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Abstract

This paper provides new empirical support for the sociolinguistic monitor hypothesis, replicating Labov et al.'s (2006, 2011) study with an experiment that examines perceptual reactions to alternating distributions of the /t,d/ variable in Brazilian Portuguese, in the context of a professional news broadcast on health and welfare. Two different simulated passages were constructed, containing tokens of /t,d/ before and after /i/, respectively, that were read with stops and palatals. The participants (N=304) rated each passage on a seven-point scale of professionalism. An analysis of variance reveals a main effect of context in mean rates and response time: the speaker evaluation on the professionalism scale for the regressive context stimuli differed significantly from the progressive context, but, interestingly, the response time to the palatal realization in the regressive context, the positively evaluated variant, is greater than for the progressive. It suggests that there can be a cognitive effort to process incoming changes, and that speakers pay more attention to the social context, which is learned at school. In the regressive context, the proportion of palatals is not significant, but in the progressive context it is, which partially corroborates the hypothesis that the sociolinguistic monitor is sensitive to frequency (in negative stereotype variables).

Effects of the Linguistic Processing: Palatals in Brazilian Portuguese and the Sociolinguistic Monitor

Raquel Meister Ko. Freitag*

1 Introduction

Experimental approaches in sociolinguistics have been a new field to be explored, since they allow the integration between social information and cognitive models, such as the role of attention in sociolinguistic processing. One question in this field is how the sociolinguistic information is processed. This paper provides new empirical support to the sociolinguistic monitor hypothesis, proposed by Labov et al. (2006, 2011) and replicated by Levon and Fox (2014), with an experiment that examines perceptual reactions to alternating distributions of two realizations of the same variable (alveolar stop or palatal /t, d/), in two contexts, each one with different degree of social evaluation in Brazilian Portuguese.

2 The Sociolinguistic Monitor

In a first inquiry about the perceptual aspects of quantitative linguistic variation, Labov and collaborators proposed an approach called “sociolinguistic monitor” in which the effect of frequency of a variable in the speaker’s perception is measured.

More specifically, Labov et al. (2006, 2011) focused on how sensitive listeners are to the fine-grained quantitative differences in production that are the normal output of variable rules. The authors carried out a set of experiments designed to determine whether listeners can discriminate and evaluate the levels of variation. These experiments were concerned with an understanding of how stable sociolinguistic variables are acquired and operate to affect social categorization in everyday life.

While patterns in the community identified in a production study are an abstract construct created by the researcher, the sociolinguistic monitor intends to be an observable property displayed by the speakers. To do this, the experimental techniques allow us to observe the operation of the monitor in real-time and its variability across the population by age, social class, education, or gender.

The proprieties to be explored in the sociolinguistic monitor, according to the authors, are: (1) the temporal window – over what span of time do listeners monitor sociolinguistic variation? (2) the sensitivity – what is the just-noticeable difference in frequencies that can be detected? (3) the response pattern – is the impact of successive instances of the variable constant or does it vary over time within the temporal window? (Labov et al. 2011: 435)

Labov et al. explored these issues for the prototypical linguistic variable, ING, with realizations apical or velar, as in *coming*, *talking*, *something*, a variable with regular stylistic and social stratification in the United States.

As a sociolinguistic variable, ING is a recognized stereotype, and it is overtly and accurately associated with informality. It is a highly salient variable associated with “intelligence” and “casualness” (Campbell-Kibler 2007).

To test the sociolinguistic monitor, the authors carried out several experiments. In Experiment 1, which tests the sensitivity to ING frequency in Pennsylvania, it is assumed that a paradigmatic environment for formal speech is news broadcasting. An experimental task was developed to test subjects’ ability to rate different frequencies of the ING variants on a scale of ‘job suitability’ to a TV announcer. Ten sentences, each containing one progressive -ING suffix were read by a speaker of a conservative Northern dialect. In one reading, all contexts were realized as apical, in another, all contexts were realized as velar. The sentences were then concatenated in the order needed to produce the desired frequency of variants of ING. The experiment was applied to 23 University of

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Pennsylvania undergraduates.

The results are presented in a graphic in which the horizontal axis is the percentage of ING velar, from 0 to 100 percent, and the vertical axis is the mean rating on a Likert scale, with better performance at the bottom and worse performance at the top.

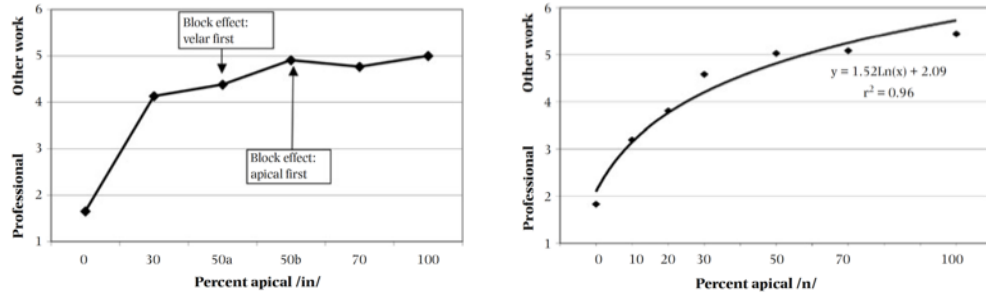


Figure 1: Mean ratings of ING on a linear scale (left) of experiment 1 and a logarithmic scale of experiment 2 (right) (Labov et al. 2011: 438, 442).

The overall pattern indicates that listeners are sensitive to the sociolinguistic norms governing ING. The curve rises with an increasing percentage of /in/, indicating an increasingly critical reaction to higher frequencies of the apical variant in the newscast trials (Figure 1 left).

Labov et al. (2011) concluded that this indicates that the width of the temporal window is not less than the time span of the experiment. They claim that it seems that the listeners can discriminate differences in frequency as small as 20 percent, but when /in/ frequencies rise, the increment becomes smaller and loses significance. They also suggested that the distribution by frequency follows a logarithmic progression. To test this, Experiment 2 was carried out the same way as Experiment 1, applied to 36 University of Pennsylvania undergraduates. But, this time, a logarithmic function was applied to data. The results in a logarithmic scale make it evident that in the evaluation of ING in this formal speech context, /in/ is the marked variant and /in/ is the expected, or unmarked variant (Figure 1 right).

Results from Labov et al. (2011) show a regular pattern of response to such quantitative variation in a single social context, uniform across regions with different levels of use. In order to replicate the sociolinguistic monitor, Levon and Fox's (2014) study examined whether listeners' evaluative judgments of speech change as a function of the type of variable presented. Two variables were considered in British English, ING and TH-fronting, different in relative social salience.

If in the United States ING is a stable sociolinguistic variable and stereotype, in Britain it presents a historical division north/south, where the northern varieties show more frequent use of apical realization as well as less social and stylistic stratification, and the southern varieties show evidence of the prestige of velar, but also show some fossilized remnants of apical as an upper-class realization.

TH-fronting is the realization of the interdental fricatives as their labiodental counterparts, as "fink" for "think", and is a relatively recent innovation in Britain; it emerged in London and is spreading to the rest of Britain. Levon and Fox (2014) explain that fronted variants occur most frequently in the speech of young, working-class speakers, young men in particular. TH-fronting is also the subject of explicit meta-discourse, negatively evaluated as "evidence of the decline of English among young people today".

In contrast to ING, TH-fronting is a highly salient variable in Britain that evokes a very clear set of social and evaluative meanings for British listeners. The authors hypothesized that the examination of ING and TH-fronting together would allow identification of how the difference in the social status of these variables in Britain may affect listeners' reactions to their quantitative distributions. To test this hypothesis, Levon and Fox (2014) carried out an experimental task in the same manner as Labov et al.'s study in Pennsylvania. The participants were 48 undergraduates at the University of London. The results showed a strong difference to Labov et al.'s (2011) results: British listeners did not discriminate differences in frequency in terms of perceived professionalism (Figure 2 left).

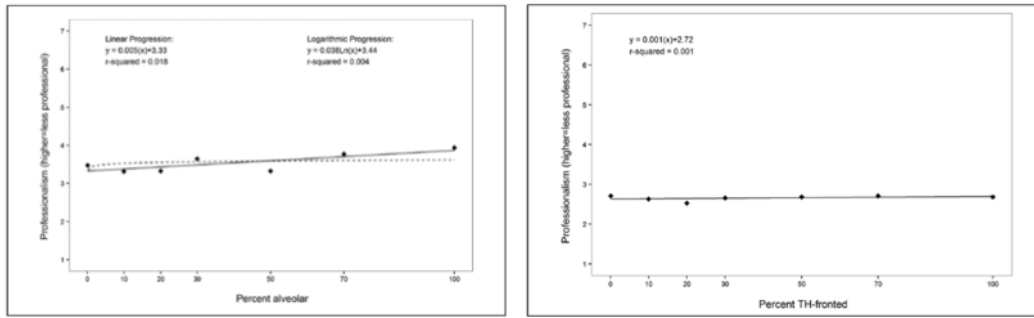


Figure 2: Mean ratings of ING in linear and logarithmic progression (left) and TH-fronting (Levon and Fox 2014: 197,203)

To examine listeners' perceptual sensitivity to quantitative differences in the frequency distributions of TH-fronting, the same experimental protocols for examination of ING were followed by Levon and Fox. Participants were undergraduate students at the University of London ($n = 39$), University of Salford ($n = 26$) and the University of Sheffield ($n = 36$). As found for ING, the differences in the frequency distributions of the [f] variants do not seem to be affecting listeners' ratings of the speaker's perceived professionalism (Figure 2 right).

The findings of Levon and Fox were very different from those of Labov et al.'s (2011). They found no evidence among British listeners for a correlation between the increased use of the alveolar variant of ING and a decrease in the perceived "professionalism" of the speaker, and a similar finding was obtained for TH-fronting. That means no apparent perceptual sensibility to a variable, even though that variable is both stratified in production and subject to explicit meta-commentary and suggests that it is less socially salient on the professionalism dimension in the United Kingdom.

The authors argue that Labov et al.'s (2011) conceptualization of the sociolinguistic monitor is based on certain potentially problematic assumptions regarding the stability of evaluations within a community and the ability to infer evaluations from patterns of observed production. Some points of Levon and Fox's (2014) discussion are presented below.

Levon and Fox (2014: 191) question the intragroup consistency of the patterns in Labov et al.'s (2011) sociolinguistic monitor study: "the group-wide logarithmic progression is replicated in only just over one-third of the individual scores with the other two-thirds of the scores evenly split between a linear pattern and no pattern whatsoever". They suggest that there is an apparent age effect: the logarithmic pattern is present in just over one-third of younger and older listeners, but 44% of younger listeners present no pattern, and 62% of older listeners present a linear pattern (Levon and Fox 2014: 192).

The authors also argue that salience is a listener's ability to notice a certain form and is impacted by individual, social, and contextual factors. Determined by these factors, how that certain form is interpreted and classified is its social salience. Levon and Fox (2014) claim a more dynamic definition for social salience than the one Labov et al. (2011) adopted for the sociolinguistic monitor, considering the listener's prior experience with a linguistic form.

Levon and Fox's (2014) findings and reflections about the sociolinguistic monitor approach encourage more studies in order to contribute to accounts of how social information is cognitively stored, encoded, and retrieved, mainly the approximations within social psychology, as evocated to explain the relationship between production and perception, and ways that attitudes may impact behavior (as proposed by Ajzen & Fishbein 2005 in social psychology, and Preston 2011 and Freitag 2016 in sociolinguistics) and the distinction between more automated and more deliberative perceptual phenomena (as proposed by Fazio et al. 1986 in social psychology, and Campbell-Kibler 2009 in sociolinguistics).

In social psychology, reaction time is an important parameter for behavior studies, and adding this parameter may contribute to improving the sociolinguistic monitor approach. Because of held prejudice and discrimination, stereotype variables demand more time to react to than markers or indicators because listeners pay more attention.

A methodological point concerning the statistical approach: Levon and Fox (2014) adopted the

linear regression method to identify the effects of listeners' social factors in the listener's evaluations of the professionalism of the speaker as a function of the frequency of the variant. That means that the ratings of professionalism of the speaker were assumed as a numeric value. However, on a Likert scale, ratings can be converted into degrees of attitude, and the ordinal logistic regression method seems an alternative to analyzing this type of data.

The ordinal regression method was used to model the relationship between the ordinal outcome variable (measured on an ordered, categorical Likert scale) and the explanatory variables, as in the development of continuous measures of consumer attitude (Russell 2010). A typical Likert scale item has points that indicate the degree of agreement with a statement, such as that adopted in the sociolinguistic monitor approach. Likert scaled data are ordinal rather than interval scaled and need to be analyzed using rank-based statistical procedures that are widely available, as the ordinal regression (O'Connell 2006, Gardner and Martin 2007).

To contribute to improving the sociolinguistic monitor approach specifically, and to how sociolinguistic information is cognitively processed more broadly, an investigation in Brazilian Portuguese is proposed regarding the palatalization of /t,d/.

3 Palatalization in Brazilian Portuguese

In Romance languages, the palatalization process results in different language features; specifically, in Brazilian Portuguese, it is triggered by the vowel /i/ in the following context, underlying or derived, and it affects /t/ and /d/ alveolar stops (Cristofaro-Silva 2003). This process can result in two types of effects: affrication with palatalization, which is the most recurrent, and affrication without palatalization. The last one is more restricted to certain dialectal areas by ethnic groups like Portuguese descendants, in the South of Brazil (Abaurre and Pagotto 2002).

There are two productive realizations for /t/ and /d/ followed by the vowel /i/: the alveolar stop realization (like in “medida” ‘measure’ and “batida” ‘shake’), and the palatal realization (“batʃida” and “medʒida”). The palatal realization for /t/ and /d/ is followed by the vowel /i/ is called the *regressive context*. Another possibility to occur palatal is when /t/ and /d/ are preceded by the glide /y/: the alveolar stop realization (like in “peito” ‘breast’ and “doido” ‘crazy’), and the palatal realizations (“peitʃo” and “doidʒo”). The palatal realization for /t/ and /d/ follows the glide /y/ is called the *progressive context*.

Palatalization in the regressive context of /t,d/ is a linguistic feature with great potential to differentiate dialectal areas in Brazil (Bisol 1991, Carvalho 2004, Battisti and Domelles Filho 2015, Cardoso et al. 2014). While in the rest of the country, the palatal realization in regressive contexts is an indicator, in Sergipe (the smallest state of Brazil, in Northeastern region), it seems to be a positive stereotype: it is well-evaluated, in conforming to patterns in the rest of the country and subject to meta-discourse evaluation, related to “non-native” (Pinheiro, Silva, and Cardoso, 2018). It is in an increasing process of change in the community, used by women, more educated, younger and urban people. These cues suggest that the affricate in regressive contexts is a positive stereotype. But, in progressive contexts, the palatal realization is considered ‘ugly’, typically used by non-educated people, “nordestinos” ‘northeastern people’, and people from the countryside. It is in a decreasing process of change in the community: used by men, less educated, older and non-urban people (Freitag 2015, Ribeiro and Corrêa 2018).

Cues about the social evaluation of palatalization in Brazil are found in planner instruments, as prescriptive grammars: palatalization in regressive contexts is positive and well evaluated, associated with prestige usage. Palatalization in progressive contexts, on the other hand, is subject to speech repairs (for example, it is frequently “*muʃo*” ‘much’ is been repaired by “*muito*” in formal spoken contexts), and is also subject to jokes. The same does not occur with palatalization in the regressive context. Nevertheless, in Sergipe, palatalization in regressive contexts is subject to positive meta-commentary, like “He is speaking like a carioca: tchi, tchi”, and that reinforces the assumption that the form is a positive stereotype in the community.

Considering this scenario, measuring how the listeners process the variation between alveolar stops and palatals in different contexts enables improvement in the sociolinguistic monitor approach, with a study of perceptual reactions to alternating distributions of the /t, d/ variable.

4 Method

This study replicates Experiment 1 of Labov et al. (2011), and consists of an experimental task to test listeners' ability to rate different frequencies of the /t, d/ variants in progressive and regressive contexts, on a scale of professionalism, of trials of a female candidate applying for a position in news broadcasting. As in Levon and Fox's (2014) study, the same procedures were followed to produce the newscast passages.

Two different newscast passages were constructed, containing tokens of /t, d/ that were read by a female speaker with a pattern dialect of Sergipe (Table 1). The newscast passage concerns a supposed news broadcast on health and welfare. The passages were prepared with special attention to avoid any clues of linguistic variation other than the target linguistic variable, palatal or alveolar stop realizations of /t, d/ preceded or followed by /i/, for example, coda /r/ and /s/, also dialectal markers of Brazilian Portuguese.

Table 1: Newscast passages for the palatalization experiment (contexts of palatalization are in **bold**).

<i>Headlines of regressive context:</i>	<i>Headlines of progressive context:</i>
<ul style="list-style-type: none"> • Dieta mediterrânea fez bem ao coração. • Doces típicos aumentam o diabetes. • Dieta detox funciona só com atividade física. • Caminhada ativa o coração e diminui a ansiedade. • Dia quente é perigoso para idosos e bebês. • Diminua o sal, tire férias e viva mais feliz. 	<ul style="list-style-type: none"> • Carinho e cuidado são essenciais. • Hoje muitos alimentos já contêm transgênicos. • Oito minutos caminhando evita ataque do coração. • Coma muita fruta para mais saúde. • Coração cansado pede respeito. • Seja feliz e viaje muito!

Each passage was separately read in two versions: one with only palatal realization [tʃ, dʒ] and another with only alveolar stop realization [t, d]. After recording, the readings were concatenated, mixing the two versions to obtain five levels of frequency of variants: none, 30%, half-half, 70%, and all palatals, as done by Levon and Fox (2014) for ING and TH-fronting, following Labov et al. (2011). While the previous ones were applied in a response sheet, in this study we used OpenSesame3.2.4 (Matôt et al. 2012) software to apply the experiment.

The participants (N=304) were balanced for sex (175 female, 129 male), level of education (228 undergraduate, 76 basic education) and area of residence (countryside 104, capital 2000). They rated each reading test on a seven-point scale of “professionalism”, similar to that used by Labov et al. (2011) and Levon and Fox (2014), but in a different order: in prior studies, the scale in the answer sheet was from 1 “perfectly professional” to 7 “try some other line of work”; in this study, the scale was inverted: from 1 “try some other line of work” to 7 “perfectly professional”. In the end, the last screen of the experiment presents the degree of “Sergipeness” attributed by the speaker themselves, as a solidarity measure.

The test was applied in the Federal University of Sergipe research lab, in São Cristóvão, a city nearby the capital, in a community health center, and in a state high school in Riachão do Dantas, in the countryside of Sergipe. After the task, some participants said that the “tips” were important to them; someone said they needed to start a diet because of diabetes. That means the participants really believed that the task was about health and welfare, not covert research about language.

Extending the sociolinguistic monitor hypothesis, in this study the assumption is that different sociolinguistic variables are different behaviors and that this difference can be measured in terms of the listener's sensibility to exposition at different degrees of frequency of the variants by rating and by reaction time. Response ratings are the dependent variable off-line and the reaction time is the dependent one online; context of palatalization, proportion of palatalization, gender, education, area of residence are the independent variables.

Data analysis followed the tutorial for raincloud plots (Allen et al. 2018), which enables visualizing raw data, probability density, and key summary statistics in a visual format with minimal redundancy. Ordinal regression was improved using the R function `polr` in the `mass` package (Ripley et al. 2013) and its visualization with `sjPlot` package (Lüdtke 2019); analysis of variance used the R basic package (R Core Team, 2019). The experiment, dataset, and analysis script have been shared at <<https://osf.io/qt47u/>>.

5 Results

The results of the experiment in palatalization are presented in Figure 3. The speaker evaluation on the professionalism scale in the regressive context passages ($M = 5.12$, $SD = 1.45$) is different from the progressive context ($M = 4.25$, $SD = 1.9$).

In the progressive context, there is a decrease in the mean rating response as a function of the increase of the percentage of frequency of palatal realizations and its effect is significant ($F(4, 1510) = 57.38$, $p < .001$). Even without a logarithmic scale, the result for the progressive context allows us to see a curvilinear pattern, similar to Labov et al.'s (2011) results. The same does not occur with the regressive context, in which palatalization presents a stable behavior. There are not any differences in the ratings as a function of the increase of the palatal variant percentage ($F(4, 1520) = 1.30$, $p > .1$) in the regressive context. The result for the regressive context is very similar to the one obtained by Levon and Fox (2014).

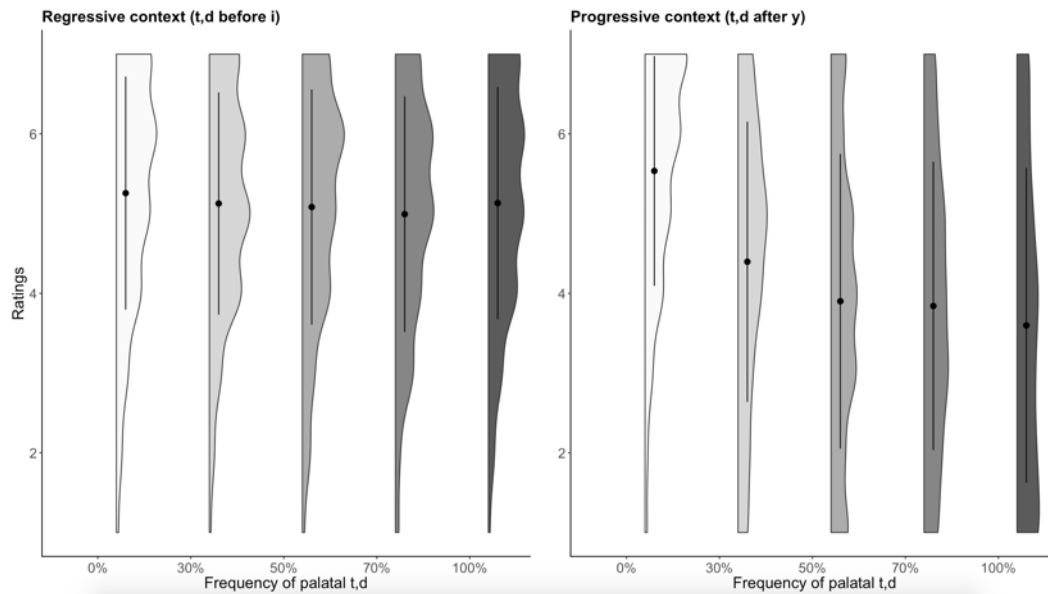


Figure 3: Raincloud plots for professionalism ratings as a function of the frequency of palatal realization in regressive and progressive contexts (1 = “try some other line of work, 7 = “perfectly professional”).

In order to identify significant patterns within the dataset, Levon and Fox (2014) ran both linear and logarithmic regressions to examine listener’s responses; in this study, an ordinal regression was run considering the listener’s evaluation of the speaker’s professionalism as the degree of agreement with a statement, and following other studies, that agreement can be considered as an ordinal scale. The model considering ratings for the progressive (Nagelkerke’s $R^2 = 0.209$) and the regressive contexts (Nagelkerke’s $R^2 = 0.108$) as a function of the proportion of palatal realization (frequency), the sex, education, local of residence and “Sergipeness” shows us that there are differences in the social profile of listeners (Figure 4).

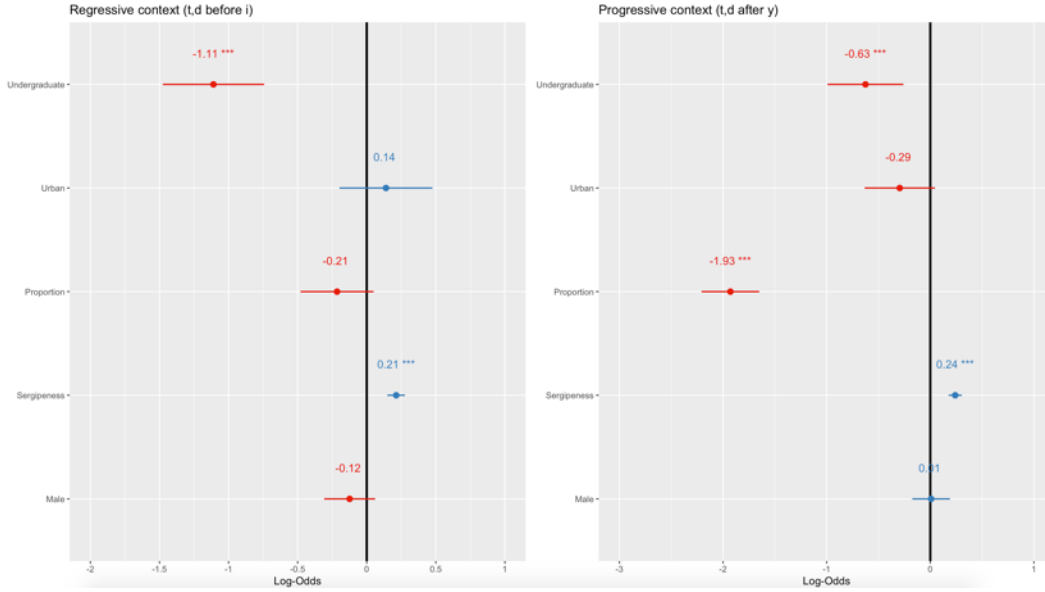


Figure 4: Visual representation of ordinal regression in regressive and progressive contexts (Formula: Ratings ~ Proportion + Sex + Education + Sergipeness + Local of residence, method = probit). Points mark the log-odds, and lines the confidence interval.

The listeners’ level of education matters in their evaluation of the palatalization. The mean rating of listeners with elementary school education is always higher than that of undergraduates. This difference is significant in both contexts. This is expected for the increase of palatal realization in progressive contexts because the palatalization of /t,d/ after a glide is a negative stereotype, but not in regressive contexts, where the palatal variant is conformist to the patterns included in prescriptive grammars. The same is observed in the solidarity measure of “Sergipeness”: higher mean ratings are followed by higher ratings of “Sergipeness”, in both regressive and progressive contexts of palatalization. This finding is complex to explain: if the palatal variant in progressive contexts is a negative stereotype, it is coherent to suppose that a solidary identification presents a negative effect. On the other hand, if the palatal variant in regressive contexts is associated with non-nativeness, it also is coherent to suppose a negative correlation with solidary identification. In both cases, it does not happen, and that reinforces Levon and Fox’s (2014) point that the relationship between production and perception must be regarded with more attention.

The result of ordinal regression points that the intercepts 5|6 in regressive context and 4|5 in progressive context are not significant. This may suggest narrowing the Likert scale from 7 to 5 points (Table 2).

Table 2: Intercepts of ordinal logistic regression in regressive and progressive contexts.

Ordinal Logistic Regression							
Predictors	Regressive context			Predictors	Progressive context		
	Log-Odds	CI	p		Log-Odds	CI	p
(Intercept: 1 2)	-4.19	-4.82 – -3.57	<0.001	(Intercept: 1 2)	-2.70	-3.18 – -2.22	<0.001
(Intercept: 2 3)	-2.81	-3.32 – -2.30	<0.001	(Intercept: 2 3)	-1.85	-2.32 – -1.38	<0.001
(Intercept: 3 4)	-1.69	-2.18 – -1.21	<0.001	(Intercept: 3 4)	-1.05	-1.52 – -0.59	<0.001
(Intercept: 4 5)	-0.58	-1.06 – -0.11	0.017	(Intercept: 4 5)	-0.22	-0.69 – 0.24	0.345
(Intercept: 5 6)	0.45	-0.02 – 0.92	0.062	(Intercept: 5 6)	0.67	0.21 – 1.14	0.005
(Intercept: 6 7)	1.75	1.27 – 2.23	<0.001	(Intercept: 6 7)	1.65	1.17 – 2.12	<0.001

Reaction time is an important parameter in behavioral studies because to held prejudice and discrimination, listeners pay more attention and demand more time to react. Following this hypothesis, negative stereotype variables demand more time to react to than others. The result for the

palatals, however, is the contrary: the reaction time to rate the realizations in regressive contexts ($M = 3416\text{ms}$), the well-evaluated variant, is greater than for the progressive ($M = 2216\text{ms}$) (Figure 5).

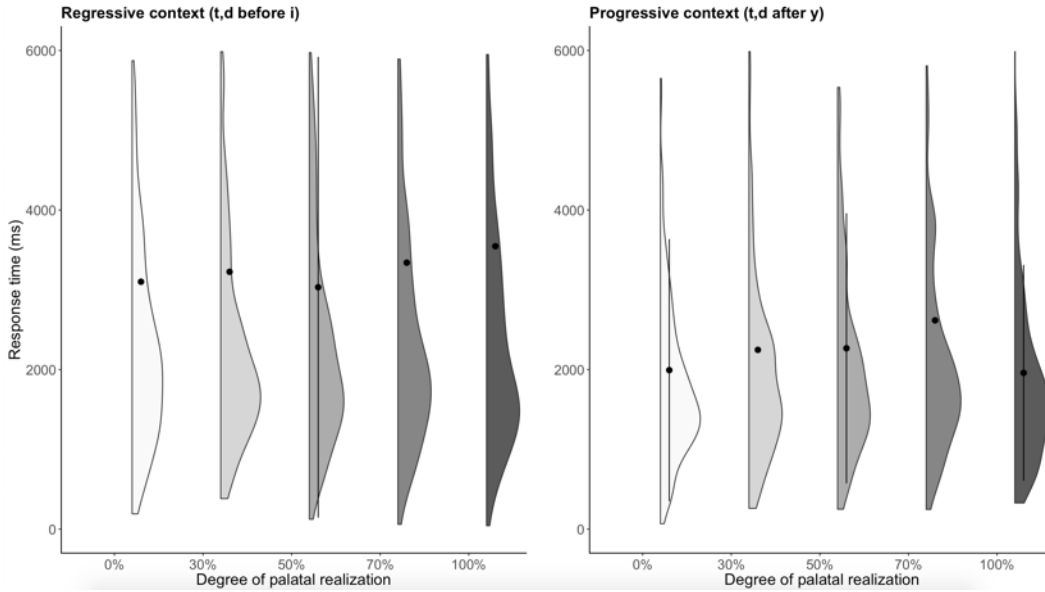


Figure 5: Raincloud plots for reaction time as a function of the frequency of palatal realization in regressive and progressive contexts (milliseconds).

Differently from the mean ratings, there is no significant difference in the reaction time as a function of the levels of frequency of the palatals in both contexts. A linear regression shows that while in the progressive context ratings are significantly more quickly than in regressive contexts, none of the other factors are significant (Figure 6).

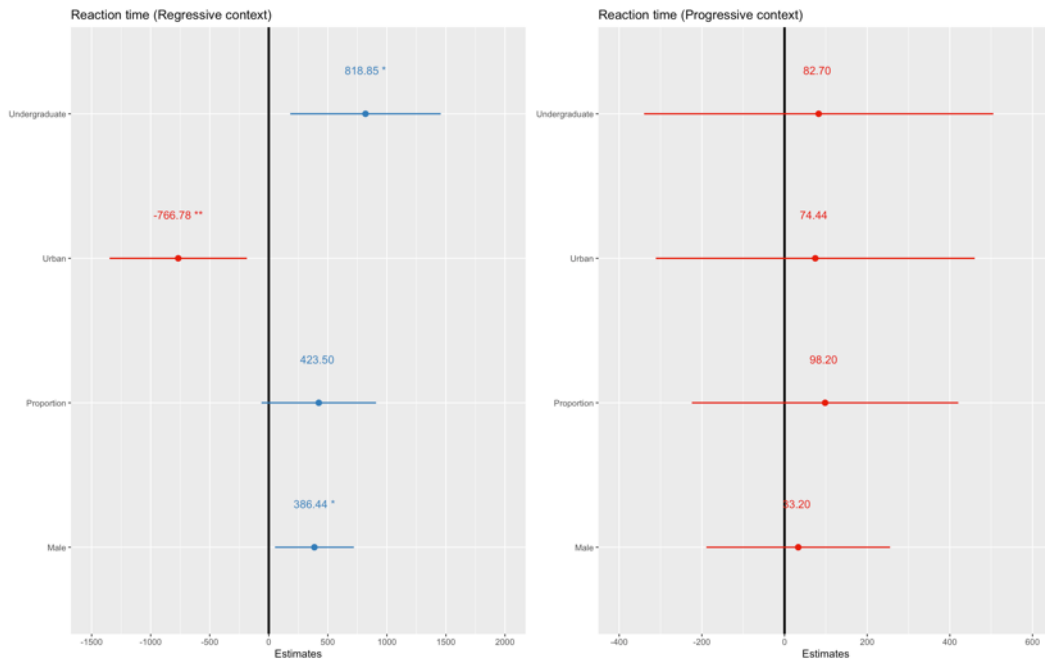


Figure 6: Visual representation of linear regression in regressive and progressive contexts (Formula: Reaction time ~ Proportion + Sex + Education + Sergipeness + Local of residence).

In the regressive context, the effects of education and locality of residence suggest that there is

a relation with prior experience, as argued by Levon and Fox (2014): it seems that there is a cognitive effort to process incoming changes and that speakers pay more attention to the social context, which is learned at school. Effects of the area of residence corroborate this point: less educated and non-urban speakers demand more time to distinguish the levels of frequency of palatals in regressive context, the prestige form.

A correlation matrix considering the interaction of effects from ratings, response time, Serpigeness, and the proportion of palatals shows a low negative correlation between ratings and proportion of palatals in progressive context (Figure 7).

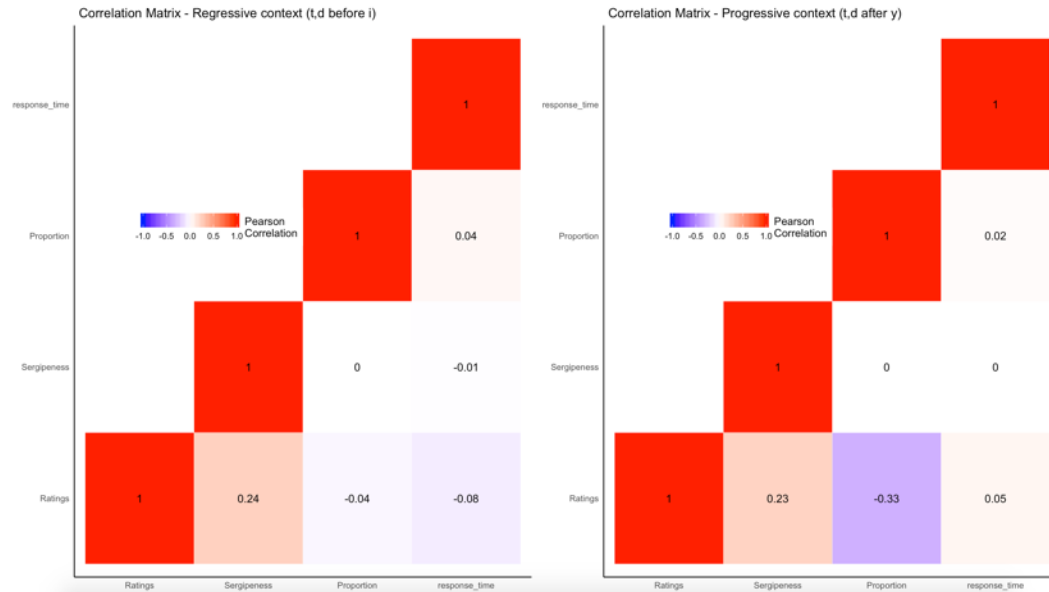


Figure 7: Correlation matrix.

6 Conclusion

These findings partially corroborate the hypothesis that the sociolinguistic monitor is sensitive to frequency for negative stereotypes, as in Labov et al's (2011) study. Nevertheless, for positive stereotypes, the results are very similar to those of Levon and Fox (2014), which did not identify a relation between frequency and the sensibility of the sociolinguistic monitor.

Labov et al. (2011) suggest that the variable's salience may impact the functioning of the sociolinguistic monitor; Levon and Fox (2014) claim that their results suggest that a variable's social salience determines both whether and how it is perceptually evaluated. Within this discussion, the findings of this study can contribute to the understanding of how sociolinguistic information is cognitively processed, adding reaction time to the sociolinguistic monitor. That listeners rate negative stereotypes faster than positive stereotypes is an assumption that must be tested in other variables. Results also suggest that other statistical methods, like the ordinal logistic regression, can contribute to refine and narrow the Likert scale adopted.

In order to further refine these results, the next steps in this research include: improving a logarithm scale to verify whether rating behavior presents more sensibility, and test the experimental task with gradual increasing of frequencies; including other statistical methods, for example, intra-rater and inter-rater agreement, with Kappa test (Freitag 2019); and also including indirect measures, such as eye-tracking, to observe the process of rating not only the final result because it can help to elucidate the decisions in the processing of a variation.

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