controlled expressive effects. In read speech, the text is ready and expressed orally a posteriori, but differently from acted speech, the text is not memorized. The differences between these types of speech may be thin, and depend on genres and interaction events. In the case of AMPER data, the speakers have the text ready, even if not in words, but presented thanks to images; we would thus be more inclined to view this corpus as read data. There is a complete control over the syntactic and phonetic structures, which, in turn, are expressed orally with no interaction context. This study compares data from the AMPER and ALIB²

² The “Linguistic Atlas of Brazil” project was created in 1996, under the coordination of a National Committee, chaired by Professor Suzana Cardoso, from the Federal University of Bahia. ALIB, more specifically, consists of data collection at 250 locations, both in state capitals and in large and medium size cities that are linguistically representative. A total number of 1100 informants were recorded. For data collection, the ALIB project uses an inquiry consisting of three questionnaires: (i) Morpho-Syntactic Questionnaire (MSQ); (ii) Semantic-Lexical Questionnaire (SLQ), and (iii) Phonetic-Phonological Questionnaire (PPQ), which includes questions for detecting prosodic differences, regarding the nature of phrases, which may be interrogative, affirmative, or imperative.

(Linguistic Atlas of Brazil) projects for these three state capitals. In the case of ALIB data, the speaker is provided with a situation, a context in which the expected or proposed phrase must be inserted with a given intentionality. Data collected from ALIB are thus considered to be acted speech.³ ALIB speakers follow a questionnaire that includes questions to detect prosodic differences relating to the sentences' nature. As an example of these interaction contexts, we provide here four contexts used in order to collect interrogative utterances, with instructions and expected answers to the interrogative utterances, the first two referring to disjunctive interrogative utterances, and the last two referring to yes-no questions (CUNHA, 2005):

- 1) *Ó, meu amigo, você prefere vinho ou cerveja?* (Hey, my friend, do you prefer wine or beer?) (**Expected Answer**)

Se você/o(a) senhor(a) quer oferecer uma bebida a um amigo e quer saber se ele prefere vinho ou cerveja, como é que você/o(a) senhor(a) se dirige a ele e pergunta? (If you want to offer a drink to a friend and you would like to know if he/she prefers wine or beer, how do you address him/her and ask it?) (**Instruction**)

- 2) *Ó, meu amigo, você toma leite ou café?* (Hey, my friend, do you drink milk or coffee?) (**Expected Answer**)

Se você/o(a) senhor(a) quer saber se o seu amigo toma leite ou café, como é que você/o(a) senhor(a) se dirige a ele e pergunta? (If you want to know whether your friend drinks milk or coffee, how do you address him/her and ask it?) (**Instruction**)

- 3) *Você vai sair hoje?* (Are you going out today?) (**Expected Answer**)

Se você/o(a) senhor(a) quer saber se alguém vai sair hoje, como é que você/o(a) senhor(a) pergunta? (If you want to know whether someone is going out today, how do you ask it?) (**Instruction**)

³ Both AMPER and ALIB data reveal “surprises” in data collection. Even if the text is ready, in AMPER, some speakers do not produce the articles and some speakers change the structures, which requires collecting six samples of each utterance. In some cases, unexpected lexical items may appear. The images are interpretable, but only phrases that reproduce the model, or are close to the expected model in number of syllables, are taken into account and selected. Cunha (2005) points out that in ALIB as well the expected phrases are hardly ever produced, in acted speech interaction.

- 4) *Eu vou sair hoje, doutor?* (Am I leaving today, doctor?) (**Expected Answer**)

Uma pessoa está internada em um hospital e quer saber do médico se vai sair naquele dia. Como é que pergunta? (Someone, being a patient at a hospital, would like the doctor to tell him/her if he/she will be discharged on that day. What is the question?) (**Instruction**)

For declarative utterances, three contexts are provided, with instructions and expected answers, the first one for a neutral declarative utterance, and the last two for declarative utterances with marks of expressiveness (CUNHA, 2006). However, Silvestre (2012, p. 59) signals that, besides having only one question regarding the neutral statement, informants did not produce the expected information satisfactorily. Moreover, contrary to what was expected, it was not possible to compare identical phrases or even phrases ending in the same word. Therefore, in her work, Silvestre (2012) compares the neutral declarative utterances produced throughout the other questionnaires.

- 1) *Você vai sair hoje.* (You are leaving today). (**Expected Answer**)

Uma pessoa está internada num hospital e quer saber do médico se vai sair naquele dia. Se a resposta for positiva, como é que o médico responde? (Someone, being a patient at a hospital, would like the doctor to tell him/her if he/she will be discharged on that day. If the answer is affirmative, how does the doctor answer?) (**Instruction**)

- 2) *Oh, gente, estou muito aborrecido com o que aconteceu.* (Oh, people, I am very upset with what happened.) (**Expected Answer, expressing displeasure, harshness**)

Você / o(a) senhor(a) quer dizer a algumas pessoas que estão presentes que você / o(a) senhor(a) está muito aborrecido com o que aconteceu. Como é que você / o(a) senhor(a) diz? (You want to tell some people in presence that you are very upset with what happened. How do you tell them?) (**Instruction**)

- 3) *Oh, gente, estou muito feliz com o resultado do trabalho.* (Oh, people I am very pleased with the work results.) (**Expected Answer, expressing happiness, politeness**)

Você / o(a) senhor(a) quer dizer a algumas pessoas que estão presentes que você / o(a) senhor(a) está muito feliz com o resultado do trabalho. Como é que você / o(a) senhor(a) diz? (You want to tell some people in presence that you are very pleased with the work result. How do you tell them?) (Instruction)

The compared structures from both AMPER and ALIB corpus are similar and, in general, have the same number of syllables, which uses interview data and paroxytonic utterances. This study considers AMPER data to be obtained from read speech, whereas ALIB data are obtained from acted speech, and both are experimental.

This comparison between the prosodic variations in utterances from AMPER-Por (Brazil), referring to three Brazilian state capitals, has four purposes: 1) characterize the declarative and yes-no question patterns from Salvador, Fortaleza, and Rio de Janeiro, checking if the accentual patterns $H + L^* L\%$, for nucleus syllables in declarative utterances, and $L + H^* L\%$ for nucleus syllables in interrogative utterances, as proposed by Moraes (2008), are materialized within these data from the AMPER project;⁴ 2) discuss the results regarding both state capitals, Salvador and Fortaleza, according to the work of Lira (2009), who analyzed data from these state capitals; 3) compare the results in AMPER to the results of the data analysis from the ALIB project proposed by Silva (2011) and Silvestre (2012) for the three state capitals; and 4) describe the stressed syllable variation in relation to the pre-stressed and post-stressed nucleus syllables in terms of duration, fundamental frequency, and intensity, comparing implementation convergences and divergences of these acoustic parameters in the three local varieties analyzed. To perform this study, we adopted the comparative patterns proposed by Moraes (2008) for the state of Rio de Janeiro, those proposed by Antunes (2012) for the state of Minas Gerais, those proposed by Nunes (2015) for the state of Santa Catarina, and those proposed by Seara and Rebollo-Couto (2011) to compare the data of Santa Catarina and Rio de Janeiro, also taking into

⁴ According to the self-segmental metric theory, the notation (*) corresponds to the lexical stressed syllable and the notation (%) to the utterance boundary tone. The prenucleus is the last stressed syllable in the utterance, and the prenucleus is everything that is on its left. The prenucleus, therefore, is the utterance end, marked by the last lexical accentuation (*) and the boundary tone (%).

account the discussion proposed by Lira (2009) regarding intonational variation in five state capitals in the Northeast Region of Brazil.

2 Previous research on declarative and full interrogative utterances

For the description of declarative and yes-no question contours, Moraes (2008) proposes two contrasting nuclear accentual patterns. The final inflection exhibits a falling final movement (\downarrow) in the assertive, exclamatory, and interrogative modalities, or, rather, a circumflex ending (\wedge), that is, falling-rising-falling, in the yes-no question. Using the autosegmental-metrical notation (Ladd 2008), Moraes (2008) proposes neutral declarative utterances with a melodic pattern $H+L^*L\%$, that is, a fall between the final pre-stressed and stressed syllables, followed by a leveling in the post-stressed syllable. For yes-no question utterances, Moraes proposes the notation $L+H^*L\%$, with implementation differences regarding the peak alignment of the stressed syllable, late for questions and early for requests. It is worth emphasizing that, according to Cunha (2000), those may vary according to the dialectal area to which the speaker belongs. The BP contrasting pair, between the declaratives $H+L^*L\%$ and the neutral yes-no question $L+H^*L\%$, as proposed by Moraes (2008), has been systematically found in several intonational studies and in different locations in the country.

Particularly regarding the descriptions for Rio de Janeiro, the results obtained by Silva (2011) and Silvestre (2012), working with data from the ALIB project, should be emphasized. For Silvestre (2012, p. 82-83):

Rio de Janeiro. The intonation in the neutral assertive utterances in speakers from Rio de Janeiro, widely described in BP, exhibited, in our corpus, the same behavior previously demonstrated by Moraes, Cunha, Tenani and other authors: low tone on the syllables that make up the pre-nuclear accent, and similarly low tones observed up to the last pre-stressed syllable of I, in which F_0 reaches its peak and after that exhibits the final falling movement. The utterance “*O sol tá nascendo*” (“The sun’s rising”), said by the Rio de Janeiro native speaker in the first age group, youth, provides, once again, a sample of the pattern. In it, the 157Hz F_0 in the first stressed syllable of I rises 14%

until it peaks at 179Hz in the last pre-stressed syllable and falls 22% until the final boundary.

Silva (2011, p. 102-103) finds two variants in the same pattern for yes-no questions in the Rio de Janeiro state capital:

The full interrogative in the Rio de Janeiro state capital exhibited, in general, the following initial configuration: initial peak hosted on the first stressed syllable, followed by a fall along the middle of the sentence. The final circumflex configuration exhibited two types of behavior on the final stressed syllable: melodic peak [+ early], followed by a falling movement, and rising movement, followed by melodic peak [+ late]. Both reach values that exceed those obtained by the first peak. The utterances “*A pessoa que tá internada vai sair hoje?*” (“Is the inpatient leaving today?”) and “*A minha alta vai ser hoje?*” (“Am I going to be discharged today?”), shown below were produced, respectively, by the man and the woman in the first age group. The initial contour common to both exhibits an initial peak on the first stressed syllable, followed by falling movement, which exhibits variation of 36 Hz on the first variation, and variation of 21 Hz on the second one. The difference between these **sentences** is related to the last stressed syllable peak manifestation. A rising movement, whose peak is reached on the right of this syllable, is detected in the first phrase. In the second phrase, however, the peak occurs at the start of the stressed syllable, followed by a falling movement.

That is, the works of Silva (2011) and Silvestre (2012) confirm Moraes’ (2008) proposal for Rio de Janeiro. What happens in the case of Salvador and Fortaleza? For these two Northeastern state capitals, this study relies on the results obtained by Lira (2009), whose data are reanalyzed in this paper, given the comparison with the results for Rio de Janeiro, taking into account, in addition to the melodic contour analyzed in Lira’s (2009) thesis, F0, duration and intensity variations.

Lira (2009) analyzes only yes-no question and partial interrogative utterances obtained in Salvador and Fortaleza. Regarding the melodic contours of yes-no questions in these two state capitals, the author proposes two contrasting patterns for the two regional varieties. The

proposal is that of a high final stressed syllable followed by low post-stressed syllables in Fortaleza, and, conversely, of a low final stressed syllable, followed by a low post-stressed syllable in Salvador, a rising movement that starts on the stressed syllable (LIRA, 2009, p. 106-107).

This low final stressed syllable for Salvador, although with a rising movement and peak on the post-stressed syllables is exemplified for the yes-no questions in Salvador (LIRA, 2009, p. 101-106), in the three accentual patterns, as follows:

- a) The **oxytone** ending, “*bisavô*” (great-grandfather) ends in a rising movement with a small appendix on the final stressed syllable (LIRA, 2009, p. 104).
- b) The **paroxytone** ending, “Renato”, with the loss of the last syllable, also ends in the same oxytone pattern, with a moderate melodic rise on the stressed syllable, from 98 to 129 Hz, considering the average values of a speaker’s performance (LIRA, 2009, p. 104).
- c) The **proparoxytone** ending, “*pássaro*” (bird), ends either with a rising movement on the final stressed syllable and extends on the final post-stressed syllables, or with a final stressed syllable located at a high level, but followed by a fall over the final post-stressed syllable (LIRA, 2009, p. 106).

This high final stressed syllable for Fortaleza is exemplified, on the three accentual patterns, as follows, for the yes-no questions in Fortaleza (LIRA, 2009, 9 p. 4-96), and the oxytone and paroxytone patterns are very close, differently from the proparoxytone pattern:

- a) The **oxytone** ending, “*bisavô*” (great-grandfather) ends in a clearer melodic rise on the stressed syllable, from 96 to 124 Hz, considering the average values of a speaker’s performance (LIRA, 2009, p. 95)
- b) The **paroxytone** ending, “Renato”, with the loss of the last syllable, also ends in a moderate melodic rise on the stressed syllable, from 96 to 105 Hz, considering the average values of a speaker’s performance (LIRA, 2009, p. 104).
- c) The **proparoxytone** ending, “*pássaro*” (bird), ends with a melodic rise after the final stressed syllable, moving from 124 to 130 Hz and reaches 180 Hz on the last final post-stressed syllable, considering

the average values of a speaker's performance, without suppressing the last unstressed syllables, reaching a peak on the last unstressed syllable (LIRA, 2009, p. 96).

Silva (2011), in a study using the ALIB project corpus, analyzes the interrogative utterances with paroxytone ending (“*O meu amigo vai ter alta hoje?*” (“Will my friend be discharged today”)); “*Você vai sair hoje?*” (“Are you going out today”), and “*A minha alta vai ser hoje?*” (“Am I going to be discharged today?”).

For Salvador, Silva (2011, p. 93-94) finds two patterns, a pattern of **high stressed syllable followed by low post-stressed syllable**, which corresponds to the accent proposed by Moraes (2008) L + H* L%, but also an accent with a high boundary tone L + H* H%, which was the pattern found by Lira (2009), **high stressed syllable followed by high post-stressed syllable**:

The most common initial contour found in the analyzed phrases from Salvador exhibits a high level in the stressed syllable, which may also be manifested in the pre-stressed syllable, followed by a falling movement that extends to the final pre-stressed syllable. Regarding the phrase ending contour, two behaviors have been detected: a circumflex configuration formed by low F0 on the pre-stressed syllable, melodic rise with a peak aligned on the right on the stressed syllable, and a fall on the post-stressed syllable; and a final rising movement hosted on the stressed and post-stressed syllables. In the analyzed data from Salvador, the second peak is more prominent than the first peak.

The utterance “*Você vai sair hoje?*” (“Are you going out today?”), [vo 'se 'vaj sa 'i 'oi ʒi], produced by the female speaker in the second age group, exhibits the most recurrent pattern in the analyzed data for Salvador. The highest level in this phrase falls on the first stressed syllable. A 54-Hz falling movement is located in the middle of the utterance. On the stressed syllable, the frequency increases to 50 Hz towards the end of the syllable, where it reaches its peak, falling 34 Hz in the post-stressed syllable.

In the utterance “*Eu estou de alta?*” (“Am I being discharged?”), [ew iʃ 'to ʒi 'aw tɐ], performed by the female speaker in the first age group, the least recurrent

melodic pattern in the analyzed data for Salvador. This phrase has its melodic peak on the pre-stressed syllable, followed by a 25-Hz falling movement up to the final pre-stressed syllable, and a 38-Hz rise in F0 of the last stressed syllable, which remains high in the post-stressed syllable.

For Fortaleza, Silva (2011, p. 84-85) detects a **high stressed syllable pattern** followed by low post-stressed syllable, which corresponds to the accent proposed by Moraes (2008) L + H* L%, with systematic devoicing of the last post-stressed syllable, potentially connected to the choice of the lexical unit “*hoje*” (today):

A single yes-no question pattern was detected in the utterances collected in Fortaleza. The first phrase configuration exhibits falling movement that extends from the first to the last pre-stressed syllable in the utterance. The second configuration, in turn, is characterized by a rising-falling movement inside the final stressed syllable, whose peak has a [+late] trait. The post-stressed syllable behavior could not be described, as it was devoiced in all data.

In the utterance “*O meu amigo vai ter alta hoje?*” (“Is my friend going to be discharged today?”), [u 'mew ã 'mi gu vaj te 'aw tẽ 'o ʒɪ], spoken by the female speaker in the first age group, it is detected that the 216-Hz prominence at the phrase’s beginning is located in the first pre-stressed syllable, and is followed by a 52-Hz fall throughout the syllables within the phrase. The final circumflex configuration is hosted in the last stressed syllable, and the peak is aligned to the right. This configuration is less prominent than the first one exhibiting a 38-Hz variation in the rise, and a 19-Hz variation in the F0 fall. (SILVA, 2011, p. 84-85)

Silvestre (2012, p. viii), in a study using the same corpus from the ALIB project, identifies, for all declarative utterances (“*Você vai estar de alta hoje.*” (“You will be discharged today”); “*Eu dou alta pra ele.*” (“I’ll discharge him”); and “*O sol está nascendo.*” (“The sun is rising”)) and for all locations, Salvador, Fortaleza and Rio de Janeiro, a falling contour on the nucleus, with the phonological notation H+L*L%. The difference between the contours from Rio de Janeiro and those for

the northeastern state capitals would be on the attack, or pre-nucleus of declarative utterances:

The pattern observed in the North and Northeast state capitals receive the same notations proposed by Cunha (2005) for neutral assertions in Recife, based on the NURC project corpus: H*___H+L*L%. For the pattern most frequently observed in Midwest and Southeast state capitals in Brazil, a notation similar to that proposed by Cunha (2005) and Moraes (2008) is assigned, for neutral assertion, both based on Rio de Janeiro's speech: L+H*___H+L*L%. (SILVESTRE, 2012, p. viii)

The works of Silva (2011) and Silvestre (2012) use the ALIB corpus for prosodic analysis of the interrogative and declarative utterances, respectively, to characterize the intonational differences among the Brazilian state capitals.

3 Methodological procedures

To execute this work, the methodology used by the AMPER Project (MOUTINHO et al., 2011) was adopted. The corpus includes the recording of a series of declarative and neutral yes-no question utterances generated by visual stimuli. The following is a detailed presentation, by parts, of the *research corpus*, *the research speakers*, and the presentation of *the analysis stages*.

3.1 The research corpus

This analysis corpus consists of 6 utterances, formed by 3 declarative utterances, those which state reality or the possibility of a fact, and 3 yes-no questions, those which correspond to the affirmative or negative nature of the predicate, that is, they may be answered with yes or no. The utterances are analyzed based on three repetitions of each, reaching a total of 18 utterances analyzed for each speaker. All of them have 10 syllables, including proparoxytone, paroxytone, and oxytone endings. These utterances were obtained by means of recordings of three phrases, repeated three times per speaker. The AMPER methodology provides for the recording of six repetitions of data in order to justify

the choice of the best three recordings. The phrases are the following, according to their paroxytone, paroxytone, and oxytone prenuclci:

- | | |
|---|--|
| ♦ <i>O pássaro gosta do pássaro.</i> (The bird likes the bird.) | ♦ <i>O pássaro gosta do pássaro?</i> (Does the bird like the bird?) |
| ♦ <i>O Renato gosta do Renato.</i> (Renato likes Renato.) | ♦ <i>O Renato gosta do Renato?</i> (Does Renato like Renato?) |
| ♦ <i>O bisavô gosta do bisavô.</i> (The great-grandfather likes the great-grandfather.) | ♦ <i>O bisavô gosta do bisavô?</i> (Does the great-grandfather <u>like</u> the great-grandfather?) |

Three phrases were selected for each modality produced by each speaker. The criteria employed were recording quality (some recordings exhibited technical problems, such as a truncate utterance) and recordings whose signal-to-noise ratio was high enough to enable one to perform acoustic analyses.

The AMPER analysis programs generate a delexicalized average F0 curve based on the three performances selected for each utterance by speaker. The delexicalization technique (RILLIARD, 2014, p. 30) is based on resynthesis process of the melodic curve, with no segmental content, which ensures the sole transmission of the prosodic information, normalizing potential microprosodic, phonotactic, and articulation effects. The delexicalisation process preserves a clear syllabic structure, and, therefore, all information regarding the regional rhythmic variation. The segmentation was done in Praat, and the analysis was done with Matlab. The procedure is detailed in Romano et al. (2011).

The data were collected by using the AMPER project methodology, with utterances adapted to BP. The utterance recording is collected from image readings. Speakers are provided with visual stimuli to produce them, as proposed by Moraes and Abraçado (2005).

FIGURE 1 – Examples of (A) declarative and (B) interrogative utterances to be produced by the speakers



A: *O pássaro gosta do pássaro.*
(The bird likes the bird.)

B: *O pássaro gosta do pássaro?*
(Does the bird like the bird?)

Once the text is ready, it is expressed orally a posteriori, after a period of training and repetition, we consider these collected data to be closer to read data, rather than acted speech data, such as the data from the ALIB project, collected in an interaction context with greater control of expressiveness. In both cases, we are faced with experimental (or laboratory) speech, triggered by a motivating element, but the fact that the text is not finished, and is not produced simultaneously to its oral expression process, leads us to consider our data to be closer to read data (the text is under the eyes of the speaker), instead of those in acted speech (the speaker has memorized the text, and has repeated and practiced its utterance many times).

3.2 Research speakers

Speakers in this research come from three cities: Salvador and Fortaleza, in the Northeast Region of Brazil, and Rio de Janeiro, in the Southeast Region of Brazil. All six speakers, a man and a woman from each location, are at least high-school graduates, and are all in the “young” people age group, between 20 and 35 years of age. The speakers from Rio de Janeiro are college seniors majoring in Languages, preparing their undergraduate thesis, which may affect the reading pattern, which we had found very marked for this city’s speakers, as compared to those from the two Northeastern state capitals, who do not have a college education.

The speech in the cities of Salvador, Fortaleza, and Rio de Janeiro have three easily recognizable “accents” that are stereotyped or publicized by the media all over Brazil, despite the absence of perception tests that attest these speeches’ recognition conditions (CUNHA, 2006). In this sense, we highlight the studies that are currently ongoing at the Federal

University of Rio de Janeiro (UFRJ), under the direction of João Antônio de Moraes, to describe relevant melodic movements (MIRANDA, 2015, p. 19) in BP.⁵

3.3 Analysis stage

The data analysis stage for this research consisted of the segmentation of the utterances in the computer program PRAAT (BOERSMA; WEENINK, 2014), in order to observe the behavior of stressed, pre-stressed, and post-stressed vowels in the utterances, and how the F0, duration, and intensity acoustic parameters were implemented for each vowel in the produced utterances. Afterwards, we generated charts for the acoustic parameters: fundamental frequency (F0), intensity, and vowel duration by means of scripts from the PRAAT program and from the Interface *_AMPER_beta11* program (RILLIARD; LAI, 2008), according to the conventions presented in Contini et al. (2009) or in Romano et al. (2011). Based on these charts, we prepared the phonetic description and the phonological analysis of the utterances' intonational contour. In the case of unrealized vowels, the convention is to define (on the graphs) an F0 value equal to 50 Hz, which makes the curve seem discontinuous in the generated contours and charts.

From a phonetic standpoint, to perform this study, we took into account the value of duration and intensity of vowels in the nucleus of each utterance (accented last syllable) and the fundamental frequency (F0). The F0 measurement is taken at three points of each vowel, beginning, middle, and end, thus introducing a temporal normalization comparable to the normalization described by Xu (2004) and Arantes (2015). To obtain stable values for each of these parameters, we opted to consider the average of three repetitions of each vowel, according to the AMPER methodology. Intensity variations associated with recording conditions (especially the recording level and the distance between the speaker and the microphone) are negligible, as we have considered, with the AMPER methodology, differences in the average intensity level between close vowels. These differences are hardly affected by the recording conditions.

⁵ These are works that emphasize modal intonation, by means of experimental phonetic studies on Brazilian Portuguese intonation, based on the F0 curve stylization and resynthesis method, in a perceptive approach based on the Dutch IPO model (MIRANDA, 2015).

Vowel duration is considered, rather than the intensity of syllables or V-V units, which constitutes a debatable approximation to the speech rhythm (BARBOSA, 2007), but the restrictions inherent in the AMPER corpus make the strict normalization of the intrinsic influence of the phonemes; these influences are controlled by the use of the same phrases (and, therefore, the same phonemes), by all of the speakers. Therefore, this work demonstrates, with this methodology, vowel duration lengthening, and reduction patterns.

The F0 behavior of vowels is analyzed based on the contrast between the values in Hz of the first stressed syllable vowel, and of the pre-stressed and post-stressed vowels in each utterance. From a phonological standpoint, we took into account the melodic contour of the utterances, as they were initially described by Moraes (2008) and confirmed by the works of Lira (2009), Silva (2011), and Silvestre (2012).

4 Results and discussions

The analysis of nuclear accentual patterns was developed for utterances from each location, based on the F0, duration, and intensity charts, and taking into account the three accentual patterns in Portuguese: starting with the paroxytone nucleus patterns, which are the most frequent and productive (1 stressed syllable and 1 final unstressed syllable), followed by the proparoxytone pattern, the longest one (1 stressed syllable and 2 final unstressed syllable), and ending by the oxytone pattern, the most controversial of these, as it occurs truncated or compressed, according to the different phonological interpretations (1 final stressed syllable).

4.1 Results and discussions: paroxytone prenuclei

The paroxytone accentual category is the most frequent in Portuguese, in terms of productivity, with a distribution frequency of approximately 70%, according to Cintra (1997), considering the accentual pattern distribution in the Portuguese words. The paroxytone accentual pattern is analyzed based on the three acoustic parameters: F0, duration, and intensity, in declarative and full interrogative utterances.

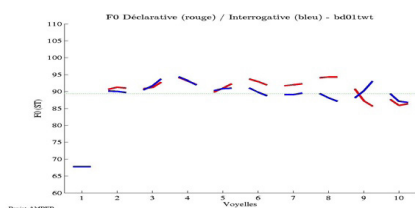
In terms of F0, in the **Salvador** variety, both the man and the women speakers perform, in declarative phrases (in red), a rising pattern, high on the prenucleus, “Renato”, pre-stressed syllable (syllable 8), a

falling pattern on the stressed syllable (syllable 9), and a low pattern on the final post-stressed syllable (syllable 10).

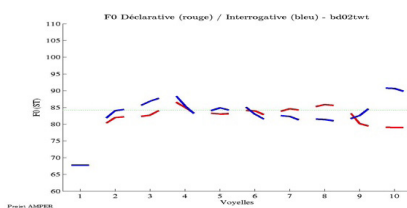
Interrogative utterances (in blue) exhibit a fall in F0 on the pre-stressed syllable (syllable 8), a rising curve on the stressed syllable (syllable 9), and a variable behavior in the post-stressed syllable, low/falling for the woman and high/rising for the man.

FIGURE 2 – Salvador variety: high-school graduates

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)
 Declarative (red) and interrogative (blue).



A: F0 for the woman from Salvador



B: F0 for the man from Salvador

Let's recall that the elided vowels are represented by convention in the AMPER charts by 50 Hz for F0 and by 0 (zero) duration and intensity. Therefore, the low bar on the first vowel indicates the fall of the initial article.

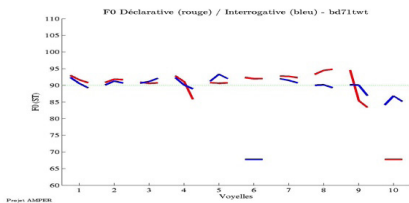
In the prenucleus “Renato” (see syllables 2, 3, and 4), the same behavior is detected in the declarative and in the interrogative utterances, although the F0 is higher for the man in interrogative utterances: a rising movement that would culminate in the post-stressed syllable, a rising stressed syllable, and a high falling post-stressed syllable. This is a progressive rising behavior, without sudden F0 falls on the stressed syllable of declarative statements, as observed in the nucleus (syllable 9), corresponding to the notation proposed by Silvestre (2012), L + H* as characteristic of dialects in the North and Northeast Regions of Brazil. From a phonological standpoint, both performances confirm the nucleus pattern H + L* L% for declarative utterances (red), but only the woman confirms the nucleus pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008). In the man's performance, the pattern performed corresponds to the L + H* H%, as previously reported by Lira (2009) and Silva (2011) for the city of Salvador.

In the **Fortaleza** variety, both the man and the woman perform, in declarative utterances (in red), a high and rising pattern in the pre-stressed syllable of the nucleus, “Renato” (syllable 8), a falling pattern on the stressed syllable (syllable 9), and a low pattern in the final post-stressed syllable (syllable 10), elided in the woman’s speech.

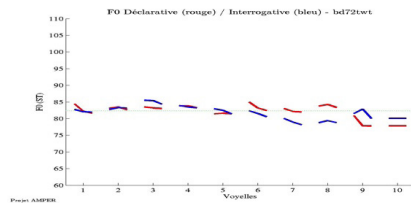
Interrogative utterances (in blue) exhibit a low F0 in the pre-stressed syllable (syllable 8), a rising-falling curve in the stressed syllable (syllable 9), and a F0 fall in the final post-stressed syllable, for both the woman and the man.

FIGURE 3 – Fortaleza variety: high-school graduates

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)
 Declarative (red) and interrogative (blue).



A: F0 for the woman from Fortaleza



B: F0 for the man from Fortaleza

In the prenucleus “Renato” (see syllables 2, 3, and 4), the same behavior is detected in the declarative and in the interrogative utterances: a rising movement that culminates in the post-stressed syllable. This is a high and slightly progressive rising behavior, without sudden F0 falls on the stressed syllable of declarative statements, as observed in the **nucleus** (syllable 9), not corresponding to the notation proposed by Silvestre (2012), L + H* as characteristic of the speeches in the North and Northeast Regions of Brazil, but rather to the notation H*. From the phonological standpoint, both performances confirm the nucleus pattern H + L* L% for declarative utterances (red), but only the man confirms the nucleus pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008). For the woman, the pattern performed corresponds to H + H* L%, previously recorded by Lira (2009) and Silva (2011), for the city of Fortaleza.

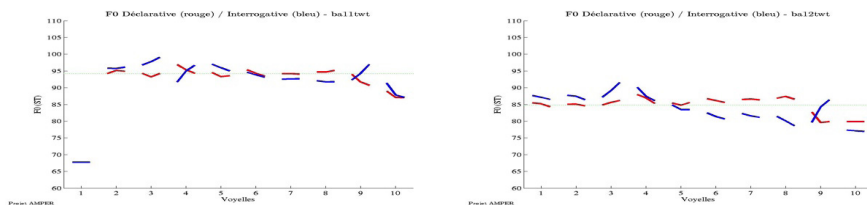
In the **Rio de Janeiro** variety, both the man and the women perform, in the declarative utterances (in red), a rising F0 pattern on the

pre-stressed syllable, in the prenucleus, “Renato”, falling on the stressed syllable, and low in the post-stressed syllable that is not elided.

FIGURE 4 – Rio de Janeiro variety: high-school graduates

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Rio de Janeiro **B:** F0 for the man from Rio de Janeiro

In the prenucleus “Renato”, the pattern behavior is quite different from the nucleus behavior (see syllables 2, 3, and 4), and corresponds to the tonal accent H*, as proposed by Moraes (2008) and Silvestre (2012) for Rio de Janeiro. This is a progressive rising behavior, which peaks at the post-stressed syllable in declarative utterances, without a sudden F0 fall on the nucleus (see syllables 8, 9, and 10). From the phonological standpoint, both performances confirm the pattern H + L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008).

In terms of duration, the duration distribution by syllable is much more regular, with fewer differences between accented and unaccented or unstressed syllables in the data from Rio de Janeiro, if compared to the data from Salvador and Fortaleza, for declarative (red) and interrogative (blue) utterances.

FIGURE 5: Duration of the utterance with paroxytone pre-nucleus: women

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)

Declarative (red) and interrogative (blue).

Duration for the women from Salvador, Fortaleza, and Rio de Janeiro⁶

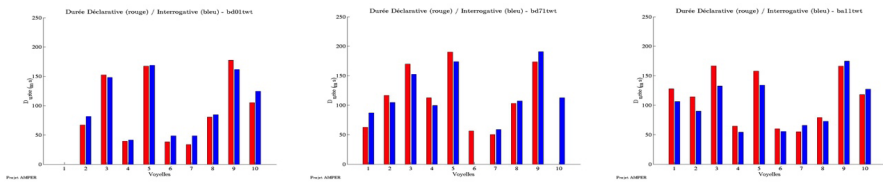
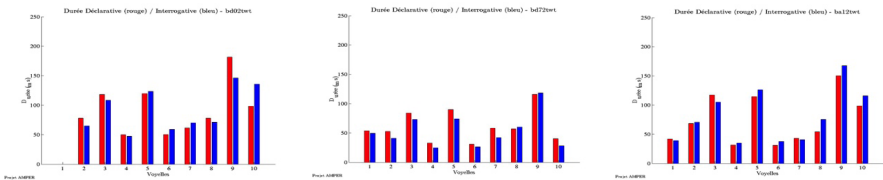


FIGURE 6 – Duration of the utterance with paroxytone pre-nucleus: men

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)

Declarative (red) and interrogative (blue).

Duration for the men from Salvador, Fortaleza, and Rio de Janeiro



The vowels in the stressed syllables in “Renato” (syllable 3) in the pre-nucleus, “gosta” (likes, syllable 5), and “Renato” (syllable 9) in the utterance nucleus, are much longer than the vowels in the unstressed syllable that follow them in Fortaleza, much like in Rio de Janeiro.⁷

In Rio de Janeiro, the post-stressed syllables 4, 6, and 10 are always performed, which may be related to a school reading pattern,

⁶ The elided vowels are represented, by convention, in AMPER charts by 50 Hz for F0, and by 0 (zero) duration and intensity. The phrase selection is performed based on this elision, when it occurs, by choosing three phrases in which the vowel is elided at the same location. If it is impossible to find three phrases with the same elision points, only two are selected.

⁷ For a more precise comparison, the vowels’ duration would need to have been normalized; however, stressed vowels are so much longer than the unstressed vowels, we believe such procedure will not alter this pattern.

learned and practiced during the education years, and exposure to the reading variant in relation to spontaneous speech. This pattern is repeated in the data for Fortaleza, despite the devoicing and the two suppressions of syllable centers in unstressed syllables, syllable 6 in the declarative utterance “*gosta*” (likes) and syllable 10 in the declarative utterance “*Renato*”. In terms of duration, the highest accentual pattern, with the greatest difference between unstressed and stressed syllables, is found in Salvador. This is a qualitative, rather than a quantitative description of this difference, which would require systematic analysis in future works.

The male speaker from Rio de Janeiro divides his utterance symmetrically in two rhythmic groups, with two duration peaks on the two stressed syllables in the nucleus, “*Renato*” and “*gosta*” (likes, syllables 3 and 5 respectively), and with two peaks on the two last syllables of the nucleus, “*Renato*” (syllables 9 and 10), with the lengthening of the final post-stressed syllable, as a rhythmic reading strategy (according to this study’s interpretation).

In terms of intensity, at the three locations, the stressed syllable intensity in the nucleus is stronger in the interrogative utterance (blue, syllable 9), than in the declarative utterance (red). The woman from Rio de Janeiro behaves differently from the others in this case, due to the progressive intensity fall on the final unstressed syllable of the utterance (syllable 10), a strategic procedure characteristic of the reading that is not detected in the other two women’s speeches.

FIGURE 7 – Intensity of the utterance with paroxytone pre-nucleus: women

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)

Declarative (red) and interrogative (blue).

Intensity for the women from Salvador, Fortaleza, and Rio de Janeiro

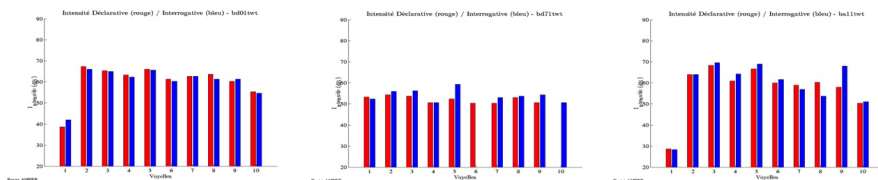
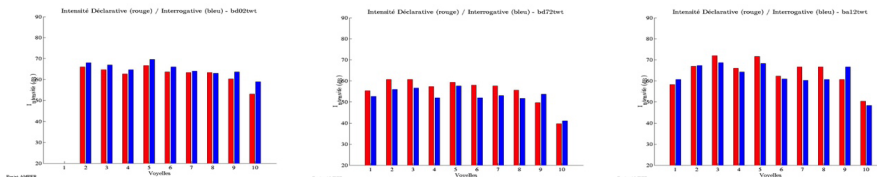


FIGURE 8 – Intensity of the utterance with paroxytone prenucleus: men

Utterance 1: *O Renato gosta do Renato.* (Renato likes Renato.)/
O Renato gosta do Renato? (Does Renato like Renato?)

Declarative (red) and interrogative (blue).

Intensity for the men from Salvador, Fortaleza, and Rio de Janeiro



The man from Rio de Janeiro, who has a higher education level, behaves differently from the others, in this case, due to the progressive intensity fall on the final unstressed syllable of the utterance (syllable 10), a strategic procedure characteristic of the reading that is not detected in the other two women’s speeches.

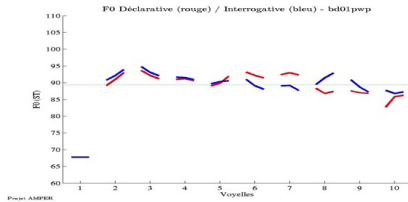
4.2 Results and discussions: proparoxytone prenuclei

The proparoxytone accentual category is the least frequent category in Portuguese, in terms of productivity (REIS, 1995). It is viewed as a longer nucleus that extends for three syllables, when the last syllable is not elided, which would transform it into a paroxytone pattern. The proparoxytone accentual pattern is analyzed on the basis of the three acoustic parameters: F0, duration, and intensity, in declarative and yes-no question utterances.

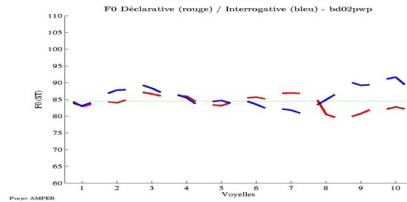
In terms of F0, in the **Salvador** variety, neither the man nor the woman elide the final syllables. Both the man and the woman speakers perform a high pattern on the pre-stressed syllable of the nucleus, “*pássaro*” (bird), in declarative sentences, but perform a falling pattern on the stressed syllable, and a low pattern on the post-stressed syllable.

FIGURE 9 – Salvador variety: high-school graduates

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)
 Declarative (red) and interrogative (blue).



A: F0 for the woman from Salvador



B: F0 for the man from Salvador

In the prenucleus “*pássaro*” (bird), the pattern behaves quite differently from the nucleus (see syllables 2, 3, and 4, to the prenucleus). This is a high or rising behavior on the stressed syllable (syllable 2), without sudden F0 fall on the prenucleus syllable 8 in declarative utterances, with a L + H* pattern for the prenucleus and a H + L* L% pattern for the nucleus in declarative utterances. In interrogative utterance, the two patterns expected for Salvador are performed, with a low ending, L + H* L% for the woman, and L + H* H% for the man.

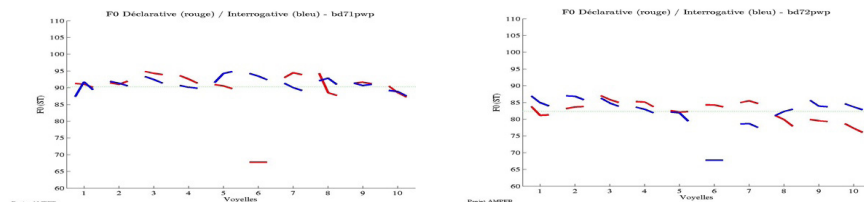
From the phonological standpoint, both performances confirm the pattern H + L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008); however, the variant described by Lira (2009) and Silva (2011), with a high ending for the city of Salvador, is observed in the man’s performance.

In the **Fortaleza** variety, neither the man nor the woman speakers elide final syllables. Both speakers perform a high pattern on the pre-stressed syllable of the prenucleus, “*pássaro*” (bird), in declarative **sentences** (red), but perform a falling pattern on the stressed syllable and a low pattern on the post-stressed syllable.

FIGURE 10 – Fortaleza variety: high-school graduates

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Fortaleza

B: F0 for the man from Fortaleza

In the prenucleus “*pássaro*” (bird), the pattern behaves quite differently from the nucleus, (see syllables 2, 3, and 4 for the prenucleus). This is a high or rising behavior on the stressed syllable (syllable 2), without sudden F0 fall on the nucleus (syllable 8) in declarative utterances, with a L + H* pattern for the prenucleus and a H + L* L% pattern for the nucleus in declarative utterances. In interrogative utterances (blue), two patterns are performed for Fortaleza, one of them with a low ending, L + H* L% for the woman, and L + H* H% for the man.

From the phonological standpoint, both performances confirm the pattern H + L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008); however, the variant described by Lira (2009) and Silva (2011), with a high ending for the city of Salvador, is observed in the man’s performance in the Fortaleza variant.

Also from the phonological standpoint, both performances confirm the pattern H + L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008). In the prenucleus “*pássaro*” (bird), the pattern behaves quite differently from the nucleus (see syllables 2, 3, and 4, for the prenucleus). This is a high or rising behavior on the stressed syllable, syllable 2, without sudden F0 fall on the prenucleus, syllable 8, in declarative utterances, with a L + H* pattern for the **prenucleus** and a H + L* L% pattern for the nucleus in declarative utterances. In interrogative utterances, two patterns expected for Fortaleza are performed, one with a low ending, L + H* L% for the woman, and L + H* H% for the man. From the phonological standpoint, both performances confirm the pattern H +

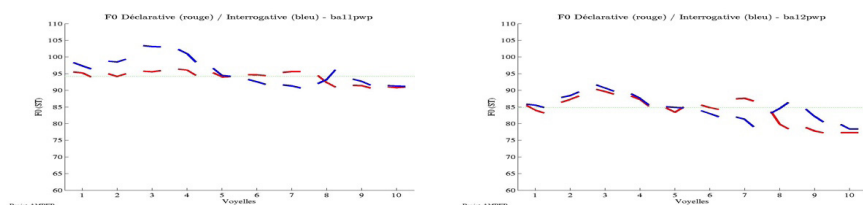
L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), as proposed by Moraes (2008); however, the variant described by Lira (2009) and Silva (2011), with a high ending for the city of Fortaleza, is observed in the man's performance.

In the **Rio de Janeiro** variety, both the man and the woman perform a high pattern on the pre-stressed syllable (syllable 7) of the nucleus, “pássaro” (bird), in declarative phrases (red), but perform a falling pattern on the stressed syllable, which fall softly on the post-stressed syllables that are not elided.

FIGURE 11 – Rio de Janeiro variety: high-school graduates

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Rio de Janeiro

B: F0 for the man from Rio de Janeiro

In the prenucleus “pássaro” (bird), the pattern behaves quite differently from the nucleus, (see syllables 2, 3, and 4 for the prenucleus). This is a rising behavior on the stressed syllable (syllable 2), which keeps rising slightly through the two following syllables (3 and 4). There are no erased syllables, and the curves are performed progressively. This rhythmic and melodic behavior, so different from the behaviors found in speakers from Salvador and Fortaleza, could be due to the different education level between these two speakers. They both demonstrate having acquired a rhythmic reading pattern, as well as having more regular melodic patterns for the oral expression of reading data.

From the phonological standpoint, both performances confirm the pattern H + L* L% for declarative utterances (red) and the pattern L + H* L% for the interrogative utterances (blue), proposed by Moraes (2008).

In terms of duration, the same syllable suppression pattern is repeated in Fortaleza for proparoxytone. However, a greater difference between the stressed and unstressed syllable in the prenucleus “pássaro”

(bird) – syllables 2, 3, 4 – and “*gosta*” (likes) – syllables 5 and 6 – may be observed both in Salvador and Fortaleza, if compared to Rio de Janeiro. These qualitative rhythmic observations would require further systematic description, based on a quantitative analysis.

FIGURE 12: Duration of the utterance with proparoxytone prenucleus: women

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)

Declarative (red) and interrogative (blue).

Duration for the women from Salvador, Fortaleza, and Rio de Janeiro

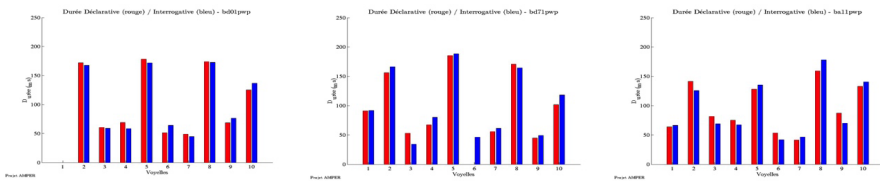
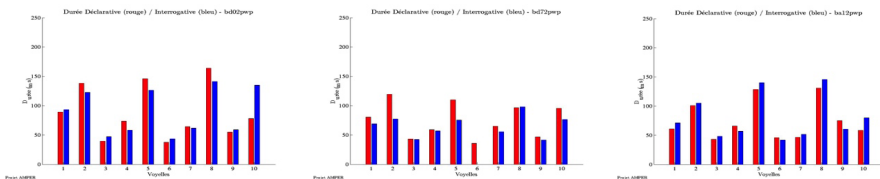


FIGURE 13: Duration of the utterance with proparoxytone prenucleus: men

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)

Declarative (red) and interrogative (blue).

Duration for the men from Salvador, Fortaleza, and Rio de Janeiro



The same syllable suppression pattern detected in male speakers from Salvador and Fortaleza is repeated in the proparoxytone, whereas the pattern for the male speaker from Rio de Janeiro exhibits less duration differences between stressed and unstressed syllables, with a more proportional contour.

In terms of intensity, the reading planning with sudden intensity fall at the end of the utterance is also performed in the proparoxytone pattern of the female speaker from Rio de Janeiro.

FIGURE 14 – Intensity of the utterance with proparoxytone prenucleus: women

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)
 Declarative (red) and interrogative (blue).

Intensity of women from Salvador, Fortaleza, and Rio de Janeiro

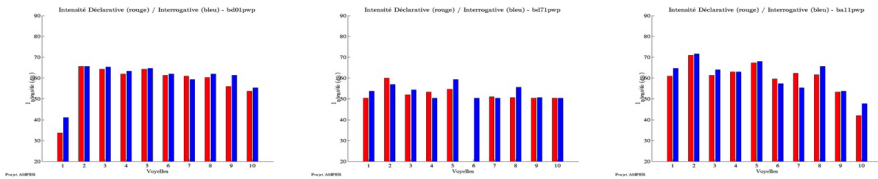
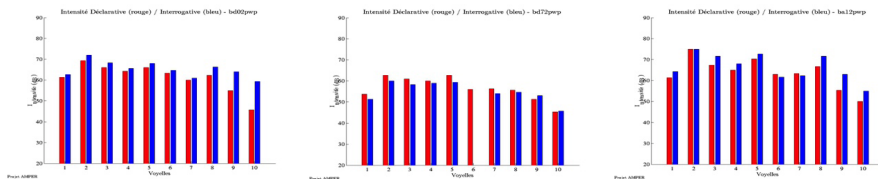


FIGURE 15 – Intensity of the utterance with proparoxytone prenucleus: men

Utterance 2: *O pássaro gosta do pássaro.* (The bird likes the bird.)/
O pássaro gosta do pássaro? (Does the bird like the bird?)
 Declarative (red) and interrogative (blue).

Intensity of men from Salvador, Fortaleza, and Rio de Janeiro



In Salvador and Rio de Janeiro, the intensity of the stressed syllable in proparoxytone stressed syllables (syllable 8) of the nucleus, is higher in interrogative (blue) than in declarative (red) utterances. In Fortaleza, the female speaker produces a similar behavior than speakers from other locations, while the male speaker displays stronger intensity in declarative utterances than in interrogative utterances.

The planned reading with a sudden intensity fall at the end of the utterance is also performed in the proparoxytone pattern of the speakers from Rio de Janeiro.

4.3 Results and discussions: oxytone prenuclei

The oxytone accentual category is the most polemic category in Portuguese, in terms of classification or accentual assignment to the nucleus, which may be interpreted as a truncated or compressed pattern.

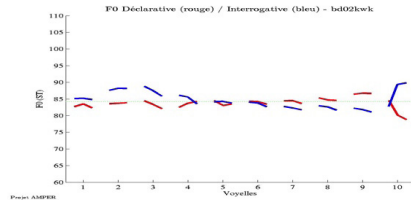
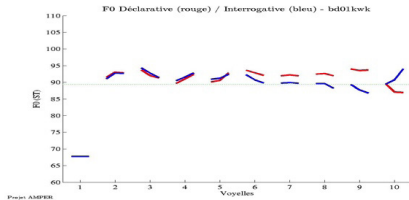
The accentual pattern for oxytones is analyzed based on the three acoustic parameters: F0, duration, and intensity, in declarative and yes-no question utterances.

In terms of F0, in the **Salvador** variety, both the man and the woman perform a high tone in the nuclear pre-stressed syllable, “bisavô” (great-grandfather), in declarative phrases (in red). The last stressed syllable is falling, and is lower than the pre-stressed syllable. This confirms the tonal accent proposed by Moraes (2008) for the nucleus of declarative utterances, without the boundary tone, in H + L* L% of declarative utterances.

FIGURE 16: Salvador variety: high-school graduates

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/
O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Salvador

B: F0 for the man from Salvador

In the prenucleus, the pattern behavior is quite different from the nucleus behavior (see syllables 2, 3, and 4). This is a high or progressive rising behavior, the nucleus of which does not fall. In interrogative utterances, the pattern may also be viewed as truncated, as there is a low pre-stressed syllable, syllable 9 in blue, followed by a high stressed syllable, syllable 10. The pattern proposed by Moraes (2008) for the nucleus in yes-no question utterances, L + H* L%, is performed without a low boundary tone, as, according to the interpretation in this study, there is no subsequent segment in which the low boundary tone L% would be performed, ending in a high accented H* syllable, by truncation.

In the **Fortaleza** variety, both the man and the woman perform a high tone in the nucleus pre-stressed syllable, “bisavô” (great-grandfather), see syllable 9, in declarative sentences (in red). The last

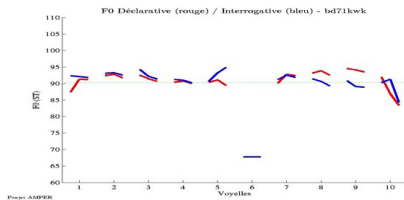
stressed syllable is falling, and is lower than the pre-stressed syllable. This confirms the tonal accent proposed by Moraes (2008) for the nucleus of declarative utterances, H + L* L%.

FIGURE 17 – Fortaleza variety: high-school graduates

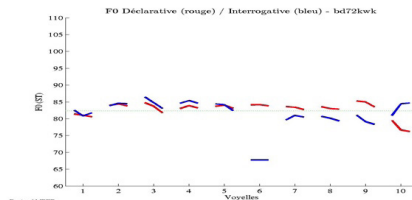
Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/

O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Fortaleza



B: F0 for the man from Fortaleza

In the prenucleus, the pattern behavior is quite different from the nucleus behavior (see syllables 2, 3, and 4). This is a H* behavior, in which the nucleus does not undergo a long and steep fall. In interrogative utterances, the pattern may also be viewed as compressed, as there is a low pre-stressed syllable (syllable 9 in blue), followed by a high stressed syllable (syllable 10), rising-falling, for the woman, and rising with the start of a fall, for the man. The pattern proposed by Moraes (2008) for the nucleus in yes-no question utterances, L + H* L%, is performed with the low boundary tone for the woman, but not for the man, whose pattern ends in a high syllable, as indicated by Lira (2009, p. 95), for the oxytone pattern from Fortaleza, by truncation or compression.

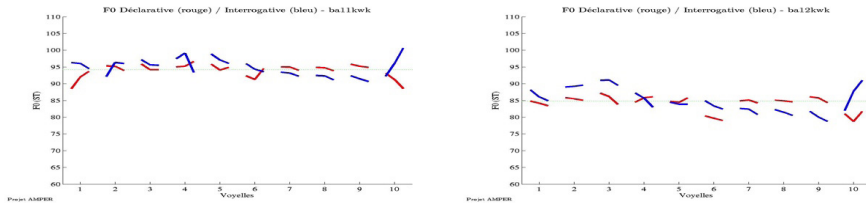
In the **Rio de Janeiro** variety, both the man and the woman perform a falling high tone in the nucleus pre-stressed syllable, “*bisavô*” (“great-grandfather”, see syllable 9), in declarative phrases (in red). The last stressed syllable is falling, and is lower than the pre-stressed syllable. This confirms the tonal accent proposed by Moraes (2008) for the nucleus of declarative utterances, without the boundary tone, in H + L* L%, implementing the fall on the stressed syllable, when it is the last syllable in the utterance.

FIGURE 18 – Rio de Janeiro variety: high-school graduates

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/

O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)

Declarative (red) and interrogative (blue).



A: F0 for the woman from Rio de Janeiro

B: F0 for the man from Rio de Janeiro

In the prenucleus, the pattern behavior is quite different from the nucleus behavior (see syllables 2, 3, and 4). This is a high or progressive rising behavior, in which the nucleus does not fall. In interrogative utterances, the pattern may also be viewed as truncated, as there is a low pre-stressed syllable (syllable 9 in blue), followed by a high stressed syllable (syllable 10). The pattern proposed by Moraes (2008) for the nucleus in full interrogative utterances, $L + H^* \bar{L}\%$, is performed with no low boundary tone, as, according to the interpretation in this study, there is no subsequent segment in which the low boundary tone $L\%$ would be performed, ending in a high accented H^* syllable, by truncation.

In terms of duration, nuclear stressed vowels tend to be longer in the final stressed syllables of interrogative utterances (blue) than in declarative utterances (red), at least in the data obtained in Salvador and Fortaleza, but are not longer in the data obtained in Rio de Janeiro. The same duration behavior is found in male speakers, the Fortaleza speaker being the most prone to syllable suppression, and in the three cases the reduction or lengthening pattern distribution, for vowel duration in two rhythmic groups that indicate a more planned oral expression of the phrases read.

FIGURE 19 – Duration of the utterance with oxytone prenucleus: women

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/
O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)

Declarative (red) and interrogative (blue).

Duration for the women from Salvador, Fortaleza, and Rio de Janeiro

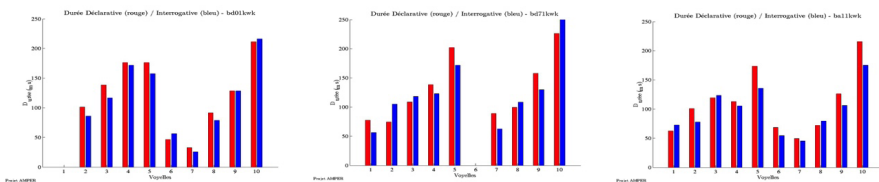
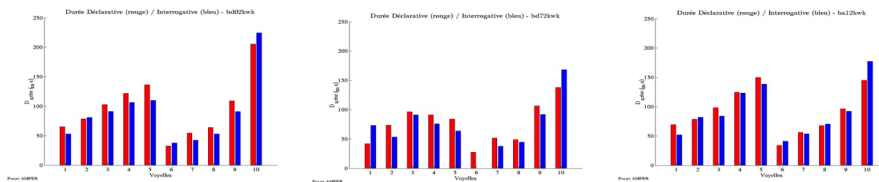


FIGURE 20 – Duration of the utterance with oxytone prenucleus: men

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/
O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)

Declarative (red) and interrogative (blue).

Duration for the men from Salvador, Fortaleza, and Rio de Janeiro



In sentences with an oxytone nucleus, the suppression pattern falls on the utterance’s internal unstressed syllables, “*gosta do*” (“likes”, syllables 6 and 7), also for the female speaker from Fortaleza. The speaker from Rio de Janeiro maintains her reading rhythm pattern, actually creating two symmetrical rhythmic groups inside the utterance, establishes the counterpoint between “*gosta*” (likes) and “*bisavô*” (“great-grandfather”, syllables 5 and 10). The female speaker from Fortaleza also performs such a pattern, despite the syllable suppression in “*gosta*” (likes), while the female speaker from Salvador also presents two rhythmic reading groups, although less symmetrical than those presented in the data from Fortaleza and Rio de Janeiro.

In terms of intensity, in the case of Rio de Janeiro, the sudden intensity fall occurs in the oxytone pattern, in the case of declarative utterances (red), a reading strategy that occurs repeatedly for male speakers, as shown below.

FIGURE 21 – Intensity of the utterance with oxytone prenucleus: women

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/
O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)
 Declarative (red) and interrogative (blue).

Intensity for the women from Salvador, Fortaleza, and Rio de Janeiro

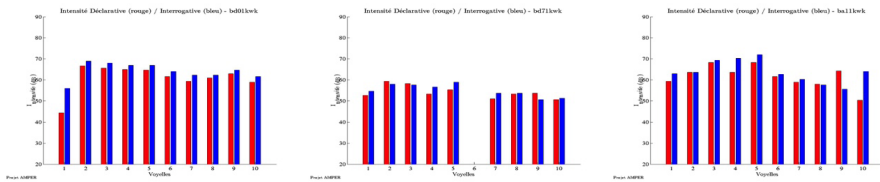
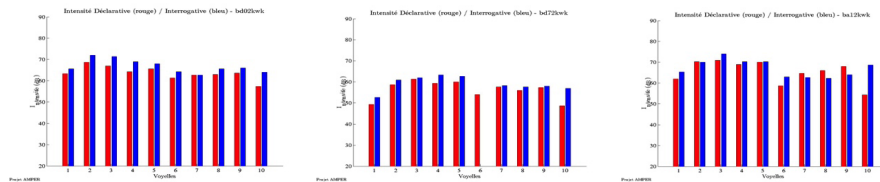


FIGURE 22 – Intensity of the utterance with oxytone prenucleus: men

Utterance 3: *O bisavô gosta do bisavô.* (The great-grandfather likes the great-grandfather)/
O bisavô gosta do bisavô? (Does the great-grandfather likes the great-grandfather?)
 Declarative (red) and interrogative (blue).

Intensity for the men from Salvador, Fortaleza, and Rio de Janeiro



As is the case of the female speaker, in Rio de Janeiro, the sudden intensity fall happens in the oxytone pattern, in declarative utterances (red), a reading strategy that, associated with the duration and F0 behavior, differentiates the speakers from Rio de Janeiro, for having learned a reading prosody pattern that is applied to the oral expression of data at the corpus reading moment.

5 Final considerations

This study seeks to establish a dialog between its analytical results and research project data that is similar for the three state capitals. In terms of duration, the regular duration distribution throughout the utterance, forming symmetrical rhythmic groups, indicates the performance of a planned speech, by reading, in the case of the three locations, which we attribute to the speakers' education level, as they have already acquired the reading prosody, was learned in school practices. The internalization of a more syllabic and regular reading pattern for the speakers from Salvador, Fortaleza, and Rio de Janeiro is more prominent in the case of proparoxytones and oxytones.

In the case of men's performances, in terms of duration, the distribution of vowel reductions and lengthenings per syllable is also quite regular, both in the data obtained in Rio de Janeiro and in those obtained in Salvador, but it less regular in the data obtained in Fortaleza. The results regarding intensity may not be taken into account without normalization, in raw terms, as the recording conditions were certainly not the same, which affect the data in dB. However, we may compare the distribution of intensity values throughout the utterance, by comparing inter-syllable intensity differences and proportions; as the sentences are the same and the intensity variation inside the utterance is insignificant.

As is the case for female speakers, in the data obtained from male speakers, for the three locations, the stressed syllable intensity on the nucleus is more important in interrogative utterances (blue) than in declarative utterances (red). Based on the data analyzed, we detected significant differences regarding the modalities – declarative and yes-no question utterances – and, in a lesser scale, regarding the speakers' origin.

5.1 Regarding the modalities, it may be stated that:

- a. The pre-stressed syllable preceding the last stressed syllable is higher in the declarative modality than it is in the yes-no question modality;
- b. The last stressed syllable duration is shorter in the declarative modality than it is in the yes-no question modality, except for the Salvador variety;
- c. The intensity of the last stressed syllable is lower in the declarative modality than it is in the yes-no question modality;
- d. The intonational contour in the declarative modality is a falling contour, whereas in the yes-no question modality it is, predominantly, proparoxytone and paroxytone circumflex;

- e. In the oxytone pattern for interrogative utterances, rising results were obtained for Rio de Janeiro, truncated results were obtained for Salvador (rising, with the start of a fall), and circumflex for women speakers, but truncate for the men from Fortaleza.

5.2 Regarding the speaker origin, it may be stated that:

- a. In declarative utterances, the F0 behavior is a falling behavior for the nuclear's pre-stressed syllable, gradually falling until it reaches the post-stressed syllable (falling line). However, in interrogative utterances, the F0 movement is also a rising movement in the nuclear stressed syllable, for the three locations. Results from Fortaleza differ from those from Rio de Janeiro and Salvador, as the F0 rise in the stressed syllable is followed by a falling movement in the stressed syllable itself.
- b. The difference in duration between stressed and unstressed syllables in nuclear positions joins Rio de Janeiro and Salvador in a group whose behavior is opposite to that of Fortaleza. In Fortaleza, the nuclear stressed syllable is proportionally longer than the post-stressed syllable, which actually reaches the vowel elision in the woman's speech.
- c. The intensity fall throughout the utterance is visible in the three varieties; however, the nucleus fall from the stressed syllable to the post-stressed syllable is more abrupt in Fortaleza, due to final erased syllables.
- d. The intonational contour of the declarative modality is a falling contour in the three locations, whereas the yes-no question contour is predominantly circumflex for the paroxytone and proparoxytone nuclei. In oxytone nuclei, the intonational contour is variable. Moraes (2016, oral information) suggests that it would be important to determine whether the rising pattern for oxytones is a case of truncation or a different pattern from that of the paroxytones by means of perceptual tests with stimuli generated from synthesis manipulation in key points of the utterances.

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