Intonational interference in English-L2 Brazilian speakers: production and perception

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Abstract
We investigate the phenomenon of intonational contour interference, in both production and perception, in the Brazilian Portuguese/English (BP/EN) language pair. Brazilian learners and English natives were tested. We analysed polar questions as their final contour patterns differ – rise-fall in BP and rise in US English. A production task was conducted which revealed the typical BP yes/no question contours, approximately 33% when Brazilians uttered English questions. Regarding perception, a forced decision task was conducted in which EN native participants had to choose whether they heard a question or a statement. This task was to investigate (a) the perception of EN-L1 listeners to EN questions with BP intonational interference, and (b) the perception of BP-L1 listeners to (i) the same questions with interference, and (ii) the interrogatives produced by English-L1 speakers. Results show that EN-L1 listeners tend to perceive questions with the BP contour as statements. Conversely, Brazilians do not have significant problems recognizing their own question contour, or the US English characteristic rising contour as proper questions. In perceptual terms, BP-L1 listeners do recognize the English typical interrogative contour. When there is BP interference, they also display a high rate of question recognition, although with a delayed reaction time.

Index Terms: L2 intonation, L2 acquisition, Brazilian Portuguese, English, perception

1. Introduction
Intonational interference refers to the presence of prosodic features of a given language in the production of contours in another language. This research considers this phenomenon in L2 learners. Prosody plays a fundamental role in the organization of utterances and the generation of various configurations of expressions, distinctions between statements and questions, focus of information in an utterance etc. Modulating parameters allow us to assign the correct meaning to what we are saying and it helps the listener to properly interpret a message. [1]

In this paper we investigate this phenomenon in the speech of Brazilian learners of English as L2 focusing on the intonation of polar questions since the two languages differ in their respective nuclear intonational contours. Crosslinguistic prosodic interference was observed between several languages and contexts [2-5]. Contrasting BP and English, Passarella-Reis [6] and Passarella-Reis et al. [7] sought to investigate the interference between BP and English and the perception of different intonational patterns and speakers’ intentionality through offline tests. Here we analyse this phenomenon in both offline and online manners, exploring the perception of native English speakers to yes/no questions in English being uttered with the BP contour.

2. Methods
We conducted production and perception tasks to investigate (i) the presence of intonational interference in the L2 utterances; (ii) the effect of these interferences on the perception of English-L1 listeners; and (iii) the perception of Brazilian learners of yes/no questions with and without interference.

2.1. Production task
This activity aims to collect data on the production of polar questions in English uttered by Brazilians at different levels of proficiency. Brazilian Portuguese and US English polar questions differ in their final contours, a rise-fall [8], for BP, and a rise [9], for English. Although rising contours exist in BP, they are not used in canonical yes/no questions. Fig. 1 shows the BP contour.

![Fig. 1: “Renata jogava” uttered as a neutral yes-no question in BP [Moraes, 2008]](image)

2.1.1. Stimuli
12 English sentences were elaborated, six declarative and six yes/no interrogatives.

Five declaratives and five polar interrogatives had a pattern of five to seven words and consisted of only one sentence. The
other declarative and the other interrogative had more than seven words and consisted of two sentences each.

Below, four of the sentences are illustrated, the first two consisting of a single sentence and the last two consisting of two sentences, respectively.

- The supermarket was out of tomatoes.
- Can I still order some beer?
- If it keeps going like this, you’ll have to move out pretty soon.
- What time does the restaurant open? Is it open at 7pm?

All sentences were preceded by short conversational contexts to eliminate intonational variations between participants and guide a single interpretation. In this way, we could minimize the chance of having intonations that would affect the prosody for the same sentence, by expressing emotions or attitudes like surprise, joy, sadness, disappointment etc.

2.1.2. Participants

12 BP native adults (7 women) aged between 20 and 25 years old were recruited for the task. Four English native speakers, 2 Americans and 2 British, in the same age range, one man and one woman for each nationality also recorded the stimuli for comparison purposes with the data produced by the non-native speakers. In the perception tasks, 2.2 and 2.3, we used the declaratives uttered by the British speakers as distractors.

The proficiency profile of the participants is mixed, precisely to check whether there is a relationship between proficiency level and intonational interference. A preliminary division was made based on the participants’ answers to an adapted language background questionnaire [11]. Thus, the 12 participants were arranged into advanced (5), intermediate (2) and basic (5) levels.

2.1.3. Procedure

The participants recorded 12 sentences, 6 declarative and 6 yes/no questions, repeating each one three times, for a total of 36 audio files. Each sentence was accompanied by a short context. Repetitions are key to getting the best pronunciation of the sentence, as during the recordings some participants might have some difficulties pronouncing certain words.

The collection phase took place on an individual basis, done by the participant via their cell phone, at home, due to social isolation guidelines during the COVID-19 pandemic.

Participants received recording instructions in PDF format, along with the stimuli to be recorded. The participant was to silently read the context before recording the three repetitions of each sentence.

All the resulting material was analysed with the Praat software [10].

2.1.4. Results

The acoustic and auditory analysis of the F0 curves in Praat revealed typical contours of BP polar questions in 12 out of 36 audios, so approximately 33% of the basic and intermediate groups’ audios show interference. The remaining audios presented rising contours and were mainly uttered by the advanced participants.

Examples of this interference are shown in Fig. 2 and 3.

Based on these results, we conducted an experiment to investigate the extent to which this type of interference can impact the perception of English-L1 listeners.

2.2. Perception task with English-L1 listeners

This aspect of the research had two versions. The offline version was initially conducted by means of a form. Then the online version was conducted by programming a task with the jsPsych library [12] and it was applied by the Cognition platform.

- Variables:
  - As the independent variable, we have the interrogative contour, at two levels: standard (rise), English-L1, and non-standard (rise-fall), BP-L1.

As dependent variables, we have choice rate (offline and online versions) and reaction time (RT) (online version).

2.2.1. Hypothesis and predictions

Interrogatives with prosodic interference will be less recognized compared to interrogatives without interference since they are distant from the intonational pattern of English, which is the L1 of the participants.

The choice rate for “question” is expected to be significantly lower for questions with prosodic interference compared to the choice rate for questions produced with the US English (rising) pattern. Similarly, the reaction times (RTs) are expected to be significantly higher for questions with the rise-fall circumflex configuration (BP pattern) when compared to the RTs for questions with the rising configuration, signaling difficulties in
recognizing polar questions in English with the rise-fall configuration as well-formed questions.

2.2.2. Stimuli

We used 27 recordings collected in the production task. As test stimuli, 12 questions were selected from Brazilians, 6 with interference and 6 without interference. As distractors, we selected 5 questions from native English speakers, 6 declaratives from native speakers, and 4 declaratives from Brazilians – for a total of 15 distractors. A delexicalization procedure was performed so that there was no influence of the syntactic structure of the sentences in the choice of the participants. This was done in Praat through the “pass-hann-band” filter, with the settings varying between 300 and 600Hz, for female voices, and between 600 and 800Hz for male voices. Our test is characterized as a forced-choice classification in which the participant has a closed set of possibilities to choose from (question or statement, see procedure).

2.2.3. Participants

15 English-L1 listeners voluntarily participated, with 9 coming from the offline version and 6 from the online version. Recruitment was done in the manner of Task 2.1.

2.2.4. Procedure

Before the task, the participants were to read the instructions and provide some personal information, such as country of origin, whether he or she speaks a language other than English, and age. Remember that the task had online and offline versions and the online test recorded the decision time and was programmed using the jsPsych library [12] and applied by the Cognition platform. The offline test was done through Google Forms.

2.2.5. Results

Fig. 4 shows the choice rate for “statement” and “question” with and without interference. When questions had the BP rise-fall contour, the preferred choice was for “statement”. Similarly, when questions had the standard contour, the preferred choice was for “question”. Fig. 5 shows the means for questions with and without interference. Questions with interference show higher RTs (4.577ms).

Fig. 4: Choice rate for “statement” and “question” – English-L1 listeners

Fig. 5: Means for the RTs for questions – English-L1 listeners

2.3. Perception task with Brazilians

In the production task, 33% of the audios of the basic and intermediate levels revealed intonational interference. We believe that the intermediate level may correspond to learners who are in process of consolidating the L2’s prosody. The purpose of this task is to investigate the perception of intermediate Brazilian learners of English to see if there is any difference in perception between the standard English rising contour and the BP rising-falling contour used when producing total yes/no questions.

2.3.1. Hypotheses and predictions

We hypothesize that the not yet consolidated prosodic knowledge in the intermediate level subjects that led to instability in production may lead to instability in perception as well. Therefore, we predict ease of recognition for the BP contour, as it is characteristic of the participants’ mother tongue. Consequently, we expect a lower RT and a higher choice rate for “question”. On the other hand, the L2’s contour knowledge may not be yet consolidated, so we expect a higher RT and a lower choice rate for “question”.

2.3.2. Stimuli

We used the same 27 delexicalized stimuli as in 2.2.2. Additionally, as test stimuli, we selected 11 questions, 5 from English native speakers (rising pattern) and 6 from Brazilians with interference (rising-falling pattern). Thus, as distractors, 10 declaratives were selected, 5 from English native speakers and 5 declaratives from Brazilians; and 6 questions from Brazilians without interference – totaling 16 distractors in total.

2.3.3. Participants

16 Brazilians volunteered. The recruitment was done as in the previous tasks.

2.3.4. Procedure

The procedure used on this task was the same as in 2.2.4.

2.3.5. Results

Below in Fig. 6 we show the choice rate for questions with and without interference.
3. Discussion

Regarding the perception task with English-L1 listeners, our results are overall in line with our predictions since we have a higher choice rate for “statement” and a higher RT mean for the yes/no questions with interference. The number of participants is not sufficient yet for a statistic test, however, the choice rate and the means give us a good idea of the English natives’ interpretation’s tendency.

Regarding the perception task with Brazilians, the results suggest that perceptually speaking, PB-L1 listeners are familiar with the English pattern – which is consistent with the high rate of adequate choice for questions without interference (85.42%). However, when there is BP interference, despite the high rate of appropriate choice (70.2%), this interference seems to delay the decision. In this sense, prosodic information from the L1 seems to interfere perceptually (less consciously perhaps), generating noise in the identification of the type of structure.

4. Conclusions

Taken together, our results show L1 intonational interference in both production and perception of L2 utterances. The production task revealed that our basic and intermediate Brazilian learners of English used the characteristic Brazilian contour when uttering yes/no questions in English. Our perception task demonstrated that EN-L1 listeners tend to perceive questions with the BP contour as statements. Brazilians on the other hand do not have significant problems recognizing their own question contour, or the US English characteristic rising contour as proper questions. In perceptual terms, BP-L1 listeners do recognize the typical English interrogative contour. There are few studies focusing on crosslinguistic prosodic interference and, as far as we know, our study is the first to capture online intonational interference, showing a delayed reaction time when there is BP interference, although with a high rate of question recognition.

5. Acknowledgements

We would like to thank all participants who took part in the tasks. This research was supported by CNPq and CAPES.

6. References