

---

RESEARCH PAPER

# Cognitive biases on the social perception of the allophonic variation of coda /S/ in Brazilian Portuguese

Ana Paula Correa da Silva Biasibetti

Independent researcher, BR

[biasibetti.ana@gmail.com](mailto:biasibetti.ana@gmail.com)

---

The allophonic variation of coda /S/ in the Florianopolitan variety of Brazilian Portuguese shows explicit associations between [ʃ] and the local stereotype of native resident – one who was raised in Florianópolis whose parents were also raised in the area. We hypothesize that the aforementioned explicit association is an implicit association, that is, an unconscious and automatic one. We argue that an implicit association towards the native resident stereotype is a cognitive bias that affects how Florianopolitans perceive the speech of other Florianopolitans. The strength of the associations was verified in terms of participants' linguistic background. In order to do so, an Implicit Association Test and an explicit task pairing the [ʃ]/[s] variants with the native/non-native resident stereotypes were applied to 30 Florianopolitans whose parents were native, non-native, or mixed-origin residents. We found that an implicit association is at play in a moderate fashion. However, linguistic background only predicted the explicit association. More important, the fact that Florianopolitans explicitly chose the guise containing [ʃ] as the most representative of the speech of the native resident – even though some participants reported that non-existent prosodic elements differentiated the guises – reinforces the role of implicit cognitive biases on the social perception of coda /S/.

---

**Keywords:** sibilants; allophonic variation; perception; Brazilian Portuguese

---

## 1. Introduction

In Brazilian Portuguese, coda sibilant is a phonological category variably produced as an alveolar fricative or a post-alveolar fricative in medial and final word position.<sup>1</sup> Therefore, [s] and [ʃ], as in [ˈkɔs.tɐ] ~ [ˈkɔʃ.tɐ] *costa* 'coast' and [lus] ~ [luʃ] *luz* 'light', are allophones of the same phoneme represented in coda position by the archiphoneme /S/ (Seara, Nunes & Lazzarotto-Volcão 2015).<sup>2</sup>

In terms of dialect variants, coda /S/ is consistently produced as an alveolar fricative by speakers from the cities of São Paulo (state of São Paulo) and Porto Alegre (state of Rio Grande do Sul) (Biasibetti 2018; Callou & Moraes 1996). On the other hand, post-alveolar fricative is the norm in Rio de Janeiro and the predominant variant in Florianópolis and

---

<sup>1</sup> Non-morphemic coda /S/ can also be pronounced as a glotal fricative or be deleted, as in [ˈmefi.mo] and [ˈme.mo] *mesmo* 'same', but these variants are much less frequent than alveolar and post-alveolar fricatives (Brescancini 1996; Scherre & Macedo 1989). Morphemic coda /S/ is often deleted in nouns inflected by a plural suffix, as in *os livro/S/* 'the books', or in verbs inflected by a second person singular suffix, as in *tu fala/S/* 'you speak' in non-Standard Brazilian Portuguese. Inflected words were not addressed in this study.

<sup>2</sup> Coda /S/ also assimilates the voicing of the following context. Thus, it is produced as [s] or [ʃ] before a voiceless consonant, as in [ˈlis.tɐ] ~ [ˈliʃ.tɐ] *lista* 'list', and as [z] or [ʒ] before a voiced consonant, as in [ˈmuz.gu] ~ [ˈmuʒ.gu] *musgo* 'moss'. When followed by a word beginning with a vowel, as in *três/S/ amigos* 'three friends', [z] is the only possible realization of coda /S/. On the other hand, when followed by a pause, as in *três amigo/S/*, [s] and [ʃ] are possible variants (Seara, Nunes & Lazzarotto-Volcão 2015). Voiced variants of coda /S/ were not addressed in this study.

Salvador (Brescancini 2002; Callou & Moraes 1996; Mota 2002, 2012; Scherre & Macedo 2000).

In addition to dialectal factors, the production of coda /S/ variants fluctuates as a function of linguistic variables. As a more general result, word medial position, and voiceless consonants following coda /S/ tend to favor the post-alveolar fricative in the varieties spoken in Rio de Janeiro, Salvador, and Florianópolis (Brescancini 2002; Callou & Moraes 1996; Mota 2002, 2012; Scherre & Macedo 2000).

Florianópolis is the capital city of the Brazilian southern state of Santa Catarina. The largest part of its territory comprises an insular area that was settled by Azoreans between 1748 and 1756 (Cordeiro & Madeira 2003). Florianopolitans are popularly labeled by themselves as native residents or non-native residents. The native resident label applies to those who were raised in Florianópolis whose parents were also raised in the region, parents who usually descend from Azorean immigrants (Lacerda 2013).<sup>3</sup> The non-native resident is one raised in Florianópolis whose parents have settled in the region after the 1970s coming mostly from Santa Catarina's countryside or the states of Rio Grande do Sul and São Paulo.

The Azorean influence on the language spoken nowadays in Florianópolis and the coastal area of Santa Catarina is strikingly remarkable as it affects discourse, lexical, and phonological elements (Pagotto 2004; Severo & Nunes de Souza 2015; Valle 2001). In terms of phonetic and phonological features, Furlan (1989) explains that the Portuguese language variety spoken in the Azores in the 18<sup>th</sup> century resembled the one spoken in the region of Lisbon, which included the post-alveolar fricative coda.

According to Brescancini (2015), 83% (n = 21.259) of the occurrences of coda /S/ are produced as the post-alveolar fricative in Florianópolis. Sociolinguistic studies have shown that coda /S/ variants are salient both to the local group and to non-local groups of speakers, as people overtly comment on how Florianopolitans pronounce their s as a characteristic hissing sound, namely, a post-alveolar fricative pronunciation (Brescancini 2015; Freitag et al. 2016).<sup>4</sup>

Post-alveolar fricative coda has become one of the most representative language traits of the identity of the native Florianopolitan (Severo & Nunes de Souza 2015). The association between coda [ʃ] and the native resident stereotype in Florianópolis has been acknowledged in such a way that social media has fully incorporated it. It is interesting to observe that the letter x (which in Portuguese is the most emblematic orthographic representation of [ʃ]) has been used in written communication to highlight the Florianopolitan way of speaking, reinforcing the stereotype of the native resident.<sup>5</sup>

Several studies have investigated the bias caused by social stereotypes in phonetic perception, namely gender (Munson 2011; Strand & Johnson 1996) and the assumed nationality of the speakers (Hay & Drager 2010; Hay et al. 2006; Niedzielski 1999).

Strand & Johnson (1996) proposed an experiment on the perception of fricative sibilants in American English in which they presented videos of men and women pronouncing the words *sod* and *shod*. The results indicated that the same production was sometimes perceived as [s]od and sometimes as [ʃ]od depending on the gender of the speaker presented simultaneously to the audio stimulus. This result suggests that the perceptual boundary between the two fricatives changes according to the gender information about who produces them.

<sup>3</sup> Lacerda (2013) states that *Manezinho* (or *Mané*) is the term commonly used to refer to the native resident in Florianópolis.

<sup>4</sup> This level of awareness characterizes the variable as a stereotype, in Labov (1972) terms.

<sup>5</sup> As a reference, these Facebook pages make use of the letter x in order to express the coda [ʃ] in several passages:

<https://www.facebook.com/manedarci>

<https://www.facebook.com/FloripaMilGrua>

Munson (2011) found that listeners make use of gender information to identify fricative consonants in the continuum /s/-/ʃ/ in American English. His experiment revealed that the vowels produced by men or manipulated in order to sound like male productions, and the images of men led the participants to identify the stimulus as being /s/ more often. The author states that the perception of the fricative consonants seems to be subject to a culturally constructed gender judgment, that is, a tacit knowledge of listeners about specific ways of speaking of each gender.

The perceptual distortion caused by stereotypes was investigated by Niedzielski (1999) concerning the fact that Detroit speakers produce the Canadian vowel raising, but do not perceive it. Sentences containing the target vowels produced by a native speaker from Detroit were presented to 40 speakers. Half of them received a sheet containing the sentences with the title *Canada*, while the other half received the sheet with the title *Michigan*. The results revealed that the participants' knowledge about the Canadian raising made those who had been exposed to the information about the Canadian nationality perceive the stimuli as raised, while the participants who were exposed to the information about the American nationality perceived the stimuli as not raised, even though all stimuli had been produced by the same speaker.

In the same fashion, sentences produced by a New Zealander native speaker were presented to New Zealander participants, half of whom received the sheet with the title *Australian*, while the other half received the sheet with the title *New Zealander* (Hay et al. 2006). The authors state that the information that /i/ is a central vowel in New Zealand and a frontal one in Australia is known among New Zealanders. Although participants correctly acknowledged the nationality of the speaker, the participants who had received the sheet with the title *Australian* tended to perceive [i] as a more frontal vowel. In turn, the stimuli were perceived as more centralized by those participants who had received the sheet with the title *New Zealander*.

The interference of stereotypes triggered even by symbols related to nationality (such as stuffed toys, such as a kangaroo for Australia and a koala for New Zealand) was also significant, as shown by Hay & Drager (2010) in an experiment about the perception of the vowel raising and fronting in the English varieties spoken in Australia and New Zealand.

Considering the previous studies within an Exemplar-based approach, their results support the claim that social stereotypes bias the perception by activating the linguistic exemplar to which the social information about the stereotype is indexed. This is an automatic process and, therefore, not consciously controlled by the listener/speaker (Drager 2015; Drager & Kirtley 2016). According to Drager (2015: 155), "If incoming social information closely matches a previously stored social exemplar, the linguistic exemplar indexed to the social information will receive partial activation. The partially-activated exemplars reach full activation faster than acoustically similar exemplars that are not indexed to a relevant social exemplar, resulting in a bias in perception depending on the perceived social characteristics of the speaker".

Socially structured phonetic variation has been successfully investigated under Exemplar-based models of language use, as it incorporates phonetic detail and social information simultaneously into the same cognitive construct, namely, the exemplar (Foulkes & Docherty 2006; Foulkes, Scobbie & Watt 2010).

Johnson (2005) states that an exemplar is an experienced instance of a linguistic object stored in memory in its whole, that is, containing every single aspect of its occurrence (phonetic, contextual, and social aspects). It is, therefore, an episodic memory. New instances are processed according to their similarity to the instances previously stored and grouped in categories of remembered instances, which are called clouds of exemplars. An exemplar is activated due to its similarity to the incoming utterance in terms of

acoustic and other linguistic traits. Frequency, recency, context, and social information also activate exemplars by increasing the weight value of a specific exemplar within the cloud.

Drager & Kirtley (2016: 6) argue that

“A large amount of literature exists, both within linguistics and social psychology, demonstrating that listeners make judgments about speakers based on their speech, and these judgments are highly consistent across different listeners... In an exemplar model, this occurs because linguistic exemplars are activated upon perception, which in turn activates associated social exemplars. This process happens automatically and, therefore, awareness of the specific linguistic variants or their association with social categories or traits is not necessary”.

In other words, listeners are not necessarily aware of the association between a linguistic exemplar and a social category (a stereotype, for instance) because this association occurs without conscious awareness. Therefore, the activation of an exemplar and its indexical meaning is implicit in speech perception.

Research in Social Psychology has shown that many social behaviors and judgments are not consciously controlled (Greenwald & Banaji 1995). In fact, they stem from an implicit social cognition, a term that describes the “cognitive processes that occur outside of conscious awareness or conscious control in relation to social psychological constructs – attitudes, stereotypes, and self-concepts” (Nosek et al. 2011: 152).

According to Greenwald & Banaji (1995: 4) “the identifying feature of implicit cognition is that past experience influences judgment in a fashion not introspectively known by the actor”. Not only judgment, but also social behavior and social perception, are influenced by past experience in a level not consciously accessible to the subject. Thus, only indirect measures would be able to assess the content of these judgments.

In order to check for an association without directly invoking the nature of this relationship, the Implicit Association Test (IAT) was proposed by Greenwald & Banaji (1995). The IAT estimates the strength of an automatic association between two concepts/categories (*flower* and *insect*) and two attributes/stereotypes (*good* and *bad*). Faster response times for a certain alignment suggest a stronger implicit association between that one category and that one attribute. D scores are used to describe the association: positive values indicate an association between the first category (*flower*) and the first attribute (*good*); a negative value indicates an association between the first category (*flower*) and the second attribute (*bad*); and zero suggests that there is no association between the categories and attributes investigated (Greenwald et al. 2003; Nosek et al. 2007a).

The IAT has been implemented in linguistic research in order to examine the cognitive biases that underlie language accommodation (Babel 2009), language attitude (Pantos & Perkins 2012; Redinger 2010), and sociolinguistic variation (Campbell-Kibler 2012).

Babel (2009) showed that speakers imitated phonetic variants according to the bias imposed by their implicit attitude towards the interlocutor’s ethnicity: the participants who showed a positive implicit association in relation to whites tended to imitate the variant produced by the white speaker, whereas the participants who presented a positive implicit association in relation to blacks tended to imitate the variant produced by the black speaker.

Linguistic attitudes in Luxembourg were investigated by Redinger (2010) through an IAT in order to verify the implicit assessments of the participants towards the Luxembourgish and French languages. The results indicated that there was a positive implicit association towards Luxembourgish and a negative one towards French.

The implicit attitudes of American and foreign students in an American university towards the native/foreign English accent were studied by Pantos & Perkins (2012). When comparing the results of the IAT with the results of an explicit evaluation instrument, the authors identified a positive association in relation to the native accent in the implicit assessment and a positive association with the foreign accent in explicit evaluation. These results revealed that implicit and explicit evaluations do not necessarily converge.

Finally, Campbell-Kibler (2012) implemented an IAT in order to check whether the associations explicitly reported by American speakers between the Southern state stereotype and the [in] variant and between the Northern state stereotype and the [ing] variant could also be verified at the unconscious level. The IAT results confirmed that the aforementioned explicit association was also an implicit association. Regarding the meaning of the sociolinguistic variable, the author suggested that the indexical meaning investigated by sociolinguists seems to be, on a cognitive level, the implicit associations investigated by social psychologists.

Based on the sociolinguistic salience of coda /S/ in the Florianopolitan variety of Brazilian Portuguese (Brescancini 2015; Freitag et al. 2016) and Campbell-Kibler (2012)'s account on sociolinguistic meaning, we hypothesize that the explicit association between coda [ʃ] and the native resident stereotype in Florianópolis is an implicit association. Accordingly, we assume that listeners are not necessarily aware of the relationship between the linguistic variable and the stereotype in speech perception, which is consistent with the assumptions of Exemplar-based models (Drager & Kirtley 2016).

The effect of linguistic background, which is based on the origin of participants' parents, on the implicit association is also analyzed as we hypothesize that Florianopolitans who have at least one non-native parent will show stronger implicit associations towards the native resident stereotype because of their early exposure to varieties other than the Florianopolitan. More specifically, we predict that coda /S/ variants are more prominent to these participants because they were exposed to coda [s] in a context in which coda [ʃ] predominates earlier than those who have native parents. Such prominence is circumscribed to the unconscious level, as we assume that the varying levels of exposure to coda /S/ variants are indexed to the exemplars stored in the listeners' memory.

Because exemplars are automatically activated and "perception is biased towards activated exemplars" (Drager & Kirtley 2016: 8), we argue that the implicit association between coda /S/ and the stereotype of native/non-native resident could change according to the listeners' linguistic background. In this sense, coda /S/ variants are perceptually more salient for participants with non-native parents because coda [ʃ] is produced by a "foreign" rather than a "native" speaker.

We also analyze the overall mean rating attributed by the participants and the role of linguistic background on the rating task. We predict that participants will perceive a relatively large difference when comparing the guises and will report a difference in terms of coda /S/. We also believe they will indicate the guise containing coda [ʃ] as the most representative of the speech of the native Florianopolitan because of the automatic association which is at play. Finally, we assume that Florianopolitans who have at least one non-native parent will report the largest difference between the guises because their relatively earlier exposure to coda /S/ variants tend to enhance the salience of the variable at the conscious level too.

In order to explore our hypotheses, we adapted and applied an Implicit Association Test and an explicit task as described in the following section.<sup>6</sup>

<sup>6</sup> This study was approved by the Ethics Committee of the Pontifical Catholic University of Rio Grande do Sul, Brazil, under the reference number 505130151.0000.5336.

## 2. Methods

Based on the methods employed by Campbell-Kibler (2012), we designed an IAT to verify the automatic association between the allophonic categories [s]/[ʃ] and the stereotypes of non-native/native resident among Florianopolitan speakers/listeners. Participants were requested to quickly sort stimuli (audio and images) according to the attributes shown on the left and right corners of the screen along seven experimental blocks. Throughout the test, the capital letter *S* was used to represent the pronunciation of [s] and the capital letter *X* was used to represent the pronunciation of [ʃ]. As for the attributes, *nativo* ‘native’ and *não-nativo* ‘non-native’ appeared written in full.

In the first block, participants sorted the images that appeared in the center of the computer screen according to the category on the left (*S*) or the category on the right corner of the screen (*X*). In the second block, they should sort the audio stimuli according to the attribute on the left (*não-nativo*) or the attribute on the right corner (*nativo*). In the third block, images and audio stimuli randomly appeared and should be classified according to the category and attribute aligned on the left (*S* ou *não-nativo*) or on the right corner (*X* ou *nativo*). The fourth block repeated this alignment. The fifth block inverted the alignment observed in the first block: the category *X* now appeared on the left and the category *S* appeared on the right corner of the screen. The sixth block randomly displayed images and audio stimuli with *X* ou *não-nativo* on the left and *S* ou *nativo* on the right corner. The seventh block repeated the alignment of the sixth block (Table 1).

**Table 1:** Implicit Association Test layout.

EXPERIMENTAL DESIGN		CONGRUENT VERSION		INCONGRUENT VERSION	
BLOCK 1	24 trials	S	X	X	S
		audio		audio	
BLOCK 2	24 trials	não-nativo	nativo	não-nativo	nativo
		image		image	
BLOCK 3	24 trials	S	X	X	S
		não-nativo	nativo	não-nativo	nativo
		audio or image		audio or image	
BLOCK 4	48 trials	S	X	X	S
		não-nativo	nativo	não-nativo	nativo
		audio or image		audio or image	
BLOCK 5	48 trials	X	S	S	X
		audio		audio	
BLOCK 6	24 trials	X	S	S	X
		não-nativo	nativo	não-nativo	nativo
		audio or image		audio or image	
BLOCK 7	48 trials	X	S	S	X
		não-nativo	nativo	não-nativo	nativo
		audio or image		audio or image	

As shown in **Table 1**, the IAT was applied in two distinct orderings: i) part of the participants performed the congruent version in which blocks 1, 2, 3 and 4 test the association between [s] and the non-native stereotype, whereas blocks 5, 6 and 7 test the association between [ʃ] and the non-native stereotype; ii) the other participants performed the incongruent version in which blocks 1, 2, 3 and 4 test the association between [ʃ] and the non-native stereotype, whereas blocks 5, 6 and 7 test the association between [s] and the non-native stereotype. These two orderings are necessary to counterbalance the effects associated with the order of presentation of the categories. In both orderings the phonetic variant alternates their position while the stereotypes remain in the same position.

As for the stimuli, six audio stimuli and six visual stimuli were used.

Audio stimuli were recorded with a Marantz PMD661 recorder and a Shure SM-58 external microphone attached to a table tripod with a sampling rate of 44,100 Hz and eventually normalized for amplitude. The female voice belonged to an experienced phonetician from the Linguistics Department in which this study was conducted. The words *pasta* 'folder', *pista* 'clue', and *custo* 'cost' were recorded with both alveolar and post-alveolar pronunciations. Such words display the phonetic conditioning factors that favor the post-alveolar fricative pronunciation.

The visual stimuli used in the IAT are well known and very representative for the Florianopolitans. As for the non-native resident concept, the image of the mate tea cup is linked to the state of Rio Grande do Sul; the Araucaria pine tree is linked to the countryside of Santa Catarina; and the Paulista Avenue skyline is linked to the city of São Paulo. Regarding the native resident concept, the images of Hercílio Luz Bridge, the beach, and seafood are deeply linked to Florianópolis.

The audio and visual stimuli were randomly presented 240 times along the seven experimental blocks. Using the notebook keyboard, the E key should be hit when the stimulus referred to the category and/or attribute displayed on the left corner of the screen and the I key should be hit when the stimulus referred to the category and/or attribute shown on the right corner. Participants moved to the next stimulus by choosing the right answer. When a mistake was made, the message *errado* 'wrong' appeared on the center of the screen. It was necessary, then, to hit the key for the correct answer in order for the test to proceed.

A very short version of the test was presented right before the application of the actual test, in which participants were asked to get acquainted with the computer and the test procedures.

D scores were obtained by firstly eliminating response times longer than 10,000 ms. Then, the average response time of the correct answers assigned by the participants in blocks 3, 4, 6, and 7 was calculated. The response times of the incorrect answers, in turn, were replaced by the average block time plus 600 ms. Next, the combined standard deviation of all response times of blocks 3 and 6, and the combined standard deviation of blocks 4 and 7 were extracted. The difference between the averages of blocks 3 and 6 was divided by the standard deviation of blocks 3 and 6, as well as the difference between blocks 7 and 4 was divided by the combined standard deviation of blocks 4 and 7. The D score results from the mean between the two values obtained in the previous procedure. It is, therefore, an effect-size measure with a possible range of  $-2$  to  $+2$  (Greenwald et al. 2003).

Participants were also requested to respond to a direct question and a rating task immediately after the application of the IAT. They were overtly asked about which guise better represented the way a native Florianopolitan resident would speak. The researcher took note of their answers and comments. They were also asked to rate the difference between the two guises by using a five-point Likert scale: 1 means slightly different and 5 means very different. Their answers and comments were also noted by the researcher.

The stimuli consisted of the two following guises:

Guise A: *A que [s] tão, assim, de qualidade de vida que eu digo é de ter uma vida tranquila e saudável, sabe, tem e [s] paço pra isso.*

Guise B: *A que [ʃ] tão, assim, de qualidade de vida que eu digo é de ter uma vida tranquila e saudável, sabe, tem e [ʃ] paço pra isso.*

‘The issue of quality of life, I mean, is to have a calm and healthy life. There is room for that, you know.’

Guise A, which has alveolar fricative codas, was originally produced by a 29-year-old male Florianopolitan. Guise B was manipulated in order to display post-alveolar fricative codas. Guises were manipulated and had their amplitude normalized in Praat 6.0.18 (Boersma & Weenink 2016).

Each rating value obtained was multiplied by  $-1$  whenever the participant stated that the guise containing alveolar fricative codas was produced by a Florianopolitan native resident. This procedure follows Campbell-Kibler (2012).

As shown in **Table 2**, 30 participants took part in the experiment.<sup>7,8</sup> They were all raised in Florianópolis or its Metropolitan Region (considering just the neighboring cities of São José and Palhoça). In addition, they have spent at least 2/3 of their lives in the area. Regarding their linguistic background, participants’ parents raised in the region are considered native. The non-native label applies to parents who grew up in Santa Catarina’s countryside or in other States. The mixed-origin label applies to one native and one non-native parent. There are 16 participants with native parents, 9 with non-native parents, and 5 with mixed-origin parents.<sup>9</sup>

**Table 2:** Social profile of participants.

Male			Female		
Education	Age	Parents	Education	Age	Parents
High School	20	native	High School	21	native
	25	native		21	non-native
	26	mixed		22	non-native
	28	native		22	non-native
	28	non-native		24	mixed
	30	native		29	mixed
	50	native		29	native
	University	21		non-native	58
University	22	native	University	20	non-native
	23	non-native		22	mixed
	24	native		24	native
	24	mixed		26	native
	35	non-native		27	native
	38	native		33	non-native
	52	native		34	native

<sup>7</sup> Informed consent was obtained from all participants.

<sup>8</sup> There was some concern about the influence of listeners’ gender and level of education on the perception of coda /S/ at the very beginning stage of the research. For this reason, the sample is balanced according to participants’ gender and level of education. We eventually did not explore this aspect.

<sup>9</sup> We selected participants whose non-native parents were raised in regions in which coda /S/ is consistently produced as the alveolar fricative [s].



The IAT and the explicit task were designed in PsychoPy 1.83.00 (Peirce 2007) on a Windows computer. Participants used over-ear headphones and the tests were applied using a 14” notebook. RStudio software (RStudio Team 2017) was used to perform the data analysis.

### 3. Results

The overall mean D score and the mean scores obtained for each conditioning factor investigated are shown in **Table 3**.

As for the direct question responses, 28 participants identified Guise B as more representative of the speech of a native Florianopolitan, whereas Guise A was chosen by 2 participants. In addition, 11 participants indicated the pronunciation of coda /S/ and 19 participants indicated fast speech rate as the key element indicative of the native Florianopolitan linguistic identity.

The overall mean rate attributed by the participants in the rating task and also the mean rate for each factor are presented in **Table 4** as follows.

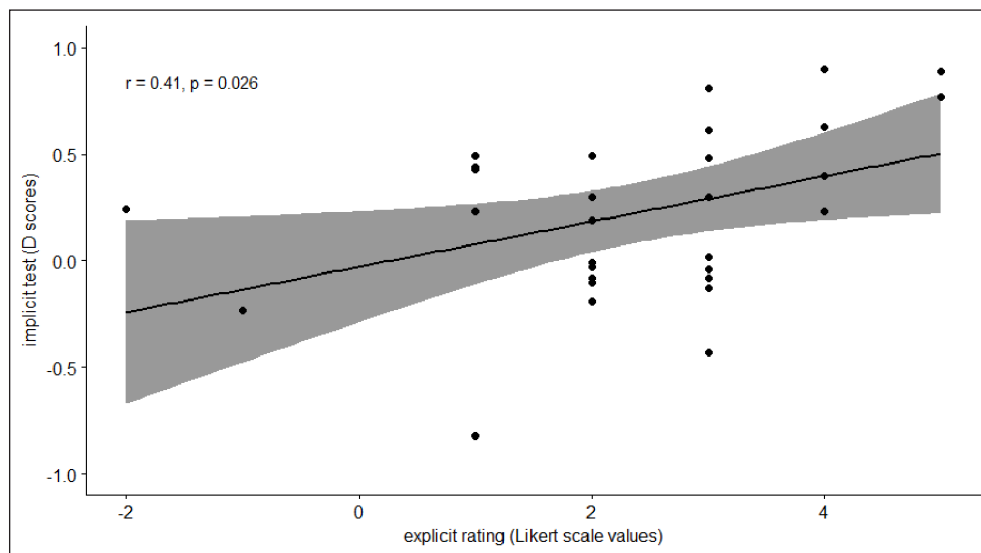
Finally, **Figure 1** shows the correlation between the implicit and the explicit associations obtained for each participant.

**Table 3:** D Scores (Implicit Association Test).

Variable	Factors	D score	p-value
Linguistic background (parents' origin)	both native	+0.14	native × non-native 0.70
	both non-native	+0.27	native × mixed 0.45
	mixed origin	+0.39	non-native × mixed 0.86
			native × (non-native + mixed) 0.23
Overall mean D score + 0.22 (p = 0.005).			

**Table 4:** Explicit task ratings.

Variable	Factors	Rating	p-value
Linguistic background (parents' origin)	both native	1.68	native × non-native 0.11
	both non-native	2.88	native × mixed 0.03
	mixed origin	3.60	non-native × mixed 0.63
			native × (non-native + mixed) 0.05
Overall mean Rating 2.36 (p-value = 2.901e-09).			



**Figure 1:** Correlation between the implicit test (D score) and the explicit task (Likert scale values).

#### 4. Discussion

We found a moderate implicit association (+0.22) between coda [ʃ] and the native resident stereotype ( $p = 0.005$ ) (Table 3).<sup>10,11</sup> This result therefore confirmed our initial hypothesis that an automatic association between the linguistic variable and the social stereotype is at play at the unconscious level, which means that the social perception of coda /S/ in terms of the native status of the Florianopolitan speakers is influenced by a cognitive bias.

However, the assumption that the early exposure to coda [s] in a context in which coda [ʃ] predominates would strengthen participants' implicit association towards the native resident stereotype was not validated, as we found a moderate implicit association for the participants whose parents are mixed-origin (+0.39), a moderate implicit association for the participants whose parents are non-native (+0.27), and a relatively weak implicit association (+0.14) for the participants whose parents are native, all of which were not statistically significant.

As shown in Table 3, the difference between Florianopolitans whose parents are native and those whose parents are non-native was not statistically relevant ( $p = 0.70$ ). Also, the difference between participants whose parents are non-native and those with mixed-origin parents did not reach significance ( $p = 0.86$ ). Similarly, no difference was verified between participants whose parents are native and those with mixed-origin parents ( $p = 0.45$ ). The difference was not relevant even when mixed-origin parents and non-native parents were grouped and compared to the participants with native parents ( $p = 0.23$ ).

It turns out that our hypothesis about the linguistic background of the participants did not explain the mean D score obtained by the IAT. It is possible that the observed lack of correlation between the automatic association and participants' linguistic background stems from the size and the imbalance in the sample, as  $p$ -values are sensitive to sample size.

As for the explicit task, we found a mean rating of 2.36 ( $p = 2.901\text{e-}09$ ) (Table 4).<sup>12</sup> Thus, the difference between the guise containing coda [s] and the guise containing coda [ʃ] was perceived as moderate.

As predicted, participants whose parents are native perceived the guises as slightly different (1.68), whereas those with non-native parents perceived the stimuli as moderately different (2.88) and those with mixed-origin parents attributed the largest difference (3.60) (Table 4).

The difference between the ratings attributed by participants with mixed-origin parents and by those with native parents was significant ( $p = 0.03$ ), and the rates assigned by participants whose parents are mixed-origin and those with non-native parents were non-significant ( $p = 0.63$ ). When mixed-origin parents and non-native parents were grouped together, the difference was also significant ( $p = 0.05$ ). Even though the rate assigned by the participants whose parents are native and those whose parents are non-native was not significant ( $p = 0.11$ ), this relatively small  $p$ -value reflects the trend we hypothesized.

<sup>10</sup>Based on Nosek et al. (2007b), Campbell-Kibler (2012) stated that D scores of 0.38 and 0.44 represent relatively large effect sizes, whereas 0.24 is a relatively moderate effect.

<sup>11</sup>Many studies have reported their IAT scores employing Cohen's  $d$  measure. However, Greenwald et al. (2006: 58) point out that "Although the IAT's  $D$  measure is a standardized measure, its values are not interpretable in the same fashion as are values of Cohen's  $d$  measure (of effect size of mean differences)... The performance latencies from which  $D$  is computed are not conducive to intuitive interpretations of the sort that performance accuracy provides for  $d$  (...)"

<sup>12</sup>We divided the 5-point scale into three equal thirds. Ratings ranging from 1 to 2.33 express a slight difference between the guises; ratings from 2.34 to 3.66 represent a moderate difference; and, finally, ratings from 3.67 to 5 reveal an extreme difference.

Although the results of the explicit task did pattern with those presented by the implicit test, in the sense that the strongest implicit associations and the highest ratings were found for the participants with at least one non-native parent, participants' linguistic background was only relevant for explaining the responses to the explicit task.

More important, the positive correlation between the results of the implicit association test and the explicit task reveals that the stronger the implicit association between coda [ʃ] and the stereotype of native resident, the larger the difference overtly attributed to the guises, ( $r = 0.41$ ;  $p = 0.026$ ) (**Figure 1**). This significant correlation suggests that an implicit cognitive bias has a role on the perception of coda /S/ in the Florianopolitan variety of Brazilian Portuguese.

This seems to be true specially because participants consistently indicated the guise containing [ʃ] as belonging to a Florianopolitan (28 out of 30 participants), although 19 participants did not acknowledge coda /S/ as the element that differentiated the guises. Instead, they indicated a non-existent prosodic trait as the main distinction between the two guises, namely, speech rate, which is considered fast and one of the most remarkable linguistic traits of the Florianopolitan linguistic variety (Severo & Nunes de Souza 2015).

Perceiving a difference in speech rate that it is not present in the experiment is possible, supposedly because fast speech exemplars socially indexed to the information about the native resident stereotype have higher activation than the coda /S/ exemplars for these participants. In this case, fast speech rate was *perceived* as soon as the concept of native resident was elicited. Such dynamics surpasses the phonetic perception per se by ignoring the acoustic cues. This fact reinforces the findings of Strand & Johnson (1996), Niedzielski (1999), Hay et al. (2006), Hay & Drager (2010), and Munson (2011) about how stereotypes may distort phonetic perception.

Data obtained in the explicit task also indicated that participants with non-native parents were more sensitive to the allophonic variation of coda /S/, as 7 out of the 11 participants who correctly reported a difference in coda /S/ between the guises have non-native parents. On the other hand, fast speech seems to be a more salient phonetic trait than coda /S/ for those Florianopolitans who were less exposed to other varieties in early childhood, as 13 out of the 19 participants who reported a difference in terms of speech rate have native parents. Interestingly, 4 out of the 5 participants with mixed-origin parents referred to fast speech as the main difference between the guises.

Therefore, these findings support only partially our hypothesis that the early exposure to coda /S/ variants verified in participants with at least one non-native parent would have an impact on the perception of the allophonic variation of coda /S/ in the explicit task.

## 5. Conclusion

To the best of our knowledge, no study so far had addressed the cognitive biases that might be driving the social perception of coda /S/ in Brazilian Portuguese. Concerning the variety spoken in Florianópolis, we explored the associations between coda [ʃ] and the native resident stereotype at the conscious and at the unconscious level.

A moderate implicit bias between the native resident stereotype and coda [ʃ] was found. In addition, the difference between the guise containing coda [s] and the guise containing coda [ʃ] was perceived as moderate in the explicit task. Linguistic background did not have an impact on the strength of the implicit association, whereas it significantly affected the ratings attributed by the participants in the explicit task.

We concluded that a cognitive bias – in the form of an implicit association – plays a role on the social perception of coda /S/ in the Florianopolitan variety. That was particularly clear when we checked that participants did not rely on the pronunciation of coda /S/ when explicitly rating the more representative guise for the local identity.

In the sense of the Exemplar-based theory, as perception goes beyond phonetic categories encompassing the social categorization of who produces these phonetic categories, it seems that the social perception of the allophonic variation of coda /S/ depends on the strength of an automatic association between the phonological variable and the social information. Therefore, we argue that an implicit association between [ʃ] and the stereotype of native resident affects how Florianopolitans listeners perceive the speech of Florianopolitans speakers in terms of their native status.

We emphasize that the results we presented are incipient and require further investigation, as our sample is relatively small. Thus, one should be cautious about the claims here posed. Nonetheless, this study highlights the relevance of the application of procedures from Social Psychology to the research agenda of Laboratory Phonology, since this research paradigm is potentially informative about the cognitive processes that permeate the perception of allophonic variation.

### Acknowledgements

This research is part of my PhD thesis, which was developed between the years 2014 and 2018 at the Pontifical Catholic University of Rio Grande do Sul (Brazil) and supported by the Brazilian National Council for Scientific and Technological Development (CNPq) (grant number 141411/2014-7) and the Brazilian Higher Education Personnel Improvement Coordination (CAPES) (grant number 88881.133059/2016-01).

I would like to thank the two anonymous reviewers for their careful reading and their many contributions to this paper. Any remaining errors are my sole responsibility.

### Competing Interests

The author has no competing interests to declare.

### References

- Babel, M.** (2009). *Phonetic and Social Selectivity in Speech Accommodation*. (Unpublished doctoral dissertation). USA: University of California.
- Biasibetti, A. P. C. S.** (2018). *Produção e percepção das fricativas sibilantes em Porto Alegre/RS e Florianópolis/SC* [Production and perception of sibilant fricatives in Porto Alegre/RS and Florianópolis/SC]. (Unpublished doctoral dissertation). Brazil: Pontifical Catholic University of Rio Grande do Sul.
- Boersma, P., & Weenink, D.** (2016). *Praat: doing phonetics by computer* [Computer program]. Version 6.0.18. Retrieved March 11, 2016, from <http://www.praat.org/>
- Brescancini, C. R.** (1996). *A palatalização da fricativa alveolar não-morfêmica em posição de coda no português falado em três regiões de influência açoriana no município de Florianópolis* [Palatalization of non-morphemic alveolar fricative coda in three regions of Florianópolis influenced by Azores]. (Unpublished master thesis). Brazil: Federal University of Santa Catarina.
- Brescancini, C. R.** (2002) *A fricativa palato-alveolar e sua complexidade: uma regra variável* [The post-alveolar fricative and its complexity: a variable rule]. (Unpublished doctoral dissertation). Brazil: Pontifical Catholic University of Rio Grande do Sul.
- Brescancini, C. R.** (2015). A palatalização em coda em Florianópolis/SC: variáveis sociais [Coda palatalization in Florianópolis/SC: social variables]. *Working Papers in Linguística*, 16(1), 75–97. DOI: <https://doi.org/10.5007/1984-8420.2015v16n1p75>
- Callou, D., & Moraes, J. A.** (1996). A norma de pronúncia do S e R pós-vocálicos: distribuição por áreas regionais [The pronunciation norm of implosive S and R: distribution according to region]. In S. A. M. Cardoso (Ed.), *Diversidade linguística e ensino* (pp. 133–147). Salvador: EDUFBA.


- Campbell-Kibler, K.** (2012). The implicit association test and sociolinguistic meaning. *Lingua*, 122(7), 753–763. DOI: <https://doi.org/10.1016/j.lingua.2012.01.002>
- Cordeiro, C., & Madeira, A. B.** (2003). *A emigração açoriana para o Brasil (1541–1820): uma leitura em torno de interesses e vontades* [Azorean emigration to Brazil (1541-1820): a perspective on interests and wishes]. Azores: University of Azores.
- Drager, K.** (2015). *Linguistic Variation, Identity Construction and Cognition*. Berlin: Language Science Press. DOI: [https://doi.org/10.26530/OAPEN\\_603352](https://doi.org/10.26530/OAPEN_603352)
- Drager, K., & Kirtley, M.** (2016). Awareness, Salience, and Stereotypes in Exemplar-Based Models of Speech Production and Perception. In A. Babel (Ed.), *Awareness and Control in Sociolinguistic Research* (pp. 1–24). Cambridge: Cambridge University Press. DOI: <https://doi.org/10.1017/CBO9781139680448.003>
- Foulkes, P., & Docherty, G.** (2006). The social life of phonetics and phonology. *Journal of Phonetics*, 34(4), 409–438. DOI: <https://doi.org/10.1016/j.wocn.2005.08.002>
- Foulkes, P., Scobbie, J. M., & Watt, D.** (2010). Sociophonetics. In W. J. Hardcastle, J. Laver & F. E. Gibbon (Eds.), *The Handbook of Phonetic Sciences* (pp. 703–754). Chichester, UK: Wiley-Blackwell. DOI: <https://doi.org/10.1002/9781444317251.ch19>
- Freitag, R. M. K., Severo, C. G., Rost-Snichelotto, C. A., & Tavares, M. A.** (2016). Como os brasileiros acham que falam? Percepções sociolinguísticas de universitários do Sul e do Nordeste [How do Brazilians think they speak? Sociolinguistic perceptions of university students from the Southern and Northern regions]. *Todas as Letras*, 18(2), 64–84. DOI: <https://doi.org/10.15529/1980-6914/letras.v18n2p64-84>
- Furlan, O. A.** (1989). *Influência Açoriana no Português do Brasil em Santa Catarina* [Azorean influence on Brazilian Portuguese spoken in Santa Catarina]. Florianópolis: Editora UFSC.
- Greenwald, A. G., & Banaji, M. R.** (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, 102, 4–27. DOI: <https://doi.org/10.1037/0033-295X.102.1.4>
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R.** (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. DOI: <https://doi.org/10.1037/0022-3514.85.2.197>
- Greenwald, A. G., Nosek, B. A., & Sriram, N.** (2006). Consequential validity of the Implicit Association Test: Comment on Blanton and Jaccard. *The American Psychologist*, 61, 56–61. DOI: <https://doi.org/10.1037/0003-066X.61.1.56>
- Hay, J., & Drager, K.** (2010). Stuffed toys and speech perception. *Linguistics*, 48(4), 865–892. DOI: <https://doi.org/10.1515/ling.2010.027>
- Hay, J., Nolan, A., & Drager, K.** (2006). From fush to feesh: exemplar priming in speech perception. *The Linguistic Review*, 23, 351–79. DOI: <https://doi.org/10.1515/TLR.2006.014>
- Johnson, K.** (2005) Resonance in an Exemplar-based Lexicon: The Emergence of Social Identity and Phonology. *UC Berkeley Phonology Lab Annual Report 2005*, 95–128.
- Labov, W.** (1972). *Sociolinguistic Patterns*. Philadelphia: University of Pennsylvania Press.
- Lacerda, L. A.** (2013). *A representação da identidade do ‘manezinho’: entre a arte e a vida* [The representation of the ‘manezinho’ identity: between art and life]. (Unpublished master thesis). Brazil: Federal University of Santa Catarina.
- Mota, J. A.** (2002). Variação Fônica no Português do Brasil: o [s] em coda silábica [Sound variation in Brazilian Portuguese: coda [s]]. *Proceedings of the VI Congresso Nacional de Estudos Linguísticos e Literários*. Salvador: Universidade Estadual de Feira de Santana.

- Mota, J. A.** (2012). /S/ em coda silábica no corpus do projeto ALiB: Aspectos sociolinguísticos e históricos. In M. L. Cunha, V. O. Andrade & A. L. Rauber (Eds.), *Proceedings of the II Congresso Internacional de Linguística Histórica – Homenagem a Ataliba Teixeira de Castilho* (pp. 400–405). São Paulo: Universidade de São Paulo.
- Munson, B.** (2011). The influence of actual and imputed talker gender on fricative perception (revisited). *Journal of the Acoustical Society of America*, 130(5), 2631–2634. DOI: <https://doi.org/10.1121/1.3641410>
- Niedzielski, N.** (1999). The effect of social information on the perception of sociolinguistic variables. *Journal of Language and Social Psychology*, 18, 62–85. DOI: <https://doi.org/10.1177/0261927X99018001005>
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R.** (2007a). The Implicit Association Test at age 7: A methodological and conceptual review. In J. A. Bargh (Ed.), *Automatic processes in social thinking and behavior* (pp. 265–292). New York: Psychology Press.
- Nosek, B. A., Hawkins, C. B., & Frazier, R. S.** (2011) Implicit social cognition: From measures to mechanisms. *Trends in Cognitive Science*, 15(4), 152–159. DOI: <https://doi.org/10.1016/j.tics.2011.01.005>
- Nosek, B. A., Smyth, F. L., Hansen, J. J., Devos, T., Lindner, N. M., Ranganath, K. A., Smith, C. T., Olson, K. R., Chugh, D., Greenwald, A. G., & Banaji, M. R.** (2007b). Pervasiveness and correlates of implicit attitudes and stereotypes. *European Review of Social Psychology*, 18, 36–88. DOI: <https://doi.org/10.1080/10463280701489053>
- Pagotto, E. G.** (2004). *Variação e(é) Identidade* [Variation and(is) Identity]. Maceió, Brazil: ED/UFAL & EDUFBA.
- Pantos, A. J., & Perkins, A. W.** (2012) Measuring Implicit and Explicit Attitudes Toward Foreign Accented Speech. *Journal of Language and Social Psychology*, 32(1), 3–20. DOI: <https://doi.org/10.1177/0261927X12463005>
- Redinger, D.** (2010) *Language Attitudes and Code-switching Behaviour in a Multilingual Educational Context: The Case of Luxembourg*. (Unpublished doctoral dissertation) England: The University of York.
- RStudio Team.** (2017). *RStudio: Integrated development environment for R* [Computer software]. Version 3.4.0. Retrieved August 20, 2017, from <http://www.rstudio.org/>
- Scherre, M. M. P., & Macedo, A. T.** (1989). Variação e Mudança: o Caso do S pós-vocálico [Variation and change: the case of implosive S]. *ABRALIN – Boletim da Associação Brasileira de Linguística*, 11. Brazil: Unicamp, São Paulo.
- Seara, I. C., Nunes, V. G., & Lazzarotto-Volcão, C.** (2015). *Para conhecer Fonética e Fonologia do Português Brasileiro* [Getting to know Brazilian Portuguese Phonetics and Phonology]. São Paulo, Brazil: Contexto.
- Severo, C. G., & Nunes de Souza, C. M.** (2015). Identidade e língua na ilha de Santa Catarina: Sobre a relação entre o manezinho e o manezês [Identity and language in the Island of Santa Catarina: On the relationship between ‘manezinho’ and ‘manezês’]. In M. M. G. Savedra, M. A. Martins & D. Hora (Eds.), *Identidade social e contato linguístico no português brasileiro* (pp. 13–36). Rio de Janeiro: EdUERJ.
- Strand, E. A., & Johnson, K.** (1996). Gradient and visual speaker normalization in the perception of fricatives. In *Natural language processing and speech technology: results of the 3rd Konvens Conference* (pp. 14–26). Berlin: Mouton de Gruyter. DOI: <https://doi.org/10.1515/9783110821895-003>
- Valle, C. R. M.** (2001). *Sabe? não tem? entende?: itens de origem verbal em variação como requisitos de apoio discursivo* [‘Sabe? Não tem? Entende?’: variable verbal phrases as discourse support requirements]. (Master thesis dissertation). Brazil: Federal University of Santa Catarina.

**How to cite this article:** Biasibetti, A. P. C. S. (2020). Cognitive biases on the social perception of the allophonic variation of coda /S/ in Brazilian Portuguese. *Journal of Portuguese Linguistics*, 19: 9, pp. 1–15. DOI: <https://doi.org/10.5334/jpl.233>

**Submitted:** 31 August 2019    **Accepted:** 26 July 2020    **Published:** 01 October 2020

**Copyright:** © 2020 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

 *Journal of Portuguese Linguistics* is a peer-reviewed open access journal published by Ubiquity Press.

OPEN ACCESS 