*Article*

# Portuguese and German Intonation Contours in a Two-Way Immersion School

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**Abstract:** This study investigates the intonation contours of neutral yes–no interrogatives produced by simultaneous bilingual children in their two native languages. Previous studies have shown prosodic transfer from one language to another, either from the dominant into the non-dominant language or vice versa, but little is known about what specifically triggers this behaviour. This study explores how bilingual children make use of phonetic–phonological resources while interacting with peers. Three child speakers of German (ambient language) and Portuguese (heritage language) were recorded as they performed a modified version of a map task. Natural and spontaneous data were collected and the speech was analysed. The results indicate that to some degree, bilingual children produce all intonational contours specific to their language variety. When speaking German, they produced the syntax and contour consistent with the structure of yes–no interrogatives in German. When speaking Portuguese, the children displayed variation in their choice of tune, depending on the variety of Portuguese and the language proficiency of their interlocutor. This behaviour is interpreted as prosodic convergence resulting from the high variability of prosodic structures in the different varieties of Portuguese present in the classroom.

**Keywords:** intonational phonology; two-way immersion; neutral yes–no question

## 1. Introduction

Research has shown that different factors influence the acquisition of the phonological and phonetic systems in children. Studies examining the speech prosody of monolingual English-, Dutch-, and Swedish-speaking children indicate that motor coordination and access to linguistic and cognitive resources could be adult-like starting from around seven years of age (Patel and Grigos 2006), with reports of adult-like phonological marking of focus from around seven years of age, in Swedish (Romøren and Chen 2015), or eight years of age, in Dutch (Chen 2011). Interestingly, a study on focus marking in Finnish, a language that uses word order and not exclusively prosody in this regard, showed that children four to five years old can produce adult-like prosody (Arnhold et al. 2016). This shows that language-specific factors play a role in the acquisition of these linguistic structures. However, little is known on what factors or how these interact in the acquisition of language by bilingual children. *Heritage speakers* are generally native speakers of a minority language (Kupisch and Rothman 2018; Montrul 2016) and can be either simultaneous or sequential bilinguals. As noted by Ronquest and Rao (2018), prosodic structure in the speech of heritage speakers tends to be understudied.

It has been observed that bilingual speech production displays high variability, which has been attributed to incomplete acquisition (Lleó 2018), a stand point criticised by Kupisch and Rothman (2018). Alternatively, variable productions could be indicative of developing socio-linguistic competence (Khattab 2002a). Research on prosodic and pragmatic development by bilingual school-aged children is, however, underrepresented. This study presents an exploratory field study of the speech prosody of nine-year-old bilingual speakers. The children in this study have been exposed to their two languages from birth

and, in addition, are enrolled in a two-way immersion school system that provides equal hours of instruction in the two languages of the bilinguals. In this study, the focus is placed on the speech of Portuguese-speaking children; in addition, their productions in German are also considered.

Research shows that children acquiring their heritage language via continuous formal education develop a more standard-like proficiency in comparison to those who do not. This has been shown in the acquisition of some grammatical structures. One study demonstrated that speakers with access to continuous education in the heritage language performed better when assigning grammatical gender, a category that is not typically taught explicitly at school (Kupisch and Rothman 2018). Another study found similar results in the production of segments (Rao 2015). Additionally, it has been shown that higher literacy levels lead to more accurate tonal identification (Kan and Schmid 2019). It has been proposed that consistency (e.g., at school or home) and continuity (over the life span) in language experience could play a more important role than the quantity of input in the heritage language (Caloi and Torregrossa 2021). Thus, continuous exposure is a factor that can support the linguistic development of heritage language speakers.

Following Khattab (2002a), I take the view that the mental representation of two languages for a bilingual is different from that of a monolingual. Importantly, it is not the simple combination that would result from compiling two systems into a place normally assumed as being occupied by one. In the same vein, I take an approach that acknowledges that linguistic development is a continuous process, sensitive to the context and the socio-linguistic circumstances around the child. Communication Accommodation Theory represents a social-psychological approach that integrates micro-individual aspects with the macro-collective levels of bilingual communication (Sachdev and Giles 2005). In this perspective, a bilingual speaker can accommodate to an interlocutor via either convergence (marking social integration) or divergence (marking social differentiation). Research has shown that accommodation in adult speech can make the speaker seem "more considerate" or "prepared to bridge the cultural gap" when the speaker makes the effort to use the language of their interlocutor (Giles et al. 1973, p. 186). Simonet (2011) reports prosodic convergence in Spanish–Catalan bilinguals in Majorca, showing that the Spanish utterance final tunes of Spanish-dominant female speakers are phonetically closer to the contours typical for Majorcan Catalan. Some researchers argue that accommodation belongs to the natural repertoire of a bilingual speaker (Hamers and Blanc 2000; Sachdev and Giles 2005). Interestingly, Khattab (2013) shows that bilingual five-year-old children can already use linguistic resources to accommodate to their interlocutor.

Studies examining adult bilinguals have found that the prosody of one of the two languages spoken may interfere with the prosody of the other. It is argued that bilingual speakers transfer some prosodic traits of one of their two languages into the other. Bullock (2009) reports the transfer of pitch accents from the dominant language, English, into the weak heritage language, French. In contrast, a study on utterances in broad focus (van Rijswijk et al. 2017) finds differences in intonation and duration patterns, which are interpreted as evidence of transfer from the weak heritage language, Turkish into Dutch. Additionally, it has been reported that child heritage speakers (Queen 2001, 1996) show non-normative intonation patterns in both the heritage language, Turkish, as well as German. However, in none of these three studies were the participants reported as having attended bilingual schooling programs, and in all cases, the heritage language was very likely acquired in a rather informal setting. As Kupisch and Rothman (2018) show, bilingual education provides children with more consistent and continuous exposure, giving them the opportunity to acquire the heritage language in a more standard fashion. Arguably, children exposed to not only two different languages (German and Portuguese), but also to different varieties of a language (European, African, and Brazilian-Portuguese varieties) will have a set of linguistic choices to make.

Prosody can be defined as the manifestation of a complex interplay among variations in pitch, stress, and timing of speech (Bolinger 1989; Lehiste and Lass 1976), all of which can

be measured in terms of fundamental frequency (F0), intensity, and duration, respectively. Generally, prosody is not taught explicitly in school education and is rather acquired unconsciously by the native speaker. To address the question of how simultaneous bilingual children make use of the prosodic systems of their heritage language (Portuguese) and the societal majority language (German), this study focuses on one key aspect of prosody, namely the intonation of neutral yes–no questions. This is because prosody is fairly sensitive to precise analysis but is also a useful index of dialectal variation. Specifically, it investigates peer-to-peer interaction and speech production of three children who attend a bilingual two-way immersion primary school in Berlin, Germany. Additionally, this study considers the use of intonation in relation to communicative effectiveness since it could represent a potential trigger for *transfer*.

## 2. Prosody of Yes–No Interrogatives

This study is grounded in the Autosegmental Metrical theory (AM) (Ladd 2008; Pierrehumbert 1980; Pierrehumbert and Hirschberg 1990). It is from this approach that the Tones and Break Indices (ToBI) system of intonational description is derived (Beckmann et al. 2005), which is a system that will be applied here. Intonation refers to the linguistically structured and pragmatically meaningful modulation of fundamental frequency (F0). It is manifested at the phrasal level via an interplay between metrical structure, prosodic phrasing, syntax, and pragmatics. Despite the fact that F0 represents the main phonetic exponent of intonation, these two terms are not synonymous. Intonation is part of the phonological structure of a language and F0 is its acoustic correlate. This study applies the Portuguese ToBI notation system (P-ToBI) (Frota 2014; Frota et al. 2015) and the German ToBI (GToBI) (Grice and Baumann 2002; Grice et al. 2005). In general, it is agreed that tunes convey different meanings and can also have a grammatical value (Gussenhoven 2004). This study assumes the choice of a tune or intonational contour is made to convey the pragmatic content of an utterance. However, it should be noted that ToBI systems have been developed for the phonological description of language-specific intonation patterns and that the speech of bilingual speakers has proved to represent a challenge (Hualde and Prieto 2016). Ladd (2008) warns that a lack of consideration of markedly different phonetic contours can render cross-language and cross-dialect comparison not only difficult but also meaningless. Thus, overspecification of phonological labels can hinder abstractions necessary for cross-linguistic comparison, a point I will return to later.

### 2.1. Yes–No Interrogatives in Portuguese

Six dialectal varieties of Portuguese are of interest for this study: Standard European Portuguese (SEP), Maputo Mozambique Portuguese (MMP), Northeastern Brazilian Portuguese (NEBP), Rio de Janeiro Portuguese (RJBP), São Paulo Brazilian Portuguese (SPBP), and Florianópolis Brazilian Portuguese (FLBP), with the latter three being considered Southern dialects of Brazilian Portuguese (see Castelo 2016; Nascentes 1953). One of the most widely studied interrogatives is the information-seeking or 'neutral' yes–no question which corresponds to a request for information without the expectation of a positive or negative answer and is characterised by the absence of focus on any of the words in the question (de Moraes 2008). The description of Brazilian Portuguese intonation is based on data from Castelo and Frota (2017); de Moraes (2008); Rosignoli and Fernandes-Svartman (2016); Silva (2012); and Castelo (2016), see Table 1.[1]

In SEP, neutral yes–no question intonation is characterised by an obligatory final rise, as shown below in (1), for which Frota (2002) proposes the notation H+L* LH%.[2] When nuclear and boundary syllables are separated by several intervening syllables, there is a low plateau and a slightly ascending contour up to the final syllable, which includes a rapid pitch rise, as in (2). This means that the low pitch can span several syllables. The entire pitch excursion of the boundary tone (LH%) occurs across the final syllable as well as the final post-tonic syllables. Note also that the nuclear syllable always occurs in the last word of the interrogative. Three strategies of text-to-tune accommodation have been reported

when the last word in the phrase is monosyllabic or bears final stress. In these instances, the nuclear vowel may exhibit extended lengthening; alternatively, a final epenthetic vowel may be inserted in the string, and also the blocking of final schwa deletion has been attested (Frota et al. 2015, 2016).

**Table 1.** Tunes for neutral yes–no interrogatives in six varieties of Portuguese.

| Variety | Nuclear Accent | Boundary Tone | Source |
|---|---|---|---|
| Standard European Portuguese (SEP) | H+L* | LH% | Frota (2002) |
| Maputo Mozambique Portuguese (MMP) | L+<¡H* | L% | Serra and Oliveira (2022) |
| Florianópolis Brazilian | L+H* | L% | Silva (2012) |
| Portuguese (FLBP) | L+H* | H% | |
| | L* | HL% | Castelo (2016) |
| São Paulo Brazilian | L+H* | L% | Rosignoli and Fernandes-Svartman (2016) |
| Portuguese (SPBP) | L*+H | L% | |
| Rio de Janeiro Brazilian Portuguese (RJBP) | L+<H* | L% | de Moraes (2008) |
| Northeastern Brazilian | L* | H% | Castelo (2016) |
| Portuguese (NEBP) | L* | HL% | |



(1)  *O poeta cantou uma manhã angeliCAL?*

'Did the poet sing an angelical morning?'



(2)  *As meninas angolanas LÊramnola?*

'Did the Angolan girls read it to us?'

Intonation contours of Southern varieties of Brazilian Portuguese are of special interest for this study since they display very different tunes when compared to SEP and Standard German intonation. The contours proposed for the FLBP and SPBP varieties are characterised by a rising tone associated with the nuclear syllable, often followed by a falling tone at the right boundary (Castelo 2016; Castelo and Frota 2017). Although variations in tonal alignment have been observed, the circumflex shape towards the edge of the contour—illustrated for FLBP in (3)—makes it a salient configuration when compared to SEP or German. The nuclear accent is described as a contour whose peak aligns with the accented syllable, followed by a low tone at the edge of the final syllable. Silva (2012) proposes the notation L+H* L% for the contour depicted in (3).



(3)  *Vai sair HOje?*

'Are you going out today?'

However, variation has been observed regarding the choice of tune in FLBP and Silva (2012) identifies an additional contour which has a rising tone towards the right edge, with the notation L+H* H%, as seen in (4). This second contour, which is mainly found in Northern varieties, can also occur in FLBP, showing a rising movement all along the accented syllable and the following syllable at the edge. Note, however, that this contour is the result of a tune-to-text accommodation strategy whereby the final L% tone is truncated and it is not considered the canonical contour. According to (Castelo 2016, p. 73), Northern varieties of Brazilian Portuguese tend to exhibit rising contours, L* H%, although rising–falling contours, L* HL%, are possible as well.

(4)   *Vai sair HOje?*

'Are you going out today?'

According to Silva (2011), the circumflex contour appears in two possible ways in SPBP yes–no interrogatives: within the nuclear syllable, either the peak is aligned at the left side and decreases within this syllable, or it is aligned at the right side and the low tone follows in the post-tonic syllable. Final, post-tonic syllables always show a low tone. Rosignoli and Fernandes-Svartman (2016) find similar contours in their data, where they propose the notation L+H* L% and include L*+H L% as a possible additional realisation. Castelo (2016, p. 73) notes the existence of a dialectal continuum from south to north in Brazil, with rising–falling contours being more common in the Southern/Central varieties and rising contours occurring as the unmarked patterns in Northern varieties. Contrary to SEP, Southern varieties of Brazilian Portuguese show tune accommodation for yes–no interrogatives ending on monosyllabic words or with final stress. In this case, the most common strategy is to truncate the final L%, thus creating an L* H(L)% tune (Frota et al. 2015, 2016).

*2.2. Yes–No Interrogatives in German*

Contrary to Portuguese, German makes use of syntax to mark yes–no interrogatives. Whereas in Portuguese, the syntax of yes–no interrogatives is the same as in declaratives, in German, the subject inversion is obligatory, as shown in (5) and (6). However, intonation is also used to mark yes–no questions, with the interrogative contour showing a rising pattern towards the end.

(5)   *Karl **studiert** in Potsdam.*
      'Karl studies in Potsdam.'

(6)   ***Studiert** Karl in Potsdam?*
      'Does Karl study in Potsdam?'

According to Uhmann (1991) and Féry (2010), German yes–no questions are characterised by rising final boundary tones, while nuclear pitch accents can be either falling or rising. Thus, two possible configurations are found, H*L H% and L*H H% (see Kügler 2004, p. 227). Although there is general agreement on the existence of two contours, a different notation has been proposed by Grice and Baumann (2002); Grice et al. (2005). In GToBI, two tunes have been proposed for the neutral yes–no interrogatives in Standard German (SG), L* L-H% and L* H-^H% (Grice and Baumann 2002), which is the notation I will employ. Example (7) shows a stylised pitch contour of the latter. Moreover, a study investigating neutral yes–no interrogatives and rhetorical questions[3] finds that speakers produce more utterances ending in H% in rhetorical questions and more H-^H% in information-seeking yes–no questions (Wochner et al. 2015). This result is interpreted as a conventionalised pitch scaling to signal interrogativity in SG. Contrary to Portuguese, in German, the nuclear syllable does not have to be placed in the last word but can occur prior to it. Table 2 summarises the tune contours and syntax for yes–no interrogatives in five varieties of Portuguese and SG.

(7)   *Wollen Sie BaNAnen haben?*

'Would you like some bananas?'

**Table 2.** Tunes and syntax for neutral yes–no interrogatives in six varieties of Portuguese and German.

| Language | Variety | Nuclear Accent | Boundary Tone | Syntax |
|---|---|---|---|---|
| Portuguese | SEP | H+L* | LH% | declarative |
| | MMP | L+<¡H* | L% | declarative |
| | FLBP | L+H* | L% | declarative |
| | | L+H* | H% | declarative |
| | SPBP | L*+H | L% | declarative |
| | | L+H* | L% | declarative |
| | RJBP | L+<H* | L% | declarative |
| | NEBP | L* | H% | declarative |
| | | L* | HL% | declarative |
| German | SG | L* | H-^H% | inversion |
| | | L* | L-H% | inversion |

## 3. Research Aims and Questions

In line with Khattab (2002b), I take the view that *variability* and *exposure to language* are important factors in the investigation of bilingual speech production of children who already attend school. First, a bilingual child is exposed to greater phonological variability and can choose from a larger set of phonetic realisations when producing speech. Second, in line with Kupisch and Rothman (2018), I assume that the continuity of exposure plays an important role. To assess whether there is variability in the speech production of the children, the focus will be on peer-to-peer interaction. Since all children in this study are classmates, the participants know each other and the linguistic abilities of their interlocutors quite well. This procedure allows us to capture a rather natural use of prosody.

As noted above, a number of studies argue that heritage speakers show prosodic transfer processes from one of their languages into the other. Following Müller (1998), I view transfer from the perspective of the input the child is exposed to, in terms of language varieties represented in the classroom. In my view, transfer can be seen as a relief strategy, by which a child may use parts of the analysis of one language in order to cope with the linguistic variability present in their environment. Since transfer is likely to occur in a grammar domain where the language learner is confronted with ambiguous input, such as prosodic structure, I seek to answer the following research questions:

RQ1 How do children realise yes–no interrogatives in the different Portuguese varieties?
RQ2 How do children realise yes–no interrogatives in German?
RQ3 Is there evidence of prosodic transfer in any of the two, Portuguese or German?

## 4. Method

### 4.1. Two-Way Immersion School—Staatliche Europa Schule Berlin

The bilingual immersion programme *Staatliche Europa Schule Berlin* (SESB) is the largest of its kind in Europe (Meier 2012). It is a bilingual school system in which teachers with different native languages work together. While one half of the teaching staff are native German-speakers, the other half are native speakers of one of the nine other languages in which the educational programme is available, including Portuguese.[4] The SESB is a public school open to all children who have native-like competences in either German or another language. To evaluate these linguistic competences, prior to admission at around age 6, each child is required to pass a language assessment test which compares their command of the two languages against that of native-speaking children of the same age. Class groups are divided into two groups, one of the *Muttersprache* 'mother tongue' and the other in the *Partnersprache* 'partner language'. Whether the 'mother tongue' is the heritage language or German depends on whether the child has demonstrated native-like skills on the former or the latter.

The SESB programme is offered at various public schools in Berlin, each one focusing on a particular bilingual community. The participants of this study were recruited at one of these schools. The bilingual programme is in Portuguese and German, with teachers

that are native speakers of German, European, or Brazilian-Portuguese. As outlined above, participating children are separated into two groups. One group (23 children) has German, the societal majority language, as its mother tongue, and Portuguese, the heritage language, as their partner language, whereas the other group (6 children) has Portuguese as its mother tongue and German as the partner language. In each group, the pupils have four hours of language instruction per week in each language, resulting in a total of eight hours of language class.

### 4.2. Subjects

The speech of three nine-year-old pupils interacting with classmates was recorded. The aim was to capture spontaneous speech and intonation patterns the children could use with peers in their daily school routine. For the purposes of the experiment, nine fourth-grade pupils were divided into two groups. One consisted of three participants whose speech was analysed, and the remaining six would interact with the first three, but their speech would not be analysed.

Various factors were taken into account in allocating a particular child to one group or the other, including language skills, linguistic identity, and the regional variety of Portuguese spoken at home. To assess these factors, the parents of the children completed an online linguistic questionnaire about the linguistic biography and environment of the child and the language preferences in the family. Additionally, the class teacher, a native speaker of European Portuguese, and the teaching assistant, a native speaker of German, provided an informal appraisal of the linguistic capacities of each child. Since the focus is on how pupils realise intonation when speaking Portuguese, it was decided a priori that the three pupils whose output was recorded should come from the mother-language-Portuguese track of the programme and have similar exposure to the two languages (simultaneous bilinguals from birth, who live in a bilingual household). Three classmates from the same track and three other peers from the mother-language-German track of the programme were invited as their interlocutors. Therefore, for the group recorded, the selection was to invite two girls (MAR and LAU) and a boy (ART), who were speakers of SEP, SPBP, and FLBP, respectively. All three had at least one parent who is a native speaker of Portuguese and with whom they were living. The parents also reported their children were exposed to Portuguese and German since birth.

The second group was organised differently, with three proficient Portuguese speakers, one representing the SEP, another representing the NEBP variety, and a boy who is Portuguese-dominant (RJBP). Additionally, two German-dominant girls and one boy were invited. The purpose of the second group is to provide a counterpart representing an either strong or weak Portuguese or Brazilian identity that could trigger different linguistic behaviour from the children of the first group. The first indicator for this distinction is the classification of the children into the class groups *mother tongue* or *partner language* at school. In fact, for those children dominant in German, there is a cultural link with the Portuguese-speaking culture, but it seems less strong as for the other children.[5] Based on the information provided in the questionnaire and the assessment of the teacher and teaching assistant, these children are considered to show a lower proficiency (LP) in Portuguese.[6]

### 4.3. Procedure and Materials

A modified version of the map task was used to elicit neutral yes–no interrogatives. This was conducted to make the task easier for the children. The children were naive to the purpose of the experiment and were free to choose how to speak, meaning that other intonation patterns could also be uttered. A Portuguese map task taken from the *Interactive Atlas of the Prosody of Portuguese* (Frota and Cruz 2012–2015) and an additional German map task, devised by the author, were used as stimuli. In this map task, two participants sitting face to face are each given an identical blank map. One participant is then asked to draw a path connecting various features on their map, while the other participant is asked to find out how to retrace that route on their own map.

Recordings were made with a handy recorder Zoom H4N in a quiet classroom at the school. The children carried out the map tasks working in pairs, with one child from the group of three 'speakers' to be analysed and the other from the group of six 'partners'.

The task of the 'speaker' was to reproduce the same path on their own map by asking yes–no questions. The game-like character of the experiment made it easy for the children to interact with one another in a natural way. The author was present to accommodate the children when they entered the room and give instructions in the intended language of the ensuing interaction, and thereafter sat aside unobtrusively as the children carried out the task. Since the main focus was on Portuguese, each child was recorded two times in Portuguese and once in German. This resulted in a total of nine recordings lasting between 3:0 and 7:18 min.

*4.4. Coding*

The data were transcribed manually by the author, then extracted and analysed using Praat software (Boersma and Weenink 2017, version 6.0.36). The data collected were 226 utterances in Portuguese and 115 in German, from which 17 and 7 utterances were respectively discarded because there was overlapping speech or noise that did not allow for analysis. The resulting output was labelled by the author and three additional annotators.[7] An evaluation of the pragmatic meaning of the utterances was undertaken, and the contours were annotated using the ToBI labelling systems proposed for German (Grice and Baumann 2002) and Portuguese (Frota et al. 2015), respectively. Annotators were asked to use the ToBI labels identified for regional varieties in the literature, but they were also free to use additional diacritics if they encountered variable tunes that required it. Yes–no interrogatives in German were identified on the basis of their syntactic structure and tunes. For Portuguese, annotators were asked to mark pragmatic meaning on a separate tier. An interrater reliability test was performed with 100% of the data using Fleiss' Kappa (Escudero et al. 2012). This includes reliability tests for pragmatic meaning in Portuguese, as well as for nuclear accents and boundary tones in Portuguese and German. The annotations were compiled automatically via a Praat script that was adapted for this purpose (original script `Etiquetatge en ToBI i extracció de dades` http://prosodia.upf.edu/praat/, accessed on 11 October 2017) and then transferred to R (R Core Team 2017) for purposes of subsequent statistical exploration.

It was noted that multiple labels were used to describe minute acoustic differences and that additional diacritics led to an increase in potential labels. It is known that including multiple labels in small datasets or asking transcribers to label multiple potential tonal targets generally leads to lower Kappa values. For example, in multiclass decision tasks, like the one performed in this study, Kappa statistics of nuclear accents labelled by two to four transcribers in monolingual speech sets reportedly vary between 0.51 and 0.69 (Escudero et al. 2012). It was the aim to arrive to an abstraction to be able to compare the speech of the children and focus on the overall contour.

Based on evidence from research using ToBI, a simplification technique was applied. As Ladd (2022) points out, phonological labels in ToBI can show overlap. As an example, to simplify labels such as L+H* and H*, Pitrelli et al. (1994) collapsed them to H* in ToBI AM. In a recent study, Cole et al. (2023) found compelling evidence for five instead of eight nuclear contours in AM, suggesting that the AM predictions were overspecified. Thus, to avoid overspecification of details, labels that could be attributed to a same category were collapsed (see Hualde and Prieto (2016, pp. 4–5) for a discussion on phonetic overlap in variable phonological labels). With this procedure, in the Portuguese data, notations of the type HL% were simplified to L% and LH% to H%, since the main interest was to determine the final boundary tone. Additionally, L*+H, H+L*, and L* were collapsed to L* and additional redundant diacritics were removed, including (), -, ¡ and !. The analysed database consisted of 209 contours in Portuguese and 108 in German. Since words carrying final stress can show truncation in FLBP and SPBP, tokens from the Portuguese dataset

were divided into two groups (according to lexical stress in the nuclear word): (a) final stress and (b) other (penultimate and antepenultimate stress).

*4.5. Analyses*

The data collected were analysed quantitatively and qualitatively. For the statistical investigation, since the data collected were nominal in nature, the non-parametric statistic Kruskal–Wallis test was applied. This test is the non-parametric equivalent of a one-way independent ANOVA and was used to test differences between groups when there were more than two conditions and different participants had been used in all conditions. The test was used to investigate whether there was variation in the choice of tune among the three children and to establish whether interaction with a partner affected the choice of tune. Additionally, I discuss the intonation patterns of the children in relation to their interlocutors and expected tunes, for example, from their regional varieties.

**5. Results**

An evaluation of the pragmatic meaning of all utterances revealed that the children predominantly used yes–no interrogatives. Figure 1 shows the use of yes–no interrogatives or other categories of pragmatic meanings. In 80% of the cases in Portuguese, and 81% in German, yes–no interrogatives were used. Note that LAU used fewer neutral yes–no interrogatives in comparison to the other two speakers. In general, only to a smaller degree, utterances with other pragmatic meanings were also produced. A total of 168 yes–no interrogatives were obtained in Portuguese and 88 in German.

To assess the reliability of the coding, Fleiss' Kappa was calculated for the two languages. For the Portuguese data, the Kappa statistic obtained for the choice of pragmatic meaning was 0.64, showing substantial agreement (Escudero et al. 2012). The Kappa statistic was calculated for yes–no interrogatives and collapsed categories, with nuclear accents reaching 0.36, fair agreement while boundary tones reached 0.82, and substantial agreement. Previous studies evaluating interrater agreement of monolingual speech have shown that there is generally higher disagreement between raters when determining pitch accents (and nuclear accents) than when assessing boundary tones, ranging between 0.51 and 0.69 (Escudero et al. 2012).

For the German data, the Kappa statistic obtained for pitch accents and boundary tones were 0.87 and 0.60, respectively. Overall, the interrater reliability was higher for German nuclear accents, but it should be considered that in this dataset, there is more variability for boundary tones than for nuclear accents of yes–no interrogatives (see Table 2).

The results of the interrater evaluation show that annotators agreed on a total of 110 intonation contours in Portuguese and 52 in German yes–no interrogatives. This represents a rather small dataset to carry out detailed statistical analysis, which is why the main focus will henceforth be on a qualitative analysis. The aim is to contrast clearly distinct tunes in the varieties of children and of their interlocutors.

*5.1. Results for the Portuguese Map Task*

This section discusses the contours obtained for the three children separately. This is because each child was exposed at home to a different regional variety of Portuguese. For each child, a description is given according to the stress pattern of the nuclear word and partner in the recording session. Moreover, predictions are provided about the possible intonation tunes they could employ in those conditions. It was found that the children make use of the expected tunes, but also that there is a high degree of variability.

A Kruskal–Wallis test was performed using INTONATIONAL PATTERN as the dependent variable and SPEAKER as the independent variable. The INTONATIONAL PATTERN variable was significantly affected by SPEAKER, (H(2) = 61.7, df = 2, $p < 0.0001$), confirming that the speakers used a different set of tunes. Further, Kruskal–Wallis tests were used to investigate whether the interaction with a partner had an influence for each child. For that purpose, INTONATIONAL PATTERN was the dependent variable and PARTNER was the independent

variable. The results showed that only in the productions of ART, the interaction with a different partner significantly affected his choice of tune (H(2) = 5.9, df = 1, $p < 0.01$). The choice of tune was not significantly affected by the two partners in the case of LAU (H(2) = 0.5, df = 1, $p = 0.4$) or MAR (H(2) = 2.7, df = 1, $p = 0.1$). These results show that ART was the speaker whose speech was most consistently affected by his interlocutors. How this difference played out will be discussed in more detail in the qualitative discussion below.
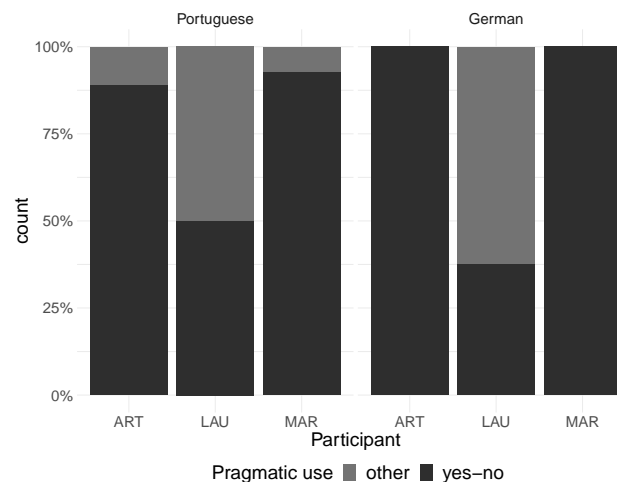


**Figure 1.** Categorisation of utterances obtained according to pragmatic meaning in Portuguese and German.

First, the results for ART and LAU will be discussed as they represent the speakers whose regional varieties are most different from German contours. In the following, contours of expected and unexpected tunes summarised in Table 3 will be discussed. Additionally, the results elicited with the partners in Table 4 will be discussed.

Speaker ART, whose regional variety was FLBP and from whom a total of 24 yes–no interrogatives were obtained, was recorded interacting with (1) a Portuguese-dominant speaker from Rio de Janeiro and (2) a German-dominant partner with limited proficiency in Portuguese. In this case, 13 utterances were obtained from the interaction with partner (1), as opposed to 11 utterances from the interaction with partner (2). The predictions for (1) are that ART will preferably make use of a tune ending in an L% boundary tone, since this is the boundary tone used in both FLBP (see Section 2.1), his regional variety, but also in Rio de Janeiro Brazilian Portuguese, the regional variety of his partner. When the nuclear accent is on a word bearing final stress, truncation is expected and the tune would be produced with H%. For (2), the prediction is that either of the tunes known for FLBP could be used, given that in the regional variety of FLBP, yes–no interrogatives can be marked by a tune ending on either an L% or an H% boundary tone.

Taking together all 24 intonation tunes produced by ART and the stress pattern of the nuclear word, I evaluated the percentage of patterns that were realised according to the descriptions of the FLBP variety given in Section 2.1. As shown in Table 3, ART used the expected tunes for his variety in 54% of instances, whereas in 46%, there was variation. Regarding the interaction with his peers, the results for (1) fulfil the prediction since ART used L% boundary tones in 76% of instances. The results for (2) show that ART produced only tunes with an H%. In one instance, this could be set in relation to word final stress associated with truncation. Figures 2 and 3 show tunes produced on words with different stress patterns. In Figure 2, the tune is realised on a polysyllabic word with antepenultimate stress, recorded while interacting with partner (1). This intonation pattern is expected as there is a low rising nuclear accent and a low boundary tone, which are commonly produced in both varieties of the speakers. In Figure 3, ART uses L* H%, recorded while interacting with partner (2). This tune is similar to the German L* L-H%, and L* H% is a tune from another Brazilian variety (NEBP). This contour is rather unexpected as low

nuclear accents are not canonical in the first postonic and neither is a rise in the final postonic syllable in his variety. Since the stress is placed on the penultimate syllable, it was unlikely that the low boundary tone could be truncated.

**Table 3.** Summary of the collapsed intonation tunes obtained for the Portuguese map task according to stress pattern. Tunes are given for three speakers and two stress patterns: final and other. The latter summarises penultimate and antepenultimate stress. Tunes produced by one speaker correspond to 100%.

| Speaker/Variety | Word Stress | Tune Used | Expected | Count | Sum Percentage |
|---|---|---|---|---|---|
| ART | final | L* H% | yes | 2 | expected 54% |
| FLBP-speaker | final | L+H* H% | yes | 1 | |
| | other | L*(+H) L% | yes | 9 | |
| | other | L+H* L% | yes | 1 | |
| | other | L* H% | no | 3 | not expected 46% |
| | other | L+H* H% | no | 8 | |
| LAU | final | L* H% | yes | 7 | expected 56% |
| SPBP-speaker | final | L+H* H% | yes | 2 | |
| | other | L* H% | no | 6 | not expected 44% |
| | other | L+H* H% | no | 1 | |
| MAR | final | L* H% | yes | 21 | expected 99% |
| SEP-speaker | other | L* H% | yes | 48 | |
| | other | L+H* H% | no | 1 | not expected 1% |

**Table 4.** Summary of the collapsed intonation tunes obtained for the Portuguese map task according to partners. Tunes are given for three speakers and two interlocutors each. Tunes produced with one partner correspond to 100%.

| Speaker | Partner | Tune used | Count | Percentage |
|---|---|---|---|---|
| ART | (1) RJBP-speaker | L*(+H) L% | 9 | 69% |
| FLBP-speaker | (L+<H* L%) | L+H* L% | 1 | 7% |
| | | L* H% | 3 | 24% |
| | (2) German-dominant | L+H* H% | 9 | 82% |
| | (L* H-^H%) | L* H% | 2 | 18% |
| LAU | (1) SEP-speaker | L+H* H% | 2 | 22% |
| SPBP-speaker | (H+L* LH%) | L* H% | 11 | 78% |
| | (2) German-dominant | L+H* H% | 1 | 7% |
| | (L* H-^H%) | L* H% | 2 | 93% |
| | MMP (L+<¡H* L%) | | | |
| MAR | (1) SEP-speaker | L* H% | 51 | 100% |
| SEP-speaker | (H+L* LH%) | | | |
| | (2) German-dominant | L* H% | 18 | 95% |
| | (L* H-^H%) | L+H* H% | 1 | 5% |
| | NEBP (L* H%, L* HL%) | | | |

The second participant, LAU, a speaker of the SPBP variety, was recorded interacting with (1) an SEP-speaking partner and (2) a German-dominant partner whose proficiency of Portuguese was lower. A total of 16 yes–no interrogatives were obtained, with 13 from the session with partner (1), and another three from the session with partner (2). The prediction for (1) is that the speaker would mainly produce the contours typical for SPBP, such as L*+H L% and L+H* L%, which both end in an L% boundary tone. In case the nuclear accent is on a word bearing final stress truncation of L% is expected. However, another prediction is that she might also display accommodation, since in the variety of her partner, SEP, yes–no interrogatives end in an LH% boundary tone. The prediction for (2), in which

LAU was confronted with a partner with low proficiency in Portuguese, is that she would produce one of the two tunes characteristic of the SPBP variety.
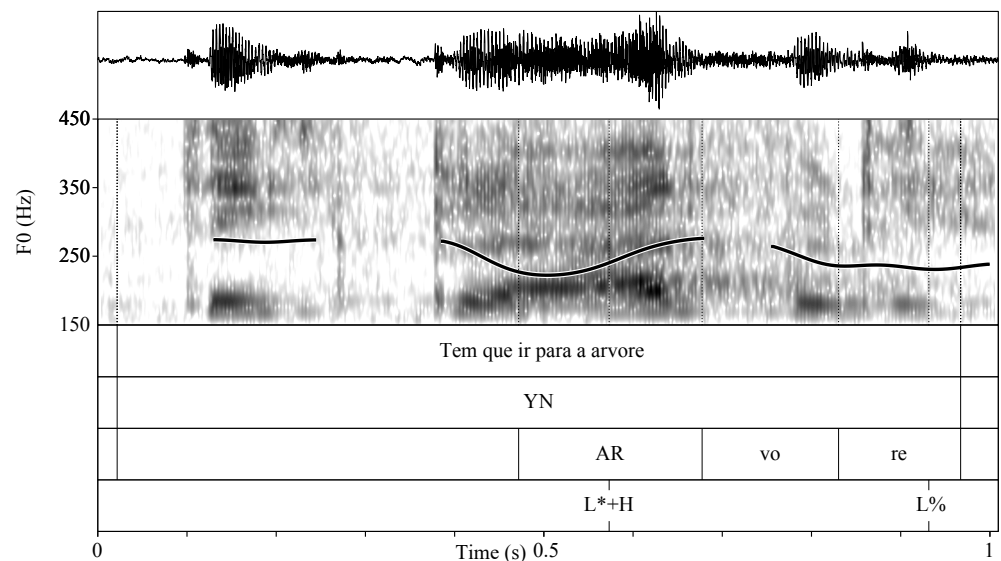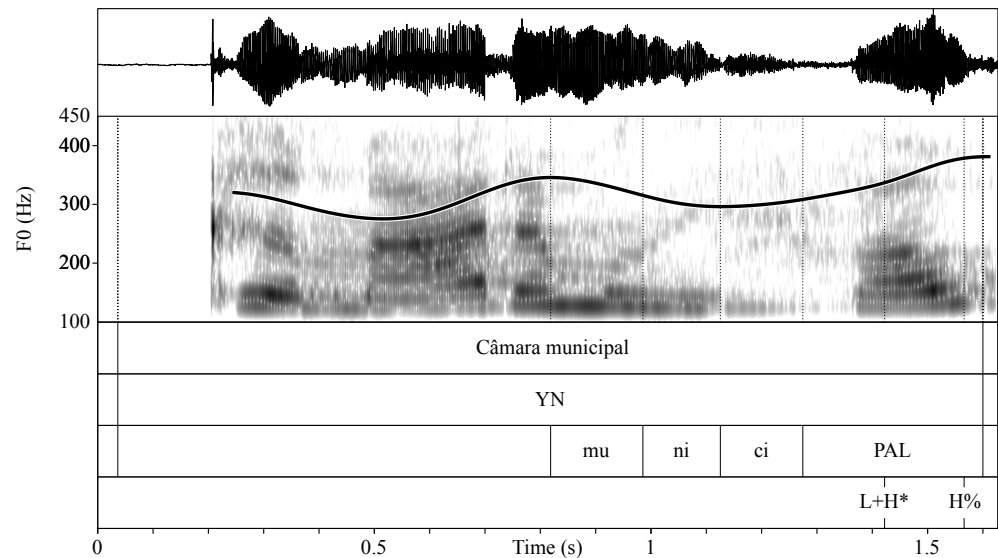


**Figure 2.** Waveform, spectrogram, and F0 contour of the yes–no question *Tem que ir para a àrvore?* 'Do I have to go to the tree?' produced by speaker ART.
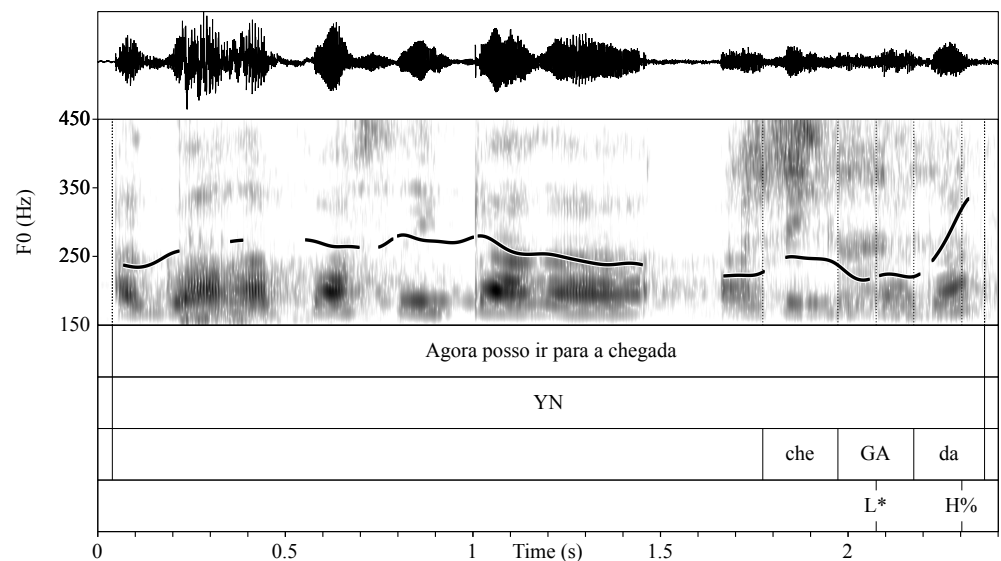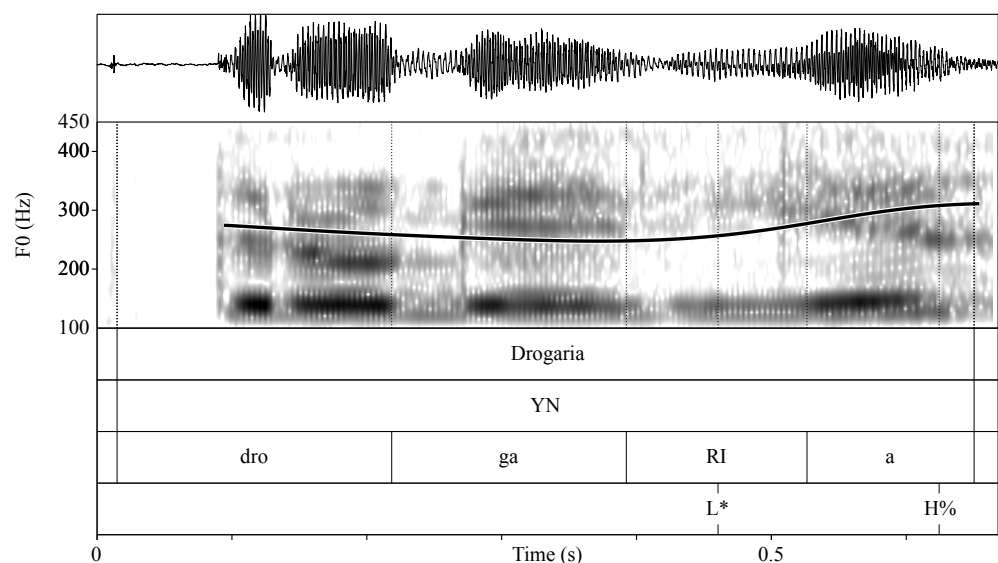


**Figure 3.** Waveform, spectrogram, and F0 contour of the yes–no question *Agora posso ir para a chegada?* 'Can I now go to the arrival?' produced by speaker ART.

Taking into account the stress pattern of the nuclear word in the 16 intonation tunes uttered by LAU, I evaluated the percentage of patterns that were realised according to the descriptions of the SPBP variety provided in Section 2.1. The results show that LAU realised expected patterns in 56% and non-expected ones in 44% of instances. All of her patterns ended on an H%, and those realised as expected were stressed on the final syllable. Figures 4 and 5 show two yes–no questions while interacting with partner (1), a speaker of SEP. For example, Figure 4 shows an expected contour as the final word carries final stress and the L% tone could be truncated, which has been observed in Southern Brazilian varieties. Figure 5 shows the contour for a yes–no interrogative with penultimate stress which is realised with an L* nuclear accent and an H%. However, it is unexpected that the final L% could be truncated in this example, as the stress is on the penultimate syllable.

SPBP is known for displaying intonation contours that end on L% when the stressed syllable is non-final. Moreover, while interacting with partner (2), it was noticed that LAU switched to German in four occasions, providing clarification of a word that was presumably difficult for her partner, as in this Portuguese example: *Posso ir para esquerda?* 'Can I go to the left?', followed by the German *links* 'left'.
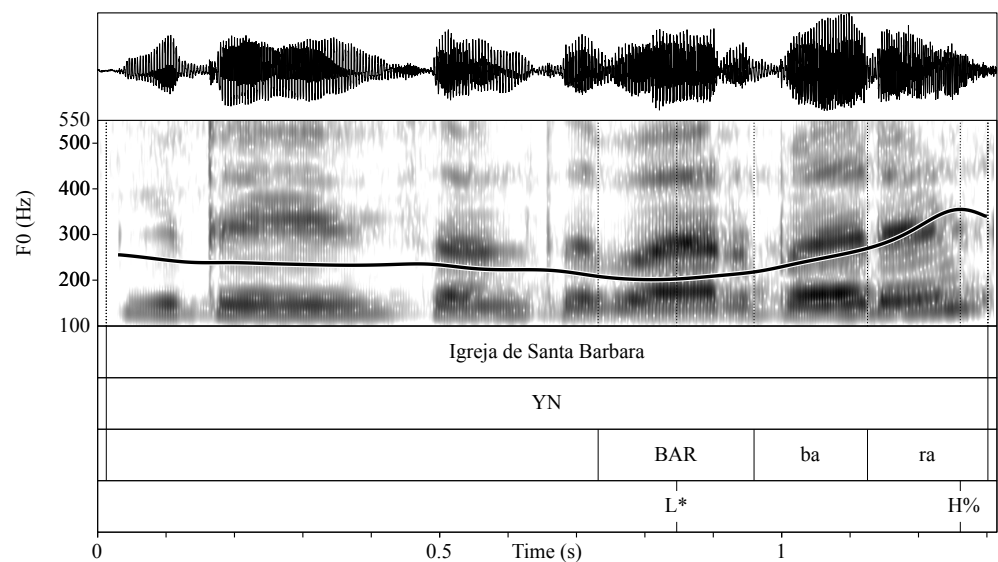


**Figure 4.** Waveform, spectrogram, and F0 contour of the yes–no question *Camâra municipal?* 'Municipality chamber?' produced by speaker LAU.



**Figure 5.** Waveform, spectrogram, and F0 contour of the yes–no question *Drogaria?* 'Drug store?' produced by speaker LAU.

Finally, MAR, who is a speaker of the SEP variety, was recorded interacting with (1) a fellow SEP-speaking partner and (2) a German-dominant partner whose father is a native speaker of NEBP (from Pernambuco state). A total of 70 yes–no interrogatives by MAR were obtained (51 utterances in the interaction with the SEP speaker and 19 in the interaction with the German-dominant speaker). The prediction for (1) is that the child would produce the contour H+L* LH% for all phrases. The prediction for (2) is that the child would either produce the H+L* LH% contour typical of SEP, her Portuguese variety, or she would accommodate to her German-dominant partner because she speaks a different variety of Portuguese.

Taking into account the stress pattern of the nuclear word in the 70 intonation tunes uttered by MAR, I evaluated the percentage of patterns that were realised according to the descriptions of the SEP variety. This was performed by taking into consideration the collapsed labels. Note that H+L* and L* were collapsed to L*. This evaluation indicates that MAR used the expected pattern in 99% of instances. These results show that MAR mostly relies on the same tune L* H%. Considering the collapsed tones, and that both SEP and German display H% boundary tones, it is no surprise that this is the tune the child used. Figure 6 shows an intonation contour of MAR interacting with partner (1). This example shows a phonetic realisation of L* H%, which corresponds to a tune that was employed by all three children, see Table 4. Figures 7 and 8 show two examples of MAR while interacting with partner (1) in German, produced with the L* H-^H% and L* L-H% contours. Note that, albeit in different languages, the contours are quite similar, displaying a low nuclear accent with a rising tone that culminates on a high boundary tone that reaches different degrees of an F0 maxima. In particular, Figures 6 and 8 show strong resemblance with regard to the excursion up to the H peak.
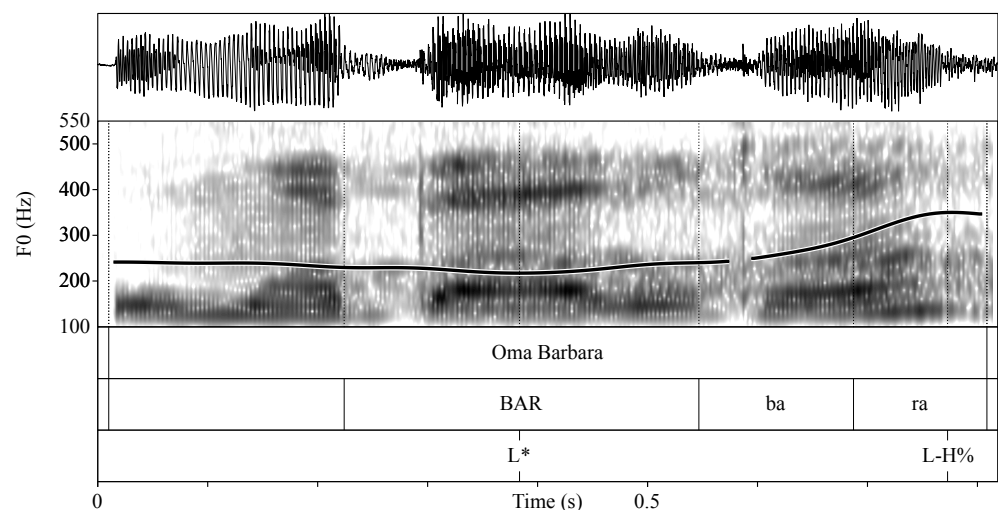


**Figure 6.** Waveform, spectrogram, and F0 contour of the yes–no question *Igreja de Santa Barbara?* 'The church of Santa Barbara?' produced by speaker MAR.
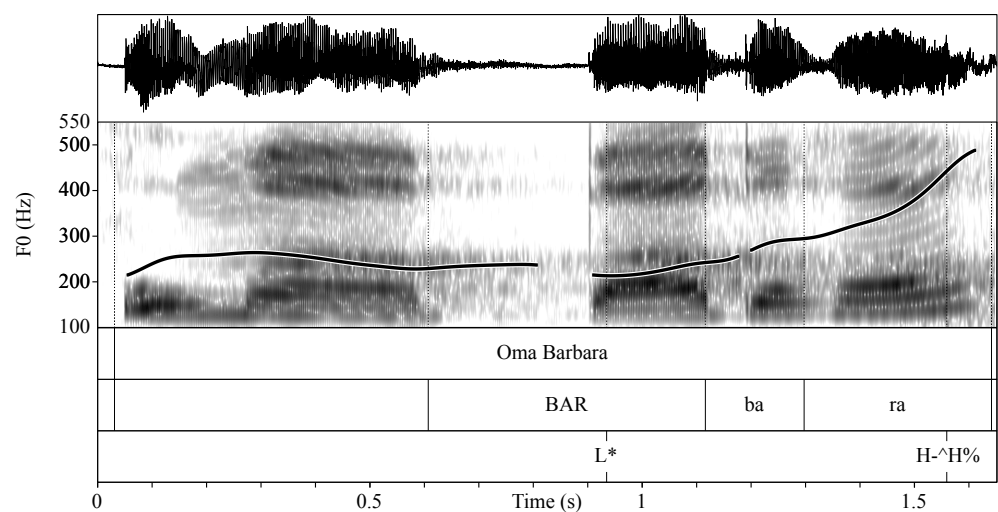


**Figure 7.** Waveform, spectrogram, and F0 contour of the yes–no question *Oma Barbara?* 'Grandma Barbara?' produced with the contour L* H-^H% by speaker MAR.

**Figure 8.** Waveform, spectrogram, and F0 contour of the yes–no question *Oma Barbara?* 'Grandma Barbara?' produced with the contour L* L-H% by speaker MAR.

### 5.2. Results for the German Map Task

For the German map-task, the three children were recorded interacting with only one partner. It should be recalled that all three were regarded as fully proficient in SG and therefore able to master the task without any linguistic barriers. Although in general, the prediction for the German map task was that children would produce the typical contours for SG, namely L* H-^H% or L* L-H%, the transfer of Portuguese prosodic traits into SG intonation was also investigated. A total of 52 information-seeking yes–no interrogatives were analysed. Table 5 presents a summary of the results for each child, together with the linguistic profile of the partners who interacted with them, the tunes attested, and the percentage of appearance. A Kruskal–Wallis test with INTONATIONAL PATTERN as the dependent variable and SPEAKER as the independent variable was then performed on the data. The results show that intonational pattern was not significantly affected by speaker ($H(2) = 2.5$, df = 2, $p = 0.3$), showing that the three different speakers used comparably similar intonational patterns.

**Table 5.** Summary of the results obtained for the German map task.

| Speaker | Partner | Tune Used | Count | Percentage |
|---|---|---|---|---|
| ART | (1) RJBP speaker | L* H-^H% | 6 | 30% |
| FLBP speaker | (L*+H L%) | L* L-H% | 14 | 70% |
| LAU | low proficiency | L* H-^H% | 4 | 50% |
| SPBP speaker | in Portuguese | L* L-H% | 4 | 50% |
| MAR | (1) SEP speaker | L* H-^H% | 5 | 21% |
| SEP speaker | (H+L* LH%) | L* L-H% | 19 | 79% |

ART was recorded interacting with FER, a Portuguese-dominant[8] speaker of RJBP. Arguably, ART could easily have resorted to an accommodation strategy since FER is more proficient in Portuguese than in German. However, at no time in their interaction did the boys switch to Portuguese. In the 20 utterances analysed, ART employed the L* H-^H% and L* L-H% contours in 30% and 70% of instances, respectively. Thus the most frequent tune is L* L-H%, as shown in Figure 9.

LAU was recorded interacting with CAR, who exhibited a low proficiency in Portuguese. In this case, eight utterances were analysed, this time revealing that L* H-^H% and L* L-H% were used equally. As shown in Figure 1, LAU was the child who mostly used other types of pragmatic contexts. A closer look at the data suggests that in addition to yes–no interrogatives, she used contours typical of confirmation-seeking questions.

Figure [10] shows a contour produced by LAU that corresponds to a polite request. These phrases show intonation contours similar to those described by Grice and Baumann ([2002]) as *Bestätigung einer Bekannten Tatsache*, 'confirmation of a known fact', with the pattern H+!H* L-%, and *beruhigende oder höfliche Aufforderung*, 'reassuring or polite request', with the contour H+L* L-%.

MAR was recorded with MAI, a speaker of the same variety of Portuguese, SEP. The two girls were proficient in both languages and in the session in German they did not switch to Portuguese at any point. In the 21 utterances that were analysed, MAR made use of L* H-^H% and L* L-H% patterns in 21% and 79% of the time, respectively. The most frequent tune is, thus, the L* L-H%.
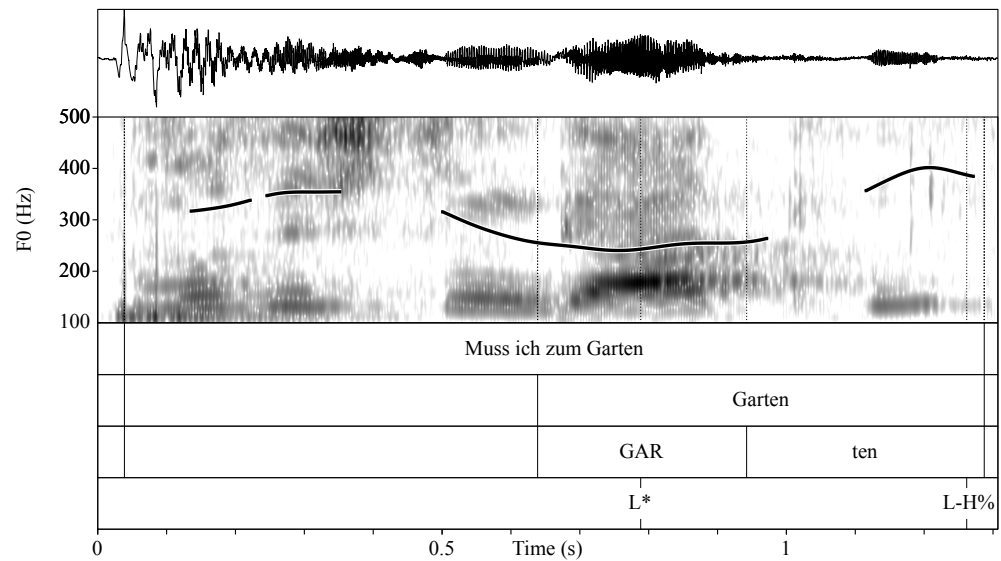


**Figure 9.** F0 contour of the yes–no question *Muss ich zum Garten?* 'Should I go to the garden?' produced by speaker ART.
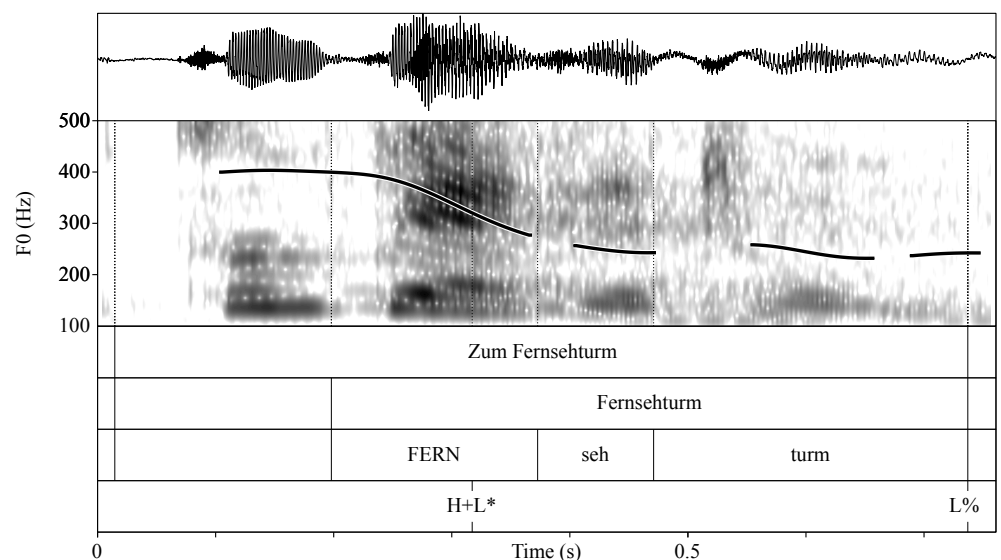


**Figure 10.** F0 contour of the polite request *Zum Fernsehturm?* 'To the TV tower?' produced by speaker LAU.

## 6. Discussion

The first two research questions examine how the children prosodically realise yes–no interrogatives in their Portuguese varieties and in German. Additionally, in the third

research question, I examine whether there is evidence for prosodic transfer from one language into the other.

First, with regard to interactions in Portuguese, for ART (FLPB), when interacting with a speaker of RJBP, ART predominantly used a falling configuration, which corresponds to a typical contour for the FLBP variety and also the variety of his partner. However, unexpected rising configurations were also attested and it was observed that ART never used a falling configuration while interacting with his German-dominant partner. A statistical analysis showed that ART's choice of tune was significantly affected by his interlocutors. Recall, ART interacted with a Portuguese-dominant child who speaks a variety close to his own. When interacting with a speaker whose intonational grammar presents falling contours, partner (1), he mostly produced falling contours, while when interacting with a German-dominant speaker, he resorted exclusively to rising contours, which could be more easily linked to interrogativity than falling contours. For LAU (SPBP), it was found that when interacting with a child proficient in a different variety of Portuguese than her own, LAU used intonational contours with a high boundary tone, atypical for her variety. LAU employed rising boundary tones very similar to those of SEP or German. The recording of LAU interacting with a non-proficient speaker of Portuguese yielded the lowest number of utterances to be analysed. Although (or maybe because) the children are good friends, they seemed to have considerable difficulty interacting in Portuguese, and LAU occasionally switched to German, a behaviour that is understood as a convergent accommodation strategy. In this case, German represents the language in which communicative effectiveness can be best achieved.

LAU was confronted with partners that did not speak her Portuguese variety and were linguistically the most distant, and as a result, it seems she attempted to accommodate in various ways to make communication more effective. When variation in tune failed to improve communication, switching to German seemed the best way to succeed in communicating. As a general observation, all three children make use of tunes typical of (or very close to) their varieties. The results obtained for MAR (SEP) coincided mostly with predictions, since she made use of rising boundary tones described as representative of the SEP variety.

Additionally, prosodic convergence was observed in the intonation of the Portuguese yes–no questions of the children. A preference to use low nuclear accents (L*) and high boundary tones (H%) could be attested. The frequent use of this tone could be linked to a German influence since L* is the typical nuclear accent of yes–no interrogatives. Additionally, in German, but also in many Portuguese varieties, yes–no interrogatives end on an H%. This preference for high boundary tones can be interpreted as the result of prosodic transfer. Since H boundary tones are tightly linked to interrogativity in German, this could have led to a higher production of the H tone. This evaluation responds to the third research question which sought to evaluate whether evidence is found for prosodic transfer. This study finds that the societal majority language, German, is used as source of prosodic transfer into Portuguese. Additionally, since all children made use of this tune, it is likely that it originates from interaction in the classroom.

As for the children's interactions in German, the results show that L* L-H% was the preferred tune for all speakers. Moreover, the children reflexively applied tunes (and syntax) appropriate to yes–no interrogatives in SG. It is noteworthy that the children, in particular MAR, opted for the German contour that is closer to the SEP. This could be an indicator that MAR shows intonational influence from SEP. Overall, this result differs from the findings by Queen (1996), who reported non-canonical intonation in German. One possible explanation for this difference is that participants in this study are more aware of specific differences between German and Portuguese varieties, since German represents the majority language in the school (as well as the dominant language in the greater social context) and all children were acquiring the same variety (SG); in this case, the degree of variability in prosodic structure is smaller.

This result is in line with previous observations which suggest formal education in the two languages of the bilingual will lead to different outcomes in proficiency (Kupisch and Rothman 2018). At the same time, the children displayed variability which seems to be motivated by the language proficiency of their interlocutor, which is indicative of an accommodation strategy.

Next to the regional varieties spoken at home or in school, as well as access to education in the two languages of the children, other factors could be influencing their speech. It is conceivable that social relationships between the children could additionally affect the degree of prosodic transfer. Possibly, children could vary their intonation contour to mark social differentiation in particular cases. Due to the exploratory nature of this study and the small sample size, it is difficult to arrive at definite conclusions in this regard. However, I did find indicators that children are capable of responding to the challenges in communicating when their interlocutors have trouble understanding them. Further investigation of this issue could explore social factors by collecting additional data on the children's relationships or the speech data from interacting with parents. Although this study and other work suggest that access to education provides support for the acquisition of the heritage language, further studies dealing with prosody are of interest. One particular challenge that remains is the description of cross-dialectal prosody. We used a simplification of phonological categories to analyse more general intonation contours which allowed for the recognition of prosodic convergence across the data. However, overspecification of phonological labels is a pervasive problem that represents an important challenge for studies dealing with this type of variability (Hualde and Prieto 2016). This methodological shortcoming within AM is one that requires further discussion and the exploration of proposals for implementable methods.

## 7. Conclusions

One of the aims of this study was to assess how children receiving formal education in their two languages realise specific prosodic contours. Additionally, it was of interest to evaluate whether evidence could be found for prosodic transfer in either language. The evaluation of the data showed that the children produce the typical intonational patterns of the heritage variety spoken at home. Since variation in the societal majority language, German, was not ruled out, children performed the same experimental task in German. It was found that for neutral yes–no interrogatives, the children exclusively use the canonical patterns typical of the societal majority language. Hence, the children in this study show no prosodic transfer from Portuguese into German. This contrasts with previous observations of Turkish heritage children producing non-canonical intonation patterns in Turkish and German (Queen 2001, 1996). In the latter, it was reported that the participants acquired the societal majority language, German, in a formal context and the heritage language, Turkish, in an informal one. This suggests that access to formal education in the two languages of the bilingual can have an impact on linguistic choices and lead to a standard oriented realisation of intonation in the societal majority language, which is German in this case. Despite the fact that all children used the tune described for the Portuguese variety they are the most familiar with to some degree, a more interesting finding is that children seemed to adapt their use of intonation depending on their interlocutor. The data in this study show that in Portuguese interactions, especially with German-dominant interlocutors, the children predominantly made use of tunes with high boundary tones which resembled German tones. The preference for tunes that are German-like could be interpreted as prosodic convergence. This behaviour is in line with convergent accommodation which emerges in order to facilitate communication between peers in the same classroom.

The implementation of GToBI and P-ToBI made it possible to identify the use of canonical contours in the two languages. However, it was difficult to account for variation in the phonetic implementation of contours in Portuguese. Since ToBI labelling systems were developed to describe phonological systems of monolinguals, it appears that the evaluation of bilinguals would benefit from some adaptations or modifications. One

possibility is to focus on the overall contour and examine the stressed syllable and major prosodic boundaries, as in this study. A simplification of labelling reducing the number of diacritics and tonal targets could be helpful as well. Cole et al. (2023) examine nuclear tunes in American English, arguing that they find no support for distinct tonal specifications for the phrase accent and boundary tone from the AM model. This is evidence that gradient phonetic differences in intonation contours are not necessarily categorical and the overall contour shape should be considered. Alternatively, annotations differentiating between phonological and phonetic levels (Hualde and Prieto 2016) may also prove to be fruitful. It goes beyond the scope of this study to provide a set of new guidelines on how to annotate the speech production of bilingual speakers. However, this study clearly shows a need for more research on the intonation and speech of bilinguals. Finally, it would be interesting to test whether children display the same amount of variability outside of school or whether this occurs exclusively among peers. Similarly, it is difficult to foresee whether the variation in intonation pattern will be maintained in the speech of the children as they grow up and reach puberty. To investigate these questions, further research on the prosodic development of children and the phonetic realisation of their speech is of interest.

## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| SEP | Standard European Portuguese |
| MMP | Maputo Mozambique Portuguese |
| FLBP | Florianópolis Brazilian Portuguese |
| SPBP | São Paulo Brazilian Portuguese |
| RJBP | Rio de Janeiro Brazilian Portuguese |
| NEBP | Northeastern Brazilian Portuguese |
| SG | Standard German |

## Notes

[1] One child reportedly has a parent who speaks an Angolan variety of Portuguese. To the best of my knowledge, there are no published descriptions of the intonation of neutral yes–no interrogatives in this variety.

[2] The examples shown are based on descriptions made by the authors cited as well as F0 contours graphically reported in the literature. These contours are exemplified in LaTeX in form of stylised F0 contours (Donnelly 2013).

[3] The rhetorical question is described as a hybrid type of utterance. The rhetoric question has the syntactic surface structure of an interrogative but may be used as an assertion of the opposite polarity of their interrogative structure (Wochner et al. 2015).

[4] The SESB offers bilingual education tracks that combine German with English, French, Greek, Italian, Polish, Russian, Spanish, Turkish or Portuguese.

[5]    The degree to which a child identified with a Portuguese-speaking culture or not was admittedly difficult to measure. However, family history often seemed to be connected with linguistic choices. A stronger identification with the German-speaking culture was noticed, for example, in the case of divorced parents when the German speaking parent had custody, or for children whose parent's first language is not exclusively Portuguese, in the case of multilingual parents from African countries.

[6]    When making use of the term *proficiency* this refers to a spontaneous, self-confident use of either language as well as an effortless participation in the experimental task.

[7]    The author is a native-like speaker of German and a fluent speaker of Portuguese. The second annotator is an expert on intonation of Romance languages and a fluent speaker of German. The third and fourth annotators are trained in phonological notation with ToBI and are native speakers of SPBP and SG.

[8]    FER's family had recently relocated to Germany and he was the only Portuguese-dominant child in the class.

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