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DIALECT PERCEPTIONS OF VARIATION: SPEAKER ORIGIN IDENTIFICATION THROUGH /S/ IN CODA POSITION IN BRAZILIAN PORTUGUESE

PERCEPÇÕES DIALETAIS DA VARIAÇÃO: A IDENTIFICAÇÃO DA ORIGEM DO FALANTE A PARTIR DO USO DO /S/ EM CODA NO PORTUGUÊS BRASILEIRO*

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ABSTRACT: This article investigates how speakers from six Brazilian capitals (Natal, João Pessoa, Recife, Rio de Janeiro, São Paulo, and Porto Alegre) assign geographic origin to speakers based on listening to utterances containing different pronunciations of the fricative /S/ in syllable coda position. The study is situated within the field of perceptual dialectology, which seeks to understand how non-specialist speakers perceive, categorize, and evaluate regional linguistic variation. The research was based on the hypothesis that specific phonetic variants – notably the palato-alveolar and alveolar – function as social indexes associated with particular Brazilian regions. The experiment employed the paired-stimuli technique, with strict control of phonetic variables, and involved 240 listeners balanced by city, gender, and age group. The results show that palato-alveolar fricatives tend to be associated with Rio de Janeiro and Recife, especially by listeners from the Southeast and Northeast, respectively, while the alveolar variant is more frequently linked to São Paulo and Porto Alegre, particularly by listeners from those same regions. These recognition patterns reinforce the principle of "perceptual proximity," which states that speakers identify linguistic traits of regionally close or culturally salient varieties with greater accuracy. Data analysis suggests that interdialectal perception is systematic and influenced by phonological, geographical, and social factors, offering important implications for studies on variation, identity, and linguistic stereotyping in Brazilian Portuguese.

KEYWORDS: Dialect perception. Coda /S/. Sociolinguistic variation. Perceptual dialectology. Regional indexes. Brazilian Portuguese.

RESUMO: Este artigo investiga a forma como falantes de seis capitais brasileiras (Natal, João Pessoa, Recife, Rio de Janeiro, São Paulo e Porto Alegre) atribuem procedência geográfica a locutores com base na escuta de enunciados contendo diferentes realizações da fricativa /S/ em coda silábica. O estudo insere-se no campo da dialetologia perceptual, que busca compreender como os falantes não especialistas percebem, categorizam e avaliam a variação linguística regional. A pesquisa partiu da hipótese de que variantes fonéticas específicas – notadamente a palatoalveolar e a alveolar – funcionariam como índices sociais, associados a determinadas regiões do Brasil. O experimento utilizou a técnica dos estímulos pareados, com controle rigoroso de variáveis fonéticas, e contou com a participação de 240 ouvintes, equilibrados por cidade, sexo e faixa etária. Os resultados indicam que as fricativas palatoalveolares tendem a ser associadas ao Rio de Janeiro e a Recife, especialmente por ouvintes do Sudeste e do Nordeste, respectivamente, enquanto a variante alveolar é mais frequentemente relacionada a São Paulo e Porto Alegre, sobretudo por ouvintes dessas próprias localidades. Esses padrões de reconhecimento reforçam o princípio da "proximidade perceptual", segundo o qual falantes identificam com maior precisão os traços linguísticos de variedades regionalmente próximas ou culturalmente salientes. A análise dos dados sugere que a percepção interdialetal é sistemática e influenciada por fatores fonológicos, geográficos e sociais, oferecendo importantes implicações para os estudos sobre variação, identidade e estereotipia linguística no português brasileiro.

PALAVRAS-CHAVE: Percepção dialetal. /S/ em coda. Variação sociolinguística. Dialetologia perceptual. Índices regionais. Português brasileiro.

1 Introduction

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The fricative /S/ in syllable coda position in Brazilian Portuguese exhibits broad phonetic and geographic variation, especially in its alveolar and palato-alveolar pronunciations, as documented in phonetic-phonological, sociolinguistic, and dialectological studies (CALLOU; MORAES; LEITE, 2002; SCHERRE; MACEDO, 2000; HORA, 2003; BRESCANCINI, 2003; MACEDO, 2004; PEDROSA, 2009; JESUS; MOTA, 2009a, 2009b; BASSI; SEARA, 2017; CARDOSO et al., 2014; CUNHA; SILVA, 2019). Regions such as São Paulo, Porto Alegre, Belo Horizonte, and Goiânia tend to favor alveolar pronunciations, while cities like Florianópolis, Rio de Janeiro, Recife, and Belém more frequently use palato-alveolar forms (JESUS; MOTA, 2009a, 2009b; CARDOSO et al., 2014). In cities like Natal and João Pessoa, both variants are used systematically, particularly in specific phonological contexts — notably before coronal consonants such as /t/, /d/, and, to a lesser extent, /n/ — a pattern already observed in production studies for those regions (Hora, 2003; Hora; Pedrosa, 2009; Cunha; Silva, 2019; Henrique; Amorim; Hora, 2022). Given this diversity in usage and regional distribution, it is worth investigating whether these pronunciations are perceived and recognized by speakers themselves as distinctive features of local varieties — a perspective that falls within the scope of perceptual dialectology.

Perceptual dialectology provides tools for investigating how speakers cognitively represent linguistic variation and attach social meaning to regional ways of speaking. Introduced by Dennis Preston in the 1980s, this approach focuses on how non-specialist speakers perceive, evaluate, and categorize regional speech styles based on their own auditory and cognitive experiences. Using methodologies such as hand-drawn maps, identification tasks, judgment scales, and affective association measures, studies in this field have shown that interdialectal perception is not random, but rather systematic, reflecting both auditory competence and internalized linguistic stereotypes. A central finding across studies is that speakers tend to recognize more accurately the speech of regions that are geographically close or culturally salient (PRESTON, 1989; MONTGOMERY, 2012). This principle of perceptual proximity has been supported by research in contexts such as the United States, the United Kingdom, Japan, and Brazil, confirming its empirical robustness and theoretical value in understanding perceived dialect boundaries.

Building on this foundation, the present study examines how speakers from six Brazilian capitals — Natal, João Pessoa, Recife, Rio de Janeiro, São Paulo, and Porto Alegre — assign geographic origin to speakers based on listening to utterances containing different pronunciations of /S/ in syllable coda position. We hypothesize that the palato-alveolar pronunciation serves as an index of localities such as Recife and Rio de Janeiro, while the alveolar pronunciation is more commonly associated with São Paulo and Porto Alegre. To test this, we designed a sociolinguistic perception experiment using the paired-stimuli technique, where the same sentence was recorded with both pronunciations by native speakers from each target city. The stimuli were then evaluated by listeners from those same communities, who were asked to indicate the presumed city of origin for each speaker.

This article is structured as follows: the next section provides a critical review of the literature on coda /S/ variation in Brazilian Portuguese and the foundations of perceptual dialectology. Section 3 describes the methodology used, including the experimental design, participant selection, stimulus organization, and statistical techniques. Section 4 presents and discusses the results of the speaker origin identification task. Finally, the conclusion highlights the main findings, discusses their theoretical implications, and suggests directions for future research on sociolinguistic perception.

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2 Dialect Perception and Perceptual Dialectology

Dialect perception, understood here as the ability of speakers to recognize and evaluate differences among geographically situated speech varieties, has received growing attention within linguistics, especially in the field of perceptual dialectology. This subfield, consolidated in the 1980s through the work of Preston (1986, 1989, 1996, 1999, 2002), aims to investigate how non-specialist speakers perceive linguistic variation, attribute social value to it, and establish dialect boundaries based on their own auditory and cognitive experiences. Unlike traditional dialectology, which focuses on describing variation itself, perceptual dialectology concentrates on how variation is cognitively represented, judged, and categorized by members of linguistic communities.

The first studies in perceptual dialectology used methods such as hand-drawn maps, where participants indicated regions with stronger or weaker "accents" or identified speech styles they found more "beautiful," "clear," or "correct." Although qualitative, these approaches revealed that speech judgments are not random but guided by social beliefs, linguistic stereotypes, and experiences of intervarietal contact (PRESTON, 1989, 1999). Later studies began to incorporate more systematic experimental techniques, such as recorded stimulus identification and judgment tasks, allowing for more robust statistical analyses (Montgomery, 2012).

One frequently reported finding in the literature is the so-called "perceptual proximity" principle, which states that speakers tend to more accurately identify regional varieties that are geographically close or socially familiar. This pattern has been widely documented in pioneering and later studies conducted in the United States, United Kingdom, Japan, and Brazil, relying on techniques such as hand-drawn maps, difference judgment scales, and dialect categorization analyses.

In the United States, Preston's (1996) work highlighted how speakers from southeastern Michigan perceived the accents of the 50 American states. Participants ranked, on a four-point scale, the degree of difference between their own accent and that of other states. Results showed that geographically closer areas were perceived as similar, while more distant regions, particularly in the South (e.g., Alabama, Mississippi, and Louisiana), were considered "unintelligibly different." This discrepancy illustrates the role of geographic proximity and sociocultural salience in dialect perception.

Complementarily, Preston (1986) also used hand-drawn maps in various regions of the U.S. For example, participants from Michigan were asked to delineate areas with distinct speech forms. The drawn dialect boundaries reflected more refined perceptions of nearby regions, while distant areas were perceived as linguistically homogeneous. This perceptual asymmetry supports the idea that more frequent contact with certain varieties facilitates their identification.

In the United Kingdom, Montgomery (2012) applied similar techniques with young people from Northern England. Participants drew boundaries between northern and southern speech and marked regions known for their accents. It was observed that speakers more accurately recognized varieties near their locality. In Carlisle and Brampton, for example, over a third correctly identified the Cumbria region. Additionally, southern informants marked the north-south boundary further south, possibly to maintain an identity tied to the "North." Once again, geographic proximity proved to be a key factor in the accuracy of dialect demarcation.

At the Scotland–England border, Montgomery (2012) compared the perceptions of speakers from both sides. Scots showed greater accuracy in identifying local varieties (such as "weeji" and "Gaelic"), while English participants used broader labels like "Scottish." Convergence in responses was greater regarding English varieties, indicating that factors such as regional identity and cultural prominence influence interdialectal perception. Heat maps

created from these responses confirmed that regions closer to the respondent's location were represented with greater density and specificity.

Finally, in Brazil, a study by Oliveira do Canto (1982 apud PRESTON, 1985) with speakers from Santa Maria, Rio Grande do Sul, showed a similar pattern. Informants classified neighboring dialects as “not different” or “a little different,” while assigning higher degrees of difference to more distant or culturally distinct varieties, such as those with strong Italian, German, or border influences. These results suggest that dialect variation perception is sensitive to geographic distance but also shaped by cultural and identity factors.

Although conducted in different cultural contexts, these studies converge in showing that dialect perception is not random. On the contrary, it appears to be systematically influenced by factors such as geographic proximity, sociocultural familiarity, and the stereotypical salience of varieties. This supports the principle of perceptual proximity and provides strong empirical backing for its application in sociolinguistic perception analyses across different languages and communities.

Another element widely explored in perceptual dialectology is the role of linguistic stereotyping. Certain phonetic features — such as intonations, vowel qualities, or consonant pronunciations — can acquire significant symbolic meaning within certain communities and come to be socially indexed to specific groups or regions. In Brazilian Portuguese, for instance, the palato-alveolar variant of coda /S/ has been associated with speech from Rio de Janeiro and parts of the Northeast, such as Recife, and is frequently reinforced by media representations (CALLOU; MORAES; LEITE, 2002; CUNHA; SILVA, 2019; HORA, 2003).

These findings provide important theoretical insights for interpreting the data in this study. The hypothesis that dialect perception is mediated by factors such as geographic proximity, exposure frequency, and sociolinguistic stereotypes helps explain the patterns of association between phonetic variants and cities of origin observed among participants. Additionally, previous studies suggest that phonetic traits perceived as more marked or stereotyped tend to be more easily recognized and associated with specific locations (Eckert, 2008; Johnstone; Kiesling, 2008).

Based on this theoretical framework, it becomes plausible to assume that the palato-alveolar variant of /S/ may operate as a more salient regional index, while the more widely distributed alveolar variants would tend to be perceived as less distinctive. Moreover, there is evidence that listeners are more likely to recognize speech similar to that of their own community with greater confidence or accuracy due to phonetic familiarity and a shared sociolinguistic repertoire (WILLIAMS; GARRETT; COUPLAND, 1999; PRESTON, 2002; MONTGOMERY, 2012).

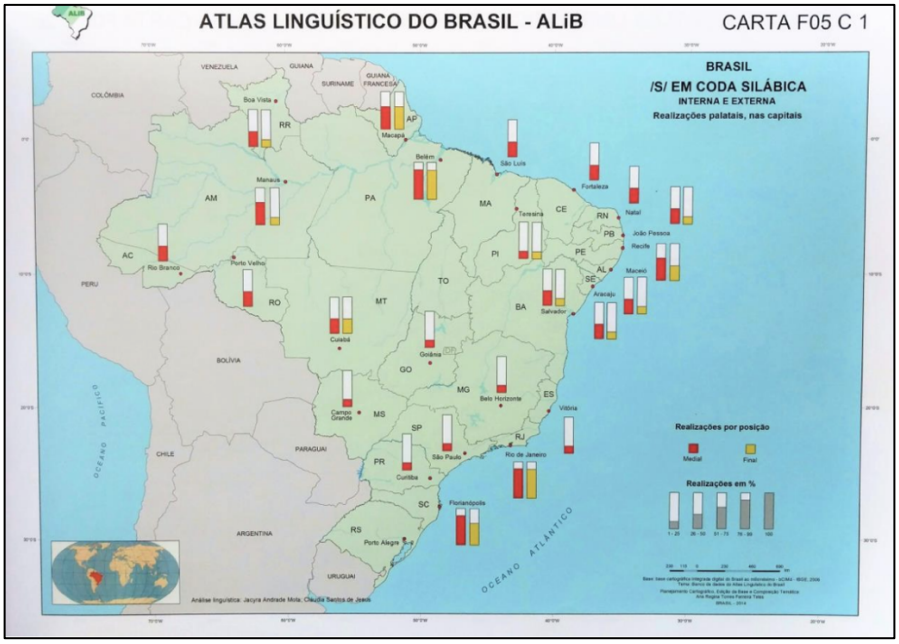
With these assumptions in mind, the data analysis in the following sections aims to explore to what extent phonetic variants of /S/ in coda position function as perceptual markers of regional origin and how the geographic background of listeners influences their judgments.

3 Studies about /S/ in sylable coda position in Brazilian Portuguese

In Brazilian Portuguese (BP), according to Callou, Moraes, and Leite (2002), Hora (2003), and Pedrosa (2009), based on variation data from several Brazilian speech communities, /S/ in coda position presents the following main variants: the alveolar – [s, z], the palatal (or palato-alveolar) – [ʃ, ʒ], the aspirated – [h, ɦ], and zero pronunciation – Ø. These authors point out that the most frequent pronunciation in most Brazilian dialects is the alveolar. However, in some dialects, the palatalized form seems to be more commonly used by speakers. Data from the Linguistic Atlas of Brazil project (Cardoso et al., 2014) show the distribution of palatalized

pronunciations across Brazilian capitals, depending on coda position (see Figure 1). Capitals such as Florianópolis, Rio de Janeiro, Recife, Belém, and Macapá exhibit this dialectal pattern.

Figure 1 - Map of palato-alveolar pronunciations of coda /S/ in internal and final syllable positions across Brazilian capitals



Source: Cardoso *et al* (2014, p. 111).

According to Figure 1, cities such as Rio de Janeiro and Recife show high rates of palato-alveolar pronunciation, while São Paulo and Porto Alegre show low levels of this variant. In cities like João Pessoa and Natal, the results are more variable. This section discusses previous research on how this variable behaves in the dialects of those capitals, offering a comparative framework for the perceptual data later discussed.

In Porto Alegre and São Paulo, sociolinguistic studies confirm a predominantly alveolar pronunciation. Works by Callou and Moraes (1996) and Callou, Moraes, and Leite (2002), based on data from the NURC project, report alveolar usage rates close to 90% in São Paulo and 86% in Porto Alegre, in both medial and final coda contexts. No significant variation by gender or age was observed, suggesting a stable and categorical usage pattern, where the palato-alveolar form, when it appears, serves as a stylistic or mimetic feature, not systematically integrated into the local vernacular.

In Rio de Janeiro, the opposite situation is observed. The palato-alveolar pronunciation dominates and is highly productive in various contexts. Since the early studies by Callou and Marques (1975), through Reis (1992), Callou and Moraes (1996), Scherre and Macedo (2000), and more recent work by Bassi (2011, 2016) and Melo (2012), high frequencies of coda /S/ palatalization have been documented. Rates of palato-alveolar pronunciation range from 62% to 98%, depending on corpus, methodology, and phonological context definitions. Influencing factors include the position of /S/ in the word (greater palatalization in medial codas), the following phonological segment (voiced and coronal consonants favor palatalization), and social variables such as gender, education level, and speech style. Despite occasional disagreements on the sociolinguistic profile of palatalization, there is broad consensus on its high productivity and sociolinguistic indexing in Rio de Janeiro speech.

Recife also shows high rates of palato-alveolar pronunciation, though with more variation than Rio. According to Callou, Moraes, and Leite (2002) and Macedo (2004), the use of the palatal form is favored in similar phonological contexts (especially medial codas followed by coronals), but greater variation across speakers and styles suggests a possible change in progress. The palato-alveolar variant is common among women and younger speakers, and while the alveolar form still occurs in some groups, a pattern of expansion and consolidation of the palatal form is observed across phonological and social contexts.

In João Pessoa and Natal, the picture is one of regulated coexistence between variants. In João Pessoa, studies by Hora (2003), Ribeiro (2006), and Henrique, Amorim, and Hora (2022) show that palatalization is strongly conditioned by the following context. In medial codas followed by coronals, especially /t/ and /d/, palato-alveolar pronunciation is preferred. In final codas or when followed by a pause, the alveolar variant and deletion become more frequent. This variation seems to reflect a stable phonological structure, not a change in progress, but rather a systematic pattern of the local phonological system.

In Natal, similar findings emerge, as shown by Pessoa (1986) and Cunha and Silva (2019). The palato-alveolar form is used in specific contexts (e.g., medial codas followed by /t/, /d/, and more recently /n/), while the alveolar variant remains strong in contexts less favorable to palatalization. The coexistence of variants, conditioned by phonological elements and reinforced by social factors (age, education), suggests a relatively stable system, though open to stylistic and sociolinguistic shifts.

Thus, the production data examined in this study, based on interviews from various corpora, demonstrate well-defined dialectal patterns in the pronunciation of coda /S/ in BP. These patterns provide the backdrop for the perceptual judgments explored later. In recent years, several studies have focused on how these coda /S/ variants are socially perceived and evaluated by Brazilian speakers. This study contributes to that growing body of research.

4 Methodology

This study investigated the interdialectal perception of the sociolinguistic variable /S/ in syllable coda position by speakers from six Brazilian capitals — Natal, João Pessoa, Recife, Rio de Janeiro, São Paulo, and Porto Alegre — through a regional origin identification experiment. The experimental design was based on the paired-stimuli technique (Lambert et al., 1960; Campbell-Kibler, 2006, 2010; Canever, 2018; Oushiro, 2015, 2019; Mendes, 2016; Soriano, 2016), in which nearly identical stimuli are presented to groups of evaluators, differing only in the phonetic pronunciation of the target segment. The goal is to observe whether listeners' evaluations of the speaker change across the two versions of the same sentence, based solely on the phonetic difference of the /S/ pronunciation.

Listeners from each speech community were divided into two groups, each hearing the same phrases spoken by the same speakers — one group heard /S/ in coda position pronounced with the alveolar variant, the other with the palato-alveolar variant.

The stimuli were created using sentences produced by eight speakers (four men and four women), all native to the target cities. Each speaker recorded the same sentences in two versions: one with the alveolar pronunciation of /S/ and the other with the palato-alveolar pronunciation. During stimulus preparation, the following phonetic elements were carefully controlled: the following segment (/k/, /t/, /d/, or /n/), whether the fricative was voiced or voiceless, and whether the /S/ occurred in a medial or final coda.

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Table 1 - Stimulus sentences by following context, voicing, and coda type

Lable	Pronunciation[2]	Sentence	Following context	Voicing	Type of coda
E1	Alveolar	A casca da fruta seria uma boa isca.	[k]	Voiceless	Medial
E2	Palatal				
E3	Alveolar	Fiquei assustado quando vi que já era agosto.	[t]		
E4	Palatal				
E5	Alveolar	Desdenhou dele quando viu a roupa desdobrada.	[d]	Voice	
E6	Palatal				
E7	Alveolar	Viram um asno no caminho e um cisne no rio.	[n]		
E8	Palatal				
E9	Alveolar	Sempre traz com ele um lápis colorido.	[k]	Voiceless	Final
E10	Palatal				
E11	Alveolar	Faz tempo que ele procura mais trabalho.	[t]		
E12	Palatal				
E13	Alveolar	Através do vidro do teto eu vi a luz da lua.	[d]	Voice	
E14	Palatal				
E15	Alveolar	Pôs na sala tanta coisa que não cabe mais nada.	[n]		
E16	Palatal				

Source: Author's own work, 2022.

A total of eight target sentences were recorded with both pronunciations, along with eight distractor sentences (also with varied pronunciations), for a total of 16 auditory stimuli per group (32 overall). In each experimental version (group A or B), participants heard one version (alveolar or palato-alveolar) of each sentence, with the variant alternating across blocks.

Due to constraints imposed by the Covid-19 pandemic, it was not possible to use phonetics laboratories for recording. Like many researchers in phonetics and perception, the study adopted an emergency remote protocol based on methods described by Freeman and Decker (2021), commonly used in the Sociophonetics Lab at the University of York.

Speech data were collected remotely, with direct mediation by the researcher. Over the phone, participants were instructed on which sentence to record and how to produce the target /S/ pronunciation. Instructions included researcher simulations and contextual suggestions to encourage natural speech. Recordings were made using the Sound Voice Recorder app (WAV format, 44.1kHz). To improve acoustic quality, speakers were advised to record inside an open wardrobe, using hanging clothes to reduce noise and reflections. The phone was held one hand-span from the mouth at lip level. Each sentence was recorded six times with each pronunciation variant.

After receiving the audio files via email, the researcher labeled and selected the tokens. Mid-range repetitions were systematically chosen to avoid prosodic artifacts from the beginning or end of controlled reading. Volume normalization was done using SoundForge's "normalize" tool.

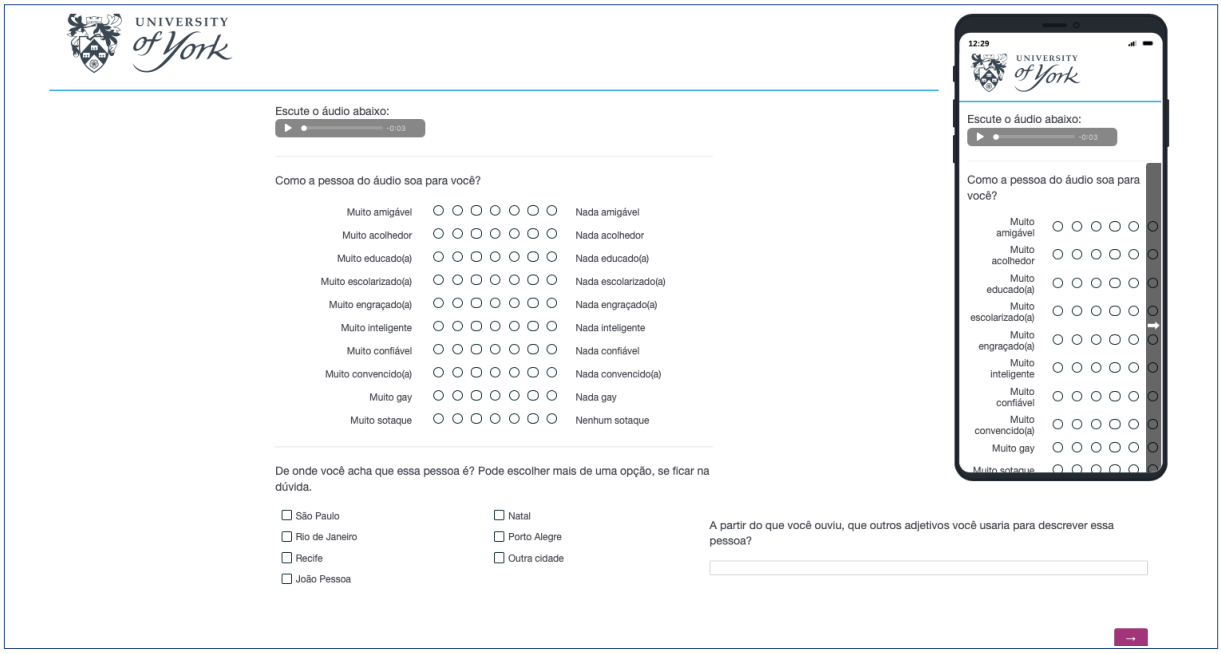
[2] Para facilitar o estabelecimento de contraste nas análises, convencionou-se tratar as produções palatoalveolares como palatais.

At first, the team considered editing the fricative segments directly using Praat ("cut" and "paste" functions) to create contrastive stimulus pairs. However, testing showed that this created perceptible acoustic artifacts (residual noise and segment transitions), compromising naturalness. As a result, natural productions were used instead: each variant was produced intentionally by the same speakers, preserving prosody and minimizing duration differences in the fricative segment.

A total of 240 listeners participated — 40 from each city, balanced by gender (20 men and 20 women per city), aged 18 to 35, all with at least a high school diploma. All reported being native to their city and had no history of hearing impairment.

The experiment was conducted online using Qualtrics, with controlled presentation of stimuli. Each participant listened to 16 stimuli (8 target + 8 distractors) in random order. Before identifying the speaker's geographic origin, participants completed a sociolinguistic judgment task, rating the speaker on nine dimensions: "friendly," "warm," "polite," "educated," "arrogant," "intelligent," "trustworthy," "gay," and "accent." Below these ratings, participants answered: "Where do you think this person is from?" with seven options: the six capital cities and "Other city." Multiple choices were allowed, to capture ambiguous or multiple associations (see Figure 2).

Figure 2 - Screenshot of the first test block page



Source: Author's own work, 2022.

To ensure internal validity, all variants were validated by expert judges; stimulus order was randomized per participant; and a pilot group (n=30) tested the stimuli for intelligibility and balance.

To analyze city identification rates, each city was treated as a binary variable — "yes" if the listener selected it, "no" if not. This allowed calculation of selection proportions for each city based on pronunciation heard and listener origin. Using nested model techniques, we then tested whether logistic regression models including the interaction between pronunciation and listener origin performed significantly better than null models (which lacked those predictors) for each city. Listener and stimulus were included as random intercepts. ANOVA tests showing

significant improvements pointed to which models would be examined in depth. Data were analyzed using the lme4 package in R.

5 Results and Discussion

To analyze how participants identified the speakers' city of origin, each city was treated as a binary variable with "yes" (if the listener selected that city as the speaker's origin) and "no" (if not). Based on this criterion, we estimated the spontaneous selection rates for each city and examined these distributions according to the heard pronunciation (alveolar or palato-alveolar) and the listener's city of origin, as illustrated in Figure 1. In the figure, the horizontal axis shows the distribution of city choices attributed to the speaker (*Speaker City ID*), while the vertical axis indicates the listener's city (*Listener City*). Each participant could select multiple cities or none at all. The proportions were calculated from the total number of responses for each set of stimuli, segmented by pronunciation variant, totaling N = 160 for each condition. For example, in the "Natal" row, we see how often that city was selected based on the pronunciation heard and the listener's origin.

Figure 3 - Proportions of city selections by pronunciation heard and listener speech community

Source: Author's own work, 2022.

Initial analysis of the data already reveals notable trends: Natal and João Pessoa show low selection rates as the speaker's presumed origin, regardless of pronunciation or listener origin. On the other hand, Recife and Rio de Janeiro display distinct patterns: Recife is more frequently selected by listeners from Natal, João Pessoa, and Recife itself when hearing palato-alveolar pronunciations, while Rio de Janeiro is predominantly selected by participants from the Southeast and South (Rio de Janeiro, São Paulo, Porto Alegre) upon hearing the same pronunciation. São Paulo was more often selected as the speaker's origin in alveolar pronunciation conditions, especially by listeners from São Paulo, with a similar pattern observed for Porto Alegre.

After this preliminary inspection, we proceeded to statistical modeling to test whether the interaction between heard pronunciation and listener city could significantly predict the selection of each target city. Generalized mixed-effects models were fitted and compared to null models via ANOVA. The results[3] showed that for Natal ($\chi^2 = 26.018$, $p = 0.0064$), Recife ($\chi^2 = 205.94$, $p < 0.001$), Rio de Janeiro ($\chi^2 = 290.1$, $p < 0.0001$), São Paulo ($\chi^2 = 277.49$, $p < 0.001$), and Porto Alegre ($\chi^2 = 207.04$, $p < 0.001$), interaction models were significantly better than the null models. For João Pessoa, however, the difference was not statistically significant ($\chi^2 = 12.801$, $p = 0.306$).

From the model analysis:

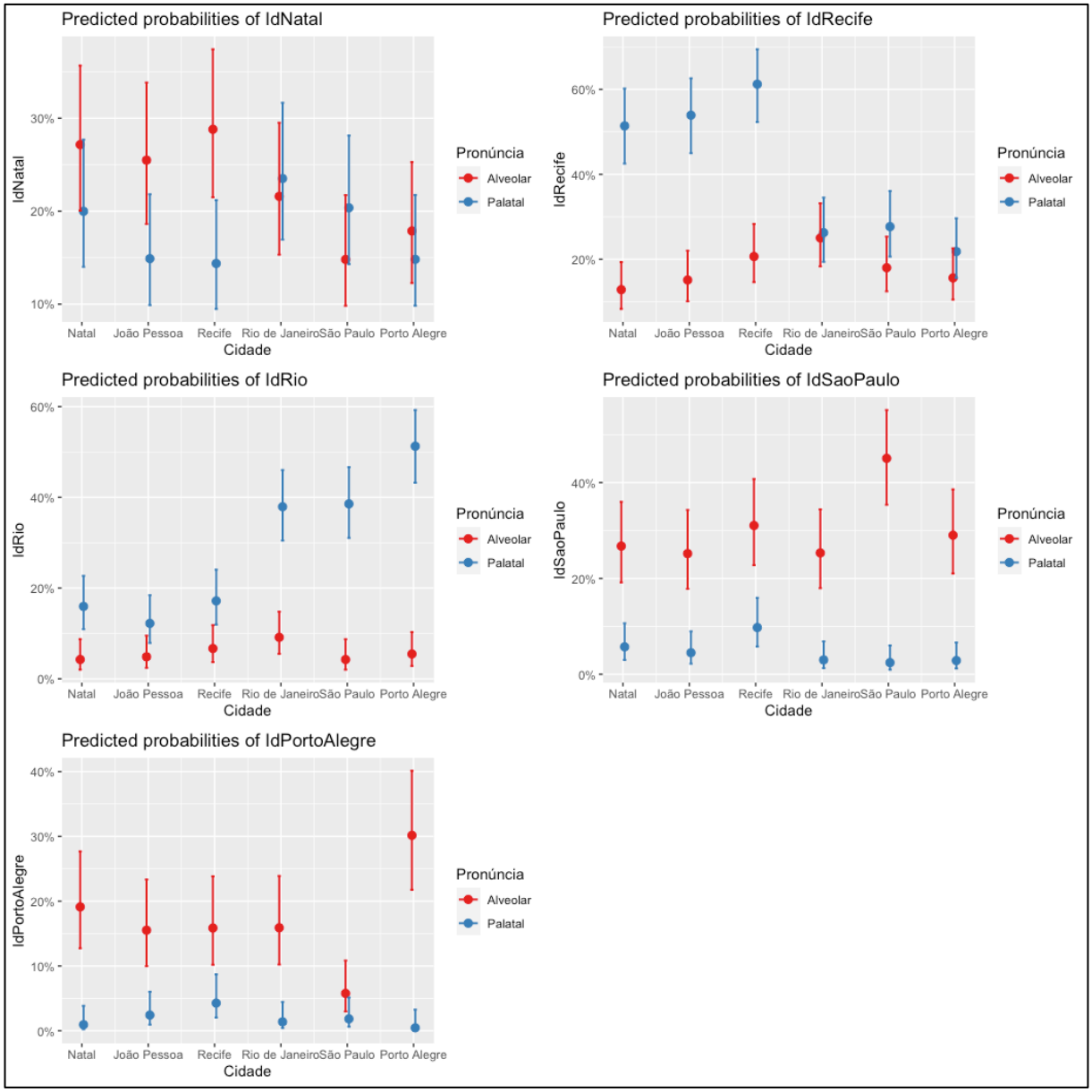
- Natal was selected less frequently by São Paulo listeners (odds = 0.47, $p < 0.01$) than by listeners from Natal itself (reference group). However, these same São Paulo listeners were significantly more likely to associate palato-alveolar pronunciations with Natal (odds = 2.20, $p < 0.001$).
- For Recife, there was a higher chance of selection with palato-alveolar pronunciations (odds = 7.18, $p < 0.001$), but this association was significantly lower among listeners from Rio de Janeiro (odds = 0.15), São Paulo (odds = 0.24), and Porto Alegre (odds = 0.21) compared to Natal listeners.
- For Rio de Janeiro, palato-alveolar pronunciation also increased selection likelihood (odds = 4.27, $p = 0.001$), particularly among São Paulo (odds = 3.31, $p = 0.05$) and Porto Alegre listeners (odds = 4.26, $p = 0.006$), compared to the reference group.
- For São Paulo, palato-alveolar pronunciation decreased the likelihood of selection (odds = 0.17, $p < 0.001$). Alveolar pronunciation increased it, especially among São Paulo listeners (odds = 2.25, $p = 0.006$). The interaction between São Paulo listeners and the palato-alveolar variant was negative (odds = 0.18, $p = 0.006$).
- For Porto Alegre, palato-alveolar pronunciation sharply reduced the selection probability (odds = 0.04, $p < 0.001$). São Paulo listeners were less likely to associate alveolar pronunciation with Porto Alegre (odds = 0.026, $p = 0.001$), but this probability increased when palato-alveolar pronunciation was heard by Recife listeners (odds = 5.90, $p = 0.036$) and São Paulo listeners (odds = 7.61, $p = 0.033$), compared to the reference group.

The statistical tests confirm that listeners' attribution of speakers' city of origin was significantly influenced by the interaction between the phonetic variant perceived (alveolar or palatoalveolar) and the listeners' city of origin in nearly all cases analyzed. This indicates that

[3] The statistical tests used allow for the verification of whether there are significant differences in listeners' choices according to the phonetic variant or their city of origin. The χ^2 value indicates the model's fit, the p-value shows whether the result is statistically significant ($p < 0.05$ indicates a relevant difference), and the odds represent the likelihood of a city being selected in comparison to a reference group: values greater than 1 indicate higher probability; values less than 1, lower probability.

specific patterns of association between phonetic variants and cities did not occur randomly, but rather reflect systematic tendencies in interdialectal recognition. For instance, palatoalveolar fricatives significantly increased the likelihood of identification with cities such as Recife and Rio de Janeiro, whereas alveolar realizations favored associations with São Paulo and Porto Alegre. These effects varied according to the listeners' place of origin, suggesting that both familiarity with local speech varieties and the strength of regional linguistic stereotypes play a direct role in the attribution of geographic origin.

Figura 4 - Predicted values from logistic regression models estimating speaker origin selection by pronunciation and listener city



Source: Author's own work, 2022.

The predicted values reveal additional trends:

- Estimated probabilities for Natal remained relatively low, especially among non-Northeast listeners, despite statistical significance.

- Recife was frequently chosen by listeners from Natal, João Pessoa, and Recife when hearing palato-alveolar pronunciations, with estimated probabilities around 60%.
- In contrast, Rio de Janeiro was more strongly associated with palato-alveolar pronunciation by listeners from the South and Southeast (notably Porto Alegre).
- For São Paulo and Porto Alegre, alveolar pronunciation significantly increased the probability of selection, especially among local listeners. That is, intra-regional recognition occurred: São Paulo listeners associated alveolars with São Paulo, and Porto Alegre listeners with their own city.

These findings suggest that palato-alveolar fricatives function as consistent social indexes for identifying Recife (among Northeast listeners) and Rio de Janeiro (among Southeast and South listeners), reinforcing patterns of regional stereotyping and perceptual salience — likely amplified by media representations and sociocultural relations between regions. These results align with previous perceptual dialectology literature, which reports greater accuracy in identifying varieties that are geographically close or symbolically prominent (Preston, 1986, 1989; Williams; Garrett; Coupland, 1999).

6 Conclusion

The analysis of the perception experiment results revealed that Recife was the city most frequently selected as the origin of speakers using palatoalveolar pronunciations by participants from northeastern capitals (Natal, João Pessoa, and Recife). Similarly, Rio de Janeiro was predominantly associated with the same variant by listeners from the Southeast and South regions (Rio de Janeiro, São Paulo, and Porto Alegre). In contrast, the alveolar variant of /S/ was more often linked to São Paulo and Porto Alegre, particularly by listeners from those respective cities. These findings are consistent with the principle of perceptual proximity (Preston, 1989; Williams; Garrett; Coupland, 1999; Montgomery, 2012), according to which speakers identify regional variants more accurately when there is greater geographical or cultural familiarity.

Based on these data, it can be observed that coda /S/ variants appear to operate as a relevant sociolinguistic index for regional categorization in Brazilian Portuguese. The distribution of perceptual evaluations suggests that such variants function as interpretable stereotypes of geographic origin, a result that aligns with previous studies on evaluation and perception above the level of linguistic awareness. As discussed by Eckert (2008) and Johnstone and Kiesling (2008), segmental features can acquire indexical value and become part of social recognition systems, as they are associated with locally established representations. In this study, palatoalveolar and alveolar fricatives appear to fulfill this role, aligning with notions of "typical" speech forms tied to specific regions and more robustly recognized by listeners from geographically closer communities. In future research, it would be relevant to include all Brazilian state capitals as possible choices for speaker origin, which could provide stronger evidence for the perceptual patterns discussed herein.

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