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TAUTOSYLLABIC VOWEL NASALIZATION IN THE PORTUGUESE OF SÃO TOMÉ

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Abstract

In this study, we analyze tautosyllabic vowel nasalization in Santomean Vernacular Portuguese (SVP) spoken on São Tomé Island. In European and Brazilian varieties of Portuguese, vowel nasality has been considered both a phonological (actual nasal vowels) and a phonetic (nasalized vowels) feature. Herein, we share an acoustic analysis demonstrating that nasalized vowels in SVP are 48% longer than their oral counterparts. Thus, a nasalized vowel could correspond to an underlying sequence of an oral vowel followed by a nasal consonant. In this sense, a nasal coda's nasal feature would spread to the continuous vowel on the left. After that, the nasal coda, which triggers the process, is deleted at the segmental tier without changing the syllable length. This suggests a biphonemic interpretation of vowel nasality in SVP. Accordingly, there are no phonological nasal vowels in SVP. As São Tomé and Príncipe is a multilingual country, we investigate the influences triggered or reinforced by linguistic contact between Portuguese and other languages spoken in the country, especially Santome.

Keywords: vernacular Portuguese, nasality, phonology, São Tomé and Príncipe, linguistic

NASALITZACIÓ DE VOCALS TAUTOSIL·LÀBIQUES EN EL PORTUGUÈS DE SÃO TOMÉ

Resum

En aquest estudi, analitzem la nasalització de vocals tautosil·làbiques en el portuguès vernacle santomeà (SVP) parlat a l'illa de São Tomé. En les varietats europees i brasileres del portuguès, la nasalitat de les vocals s'ha considerat tant una característica fonològica (vocals nasals reals) com fonètica (vocals nasalitzades). Aquí compartim una anàlisi acústica que demostra que les vocals

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nasalitzades en SVP són un 48 % més llargues que les seves contrapartides orals. Així, una vocal nasalitzada podria correspondre a una seqüència subjacent d'una vocal oral seguida d'una consonant nasal. En aquest sentit, el tret nasal d'una coda nasal s'estendria a la vocal contínua de l'esquerra. Després d'això, la coda nasal, que desencadena el procés, s'elimina en el nivell segmental sense canviar la longitud de la síl·laba. Això suggereix una interpretació bifenèmica de la nasalitat de les vocals en SVP. En conseqüència, no hi ha vocals nasals fonològiques en SVP. Essent São Tomé i Príncipe un país multilingüe, investiguem les influències desencadenades o reforçades pel contacte lingüístic entre el portuguès i altres llengües parlades al país, especialment Santomé.

Paraules clau: portuguès vernacle, nasalitat, fonologia, São Tomé i Príncipe, contacte lingüístic

NASALIZACIÓN DE VOCALES TAUTOSILÁBICAS EN EL PORTUGUÉS DE SANTO TOMÉ

Resumen

En este estudio, analizamos la nasalización de vocales tautosilábicas en el portugués vernáculo santomeano (SVP) hablado en la isla de Santo Tomé. En las variedades europeas y brasileñas del portugués, la nasalidad de las vocales se ha considerado tanto una característica fonológica (vocales nasales reales) como fonética (vocales nasalizadas). Aquí compartimos un análisis acústico que demuestra que las vocales nasalizadas en SVP son un 48 % más largas que sus contrapartidas orales. Así, una vocal nasalizada podría corresponder a una secuencia subyacente de una vocal oral seguida de una consonante nasal. En este sentido, el rasgo nasal de una coda nasal se extendería a la vocal continua de la izquierda. Después de eso, la coda nasal, que desencadena el proceso, se elimina en el nivel segmental sin cambiar la longitud de la sílaba. Esto sugiere una interpretación bifenémica de la nasalidad de las vocales en SVP. En consecuencia, no hay vocales nasales fonológicas en SVP. Siendo Santo Tomé y Príncipe un país multilingüe, investigamos las influencias desencadenadas o reforzadas por el contacto lingüístico entre el portugués y otras lenguas habladas en el país, especialmente Santomé.

Palabras clave: portugués vernáculo, nasalidad, fonología, Santo Tomé y Príncipe, contacto lingüístico

1. Introduction

The aims of this study are (a) to describe and analyze tautosyllabic nasality in Santomean Vernacular Portuguese (SVP) and (b) to compare the phenomenon of vowel nasality in this variety with that of Santome (ST), a language also spoken in the city of São Tomé, and other varieties of Portuguese, specifically Brazilian Portuguese (BP) and European Portuguese (EP). We worked with a corpus of 129 lexical items. We analyzed it according to phonetic and phonological criteria, investigating the tautosyllabic vowel nasality of SVP, aiming to describe the phenomenon empirically, and proposing a phonological analysis of the status of tautosyllabic nasality. To this end, we considered issues related to linguistic contact and compared the results obtained for SVP with those of ST. In the last 60 years, SVP has emerged as the mother tongue (L1) of the majority of STP's population, replacing the local languages. With this

in mind, the study of vowel nasality in this variety can reveal aspects related to the acquisition of Portuguese as an L2. The analysis presented herein also broadens the scope of Balduino (2018) study on nasality in Portuguese as a whole. As this is a pioneering study, some questions remain open concerning nasality in SVP — a topic of broad debate in the literature in Portuguese. SPV is already a Portuguese variety that lacks phonological descriptions. Our proposal remains limited to describing nasality and proposing it as a research topic that must be further investigated in the future.

This study is organized as follows: In the introduction, we describe the general linguistic situation of STP and the ST language (the more widely spoken native language). In Section 2, we present the methods and procedures for this research. We describe and analyze the data and present the results in Section 3. Finally, we present our conclusions in Section 4.

1.1 *São Tomé and Príncipe linguistic ecology*

The Democratic Republic of São Tomé and Príncipe (STP) is a multilingual country located in the Gulf of Guinea on the West Coast of Africa. In this territory, Santome (ISO 639-3: cri), Lung'le (pre), Angolar (aoa), and Kabuverdianu (kea) coexist with Portuguese. The relationships between these languages create a complex context. It is possible to identify not only a situation of frequent linguistic contact but also issues related to linguistic standardization interfering with language usage. In general, Portuguese is considered the country's most prestigious language (Araujo 2020b). Recently, there has been an increase in the number of Portuguese as an L1 speakers and a decrease in the usage of other languages, especially in urban contexts, leading to the dominant figure of 98% of people under 20 years old speaking Portuguese (Araujo 2020a).

Since STP's independence from Portugal in 1975, Portuguese has occupied all aspects of life in STP. The Portuguese language is taught in schools, adopted in official government acts, and disseminated prolifically throughout the media, mainly on television and the radio. According to the National Statistics Institute (the INE), while

Santome is spoken by about 36.2% of people, Portuguese is spoken by 98.4% of the general population (INE 2012). The drop in proportion of ST speakers documented in the last forty years, in contrast to the high number of Portuguese speakers, evinces a decrease in the use and transmission of national languages (INE 2012). According to Araujo (2020a), such a decrease may be associated with the establishment of Portuguese as the majority L1, the interruption of the linguistic transmission of minority languages, the absence of policies that promote local languages, and the fact that local native elites already use it as a vehicular language. Thus, the use of ST, Lung'le (LI), and Kabuverdianu has decreased, while Portuguese usage has increased exponentially (Araujo 2020a, Santiago & Agostinho 2020). However, this abandonment of the country's minority languages and the adoption of Portuguese has yielded different levels of proficiency. As most Portuguese input has come from L2 varieties and only some from Portuguese L1 speakers, the resulting language promotes grammatical reanalysis (Lucchesi & Baxter 2009), displaying structural changes caused by the need to fill structural gaps. For example, there is a possibility that vowel nasality in Santomean Vernacular Portuguese (SVP) displays features from both European Portuguese (EP) and ST, a language that has exerted some influence on SVP, and may even be a reflection of the acquisition process from original L2 input.

Apart from Portuguese, ST was the major minority language and the main urban language on São Tomé Island during the twentieth century. However, until 1990, Portuguese was not widely acquired through transmission between native speakers or through formal learning of the prestige variety; Portuguese thus represents the symbolic power of the former colonizing metropolis (Araujo 2020b, Bouchard 2017). Thus, the Portuguese that consolidated itself in the twentieth century as the native language of a large part of the population corresponds to a new variety acquired and transmitted mainly by L2 speakers. It presents unique characteristics resulting from the processes of linguistic contact and of learning within a plurilingual context. Even though European Portuguese is considered the target language of the school system, the vernacular Portuguese of São Tomé speakers differs in structural aspects from its 'target' language. Studying this distinction, Braga (2018), for example, investigated the prosodic phrasing and intonational behavior of SVP. The author demonstrated that this

African variety has its own intonational grammar, which differs from that of EP and Brazilian Portuguese (BP). The author also pointed out that this is evidence that the intonational grammar of SVP is unique and does not constitute an irregular production of the target variety. Other authors have also attested to the structural peculiarities of SVP and defined it as a unique and distinctive variety, the Santomean Portuguese (Araujo & Balduino 2019; Bouchard 2017; Braga 2018; Brandão, Pessanha, Pontes & Correa 2017; Christofolletti 2013; Gonçalves 2010, 2016; Nascimento 2018; Santiago & Agostinho 2020, *inter alios*).

ST is one of the daughter languages of the Protocreole of the Gulf of Guinea. It dates to the early years of Portugal's colonization, at a time when a series of sociolinguistic conditions promoted the emergence of a native language among the slave and creole population (Araujo 2011, Bandeira 2017, Ferraz 1979). In political terms, ST is recognized as one of the country's national languages. However, it is primarily used in informal environments to express speakers' daily lives (Bouchard 2017, Hagemeyer 2009). As ST and SVP were in direct contact during the twentieth century (Bouchard 2017), there may have been a mutual structural influence between both languages. Moreover, in addition to possible changes via linguistic contact, the acquisition of Portuguese in STP, especially in the last quarter of the twentieth century, was rooted in an L2 paradigm. Therefore, SVP presents some features of this type of acquisition.

2. Methods and procedures

We followed the experimental methodological approach of laboratory phonology (Albano 2017, Ohala 1995). Therefore, the collection of the controlled corpus was designed to limit linguistic factors that could influence the length of the nasal and oral vowels. We created a segmental and suprasegmental context that limited articulatory or suprasegmental influences as much as possible to ensure the validity of acoustic duration. Such reasoning was also applied to the vowel length analysis. The length of

nasalized vowels (represented from now on as $\check{v}N$) and oral vowels (v) were measured based on a series of phonetic and phonological criteria, such as presenting lexical stress, being preceded or not by a previous (C_1) and a later (C_2) stop, and considering the voicing of these consonants and the position of nasality within the word and phrase. The corpus consisted of 129 lexical items extracted from the carrier phrases *Eu falo x baixinho* ('I speak x softly') and *Eu falo x* ('I speak x'), where 'x' was replaced by the target lexical item. The replaced word was a member of a minimal or analogous pair, such as in *tampa* ['tẽ.pe] 'lid' and *tapa* ['ta.pe] 'slap', or a word with potential nasality at its border, such as *álbum* ['at̃bũ] 'photo album'. We also created some well-formed meaningless words to pair with actual words because it was sometimes impossible to find an actual word to form a minimal or analogous pair in some segmental and stress contexts.¹

All items were recorded during fieldwork in the city of São Tomé in 2016 and 2019. Each of our five informants (three men and two women, all L1 speakers of Portuguese) repeated the target word within the carrier phrases three times. The first attempt was discarded, and the analysis was carried out based on the following two occurrences, which totaled 258 tokens per informant. To record the sentences, we adopted the repetition method of the target word. Therefore, the reading method was not used because the informants' literacy varied widely, with most having little reading skills.

In addition to the data extracted from this controlled context, nasality in SVP was also examined using semi-spontaneous speech data. Such data serve as a "control group" since the repetition method does not exclude the possibility that speakers are repeating the word from auditory memory (i.e., mimicking the experimenter's realization) rather than pronouncing the words in their native variety. Thus, semi-

¹ This can generate a methodological issue, since it introduces word frequency as an important confound. However, using existing (and frequent) words along with non-existing words was not a factor which changed the vowel durations compared—an important acoustic correlate to determine the phonological nature of nasalized vowels in this study. Still, in future studies on SPV, it is necessary that nasality be analyzed through logistic regression. Thus, different variables, such as word frequency, can be better understood by analyzing the relevance of different linguistic variables (linguistic contact, for instance) regarding the phenomenon. At present, our goal is to bring an initial and pioneering discussion on nasality in SPV.

spontaneous speech data could limit this factor, making it possible to analyze nasality data in a context closer to its actual use. We conducted five sociolinguistic interviews with different speakers of SPV in a second round of fieldwork in São Tomé city in 2019. We discarded the first 15 minutes of recordings to limit the observer’s paradox and avoid the excessive control of speech by informants. Data collection in a context closer to the informants’ vernacular speech allowed us to observe nasality in different syntactic and discursive contexts.

Length measurements were manually made using the Praat software (Boersma & Weenick 2015). Thus, we segmented and labeled word occurrences into phones. This segmentation is indicated on the spectrogram in Figure 1. The target vowel can be divided into its formant transition, stable part, and nasal murmur. We performed two types of segmentation: considering the murmur (portions 1 and 2 in Figure 1) and disregarding it (considering only portion 1). The length of each vowel was measured in milliseconds (ms) by separating it according to quality and then assigning a final average value to the target segments.

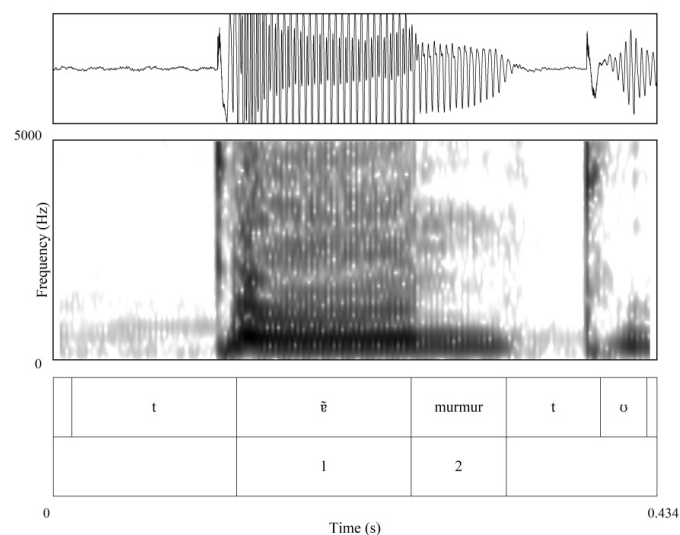


Figure 1. Spectrogram for duration measurements: *tanto* ‘plenty’ [ˈtẽtɔ]

Medeiros (2007) and Rothe-Neves & Valentim (2012) argued for excluding the murmur because it does not have vowel characteristics. Moreover, the appendix is

produced by the closure of the oral cavity, which is characteristic of consonants and not vowels. Phonetically, this interpretation is consistent and could justify discarding it (Araujo & Balduino 2019: for SVP). It is well known in the literature that (i) there appears to be a clear acoustic difference between the nasalized vowel and the nasal murmur, i.e., the nasal consonant, suggesting that two segments are present, and (ii) previous research on Portuguese has measured them separately, e.g., Medeiros (2007) and Rothe-Neves & Valentim (2012). Despite these assumptions in previous studies on Brazilian Portuguese, which indicate a clear difference between vowels with and without a murmur, it is necessary to empirically confirm that such a result is also valid for SPV. Thus, we will consider both types of measurements.

The presence of nasal murmurs is analyzed here not only as an actual feature of nasality but as a possible phonetic correlate of a nasal consonant in a phonological form that is not fully realized. Additionally, the appendix is also included in syllable duration and should be considered in a phonological analysis that considers this aspect. Therefore, when we defined $\tilde{v}N$ in SVP as the phonetic result of a phonological sequence of the oral vowel followed by a consonant without a point of articulation in the coda ($/vN/$), we identified the presence of the nasal appendix, indicating that this element occupies a temporal position within the tautosyllabic syllable $\tilde{v}N$. It is expected, then, that there will be a trade-off between the duration of the nasalized vowel and the tautosyllabic nasal consonant, as shown by Beddor (2009), indicating the presence of two segments.

Finally, it is worth mentioning that the nasal appendix in Portuguese is not always acoustically observed, especially if preceded by a fricative (Lovatto, Amelot, Crevier-Buchman, Basset & Vaissière 2007). This paper also intends to analyze its occurrence in the SVP data, investigating whether this correlate can be found in the data. For this, we will consider during the vowel measurements the portion equivalent to the murmur and, later, the measurements that discard such portion. We hypothesize that the murmur may correspond to an acoustic correlate of $/N/$ in coda in SPV and, therefore, allow us (1) to explain the lengthening of the nasal vowels in relation to the oral vowels and (2) to justify the presence of nasal vowels as result of a phonological process.

3. Vowel nasality in Santomean vernacular Portuguese (SVP)

Vowel nasality is a phenomenon widely observed in natural languages. Considering only the languages documented in *The World Atlas of Languages* (Dryer & Haspelmath 2013), vowel nasality has been identified in 244 different languages (Cohn 1990; Delvaux 2006, 2009; Dooley 1984; Hajek 1997; Miranda & Picança 2020; Styler 2008; Wetzels 1995). In Brazilian and European varieties of Portuguese, nasality has been studied using different approaches. Two main hypotheses stand out: the monophonemic (Leite 1974; Lüdtke 1953) and the biphonemic (Câmara Jr. 1971, Mateus 1982, Mateus & D'Andrade 2000, Moraes & Wetzels 1992) approaches.

According to the monophonemic hypothesis, the nasalized vowels of Portuguese are part of the phonological inventory of the language. Few studies have considered this perspective. Aside from Lüdtke (1953), Leite (1974) and Tláskal (1980), a small number of authors have assumed nasalized vowels as phonemes. This point of view is, however, common among phoneticists (Medeiros 2007). In general, this perspective is supported by the possibility of a contrast between $\tilde{v}N$ and v , as demonstrated by the minimal pairs test, which occurs in *lançar* and *laçar* and *tanto* and *tato* ('to throw' and 'to lasso' and 'so much' and 'tact', respectively).

In contrast to the monophonemic interpretation, the biphonemic hypothesis does not assign a phonological status to vowels that present nasality. Thus, $\tilde{v}N$ corresponds to a sequence $/vN/$, which, through a phonological process of nasality spreading and the further deletion of the nasal consonant (without a point of articulation specified in the underlying coda $/N/$), would be realized as $[\tilde{v}]$. The biphonemic hypothesis has had more support than the monophonemic and has been taken up in the literature by different theoretical approaches (Ashby, Cummins, Barbosa & Campaniço 2011; Balduino 2018; Battisti 1997; Bisol 1998; Lovatto et al. 2007; Mateus & D'Andrade 2000; Moraes & Wetzels 1992; Rothe-Neves & Valentim 2012).

To describe vowel nasality in SVP, we evaluated both hypotheses using spontaneous and controlled speech data. Thus, we discuss nasalized vowels in light of their phonotactic behavior as well as some acoustic characteristics that may offer clues regarding their phonological status in SVP. In SVP, as well as in EP and BP, there are five nasalized vowels word-medially and word-finally in stressed syllables (see Table 1) and in unstressed syllables (see Table 2).

Stressed			
Word-medial position		Word-final position	
<i>linda</i> ‘pretty’	[ˈlĩde]	<i>sim</i> ‘yes’	[ˈsĩ]
<i>tempo</i> ‘time’	[ˈtẽpɔ]	<i>sem</i> ‘yes’	[ˈsẽ] ~ [ˈsẽj]
<i>canto</i> ‘song’	[ˈkẽtɔ]	<i>irmã</i> ‘sister’	[irˈmẽ]
<i>conto</i> ‘tale’	[ˈkõtɔ]	<i>bombom</i> ‘bonbon’	[bõˈbõ]
<i>junto</i> ‘together’	[ˈʒũtɔ]		

Table 1. Nasalized Vowels in SVP – Stressed Syllables

Non-stressed			
Word-medial Position		Word-final Position	
[ĩ]	<i>pintado</i> ‘Pseudoplatystoma corruscans’	[pĩˈtadɔ]	
[ẽ]	<i>pensar</i> ‘to think’	[pẽˈsar]	<i>bobagem</i> ‘nonsense’ [boˈbaʒẽ] ~ [boˈbaʒẽj]
[ẽ]	<i>antigamente</i> ‘early’	[ẽˈtigamẽti]	<i>órfã</i> ‘orphan’ [ˈɔrfẽ]
[õ]	<i>bombom</i> ‘bonbon’	[bõˈbõ]	<i>cólon</i> ‘colon’ [ˈkɔlõ]
[ũ]	<i>untar</i> ‘to grease’	[ũˈtar]	<i>álbum</i> ‘photo album’ [ˈaɫbũ]

Table 2. Nasalized Vowels in SVP – Non-stressed Syllables

Nasalized vowels in SVP, in addition to occurring in different positions within a word, can be opposed to oral vowels, allowing for the formation of minimal pairs, as indicated in (1).

(1)

a.	<i>sim</i>	<i>se</i>	b.	<i>tanto</i>	<i>tato</i>	c.	<i>mundo</i>	<i>mudo</i>
	[ˈsĩ]	[ˈsi]		[ˈtẽtɔ]	[ˈtatɔ]		[ˈmũdɔ]	[ˈmudɔ]
	‘yes’	‘if’		‘plenty’	‘tact’		‘world’	‘mute’

The pairs presented in (1) suggest that there are phonological nasal vowels in SVP. Even though a commutation test may be a necessary tool to derive the phoneme chart of a language, this technique may not be enough for addressing more complex sounds, such as nasal ones. As it is based on the opposition of minimal pairs and offers quick results, the commutation test does not explain the distinction between the supposed nasal vowels, as in (1), and the nasalized vowels whose nasality features are the result of spreading, such as from a nasal onset, for example, *cama* [ˈkẽme] ‘bed’. However, the test identifies the issue of distinctive and non-distinctive nasality in Portuguese (Fonseca 1984: 104). It is thus necessary that nasality in SVP be examined based on the phonotactic behavior of the nasalized vowel.

Therefore, we analyzed nasality in SVP through Câmara Jr. (1971) phonological arguments. We noted that, just as postulated by the author concerning BP, there are structural indications that nasalized vowels in SVP may be the result of a phonological process. In the same way as in BP, we observed that the processes of elision and degemination do not apply if the nasalized vowel is at the word border. Otherwise, words ending with oral vowels — when paired with another lexical item that begins with a vowel segment — undergo re-syllabification promoted by vowel sandhi. This is exemplified in (2), in which we note the elision of [ɪ] where a nasalized vowel would block this process, as expressed in (3) and (4). In the examples (2) and (3), both within a phonological phrase (Pph) and a word boundary, the elision only occurs in (2).

(2)

O	total	não	atingiu	[set[<u>a</u>]vos] Pph	(set[ɪ] [a]vos)
The	total	NEG ²	arrive.PST	one.seventh	seven parts (of 100)
	‘The total did not reach one seventh’				

² Abbreviations: NEG: negation particle; PST: past tense.

(3)

[**Bomb[õ]** [o]tel] Pph *bob[õ]tel
 Bombom Hotel
 ‘Bombom Hotel’

The same is observed in (4) to (6) at a phonological phrase boundary: vowel sandhi is only observed at the meeting of two oral vowels in (4), or when the nasal vowel is the second vowel, as in (5). When the first vowel is nasal, the phenomenon never occurs, as in (6).

(4)

[**A** lâmpada] Pph Pph [ilumina] a noite lampad[i]lumina
 The light bulb lights the night
 ‘The light bulb lights the night’

(5)

[**A** menina] Pph Pph [andava] menin[ẽ]ndava
 The girl andar.PST
 ‘The girl had walked’.

(6)

[**O** homem] Pph Pph [aproveitou] também *hom[ẽ]proveitou
 The man take advantage.PST too
 ‘The man took advantage too’.

The non-occurrence of vowel sandhi is an argument that corroborates the existence of nasalized non-phonological vowels in SVP. Sandhi is only blocked if the first vowel is nasal, but it can be observed if the second one is nasal. However, assuming that /N/ closes the final syllable and should block sandhi rules, it is necessary to emphasize that data such as (2)-(6) behave differently from other closed syllables, as shown in (7). If nasalized vowels at word-final position block vowel sandhi (7), we

would expect that syllables with nasalized vowels would be re-syllabized into a CV syllable at the word border, as it happens to rhotics (7a) and laterals (7b). In contrast, examples such as (7c) were not observed in the SVP data. Therefore, even though data such as (2)-(6) indicate that the nasalized vowel is not phonological in SVP, the examples in (7) lead us to question whether there is a nasal consonant coda. In vowel sandhi, the behavior of /N/ differs from what is expected for the rhotic and the lateral in the coda. In examples (3) and (5), the first nasal vowel blocks resyllabification within and at the boundary of a phonological phrase, but the nasal consonant cannot be recovered if resyllabified as in (7c). This fact allows us to wonder whether it is possible to support a biphonemic status of nasality in SVP. It would be expected that the nasal /N/, as a coda, behaves similarly to the other segments in this constituent. Thus, we can speculate whether nasal vowels are a phonological unit rather than the result of a process.

- (7) a. *te[ra]coragem* ter a coragem ‘to have courage’
b. *manua[li]scolar* manual escolar ‘school textbook’
c. **home[na]proveitou* homem aproveitou ‘man took advantage’

Furthermore, as Câmara Jr. (1971) and Mateus & D’Andrade (2000) stated, we observed that the rhotic distribution in relation to the nasalized vowel, unlike BP and EP, is not an argument that can be used for SVP. According to Câmara Jr. (1970), the rhotic is realized as [r] after the nasalized vowel, behaving in the same manner as in other closed syllables: *hon./r/a*, *ten./r/o*, *Is/r/ael*, and *guel./r/a* or ‘honor’, ‘tender’, ‘Israel’, and ‘gills’. In these contexts, [r] would be impossible according to the author: **hon/r/a*, **ten/r/o*, **Is/r/ael*, and **guel/r/a*. This argument for the analysis of vowel nasality in BP and EP is assumed in different studies, such as that of Mateus & D’Andrade (2000). Similar to the proposals of Câmara Jr. (1953, 1970, 1971), the authors indicated that [r] occurs exclusively at an onset if the previous syllable is open or in a coda (Mateus & D’Andrade 2000: 21).

Considering that /r/ and /r/ vary in all contexts in SVP (Agostinho, Soares & Mendes 2020; Bouchard 2017; Vieira & Balduino 2020), even in open syllables and between vowels,³ the different variants of rhotics do not support a structural argument for the non-phonological nature of the nasalized vowel (see 8).

- (8) a. *honra* ['õre] ~ ['õʁe] 'honor'
 b. *Israel* [ifra'ɛt] ~ [ifʁa'ɛt] 'Israel'

The syllable that includes the nasalized vowel in SVP behaves in a similar way to other syllables with a coda in SVP, as Mateus & D'Andrade (2000) have reported for EP. Thus, antepenultimate syllables with lexical stress are rare if the penultimate syllable is a nasalized vowel (Mateus & D'Andrade 2000: 23). According to the authors, nasalized vowels tend to attract stress in the penultimate syllable. A similar process is identified if the penultimate syllable is closed by a glide or a consonant; therefore, forms such as *['komũdʊ], *['komuzdʊ], and *['komujdʊ] are not allowed. As the highlighted items have a coda in the penultimate syllable, they should bear the word's primary stress. The ungrammaticality of *['komũdʊ] would then arise from the syllabic weight of the penultimate syllable, which would attract the stress because it has an underlying nasal segment.

However, once again, this assumption becomes problematic when we apply it to other words in Portuguese. In *performance* [pe'fõrmẽsɪ], for example, there is a nasalized vowel in the penultimate syllable. Nonetheless, the stress falls on the antepenultimate syllable, and the lexical item remains grammatical. This is also observed in the word *recorde*, for which the form ['ʁekõrdɪ] is one of the stress possibilities, even with the coda filled by a rhotic in the penultimate syllable. Thus, there is still a need for the re-examination of such generalization as an argument for the absence of phonological vowels in SVP.

We observe frequent processes of deletions of the nasal /N/ when analyzing final unstressed syllables that carry nasalized vowels:

³ Rhotic alternation in all syllabic contexts, including between vowels is one of the phonological characteristics of SVP: *caro* ['kaʁʊ] ~ ['karʊ] 'expensive'; *carro* ['kaʁʊ] ~ ['karʊ] 'car'.

- (9) a. *homem* ['omɪ] 'man'
b. *bobagem* [bo'baʒɪ] 'nonsense'
c. *órfã* ['ɔrfã] 'orphan'

In the same way, as for BP (Wetzels 1997), items with final nasality can be realized as oral or nasal in SVP. Wetzels (1997) notes that the alternation of oral and nasalized vowels is recurrent in words whose lexical stress does not fall on the syllable that contains nasality. According to the author, considering Portuguese a weight-sensitive stress language, pretonic stressed words have a final light syllable formed by onset and a nucleus. Assuming no phonological nasal vowels in BP, but an underlying biphonemic structure /VN/, words such as those in (9) would be an exception to the rule. Although they contain a final heavy syllable, this syllable would not carry the stress. Therefore, the possibility of oral vowels in final syllables would be a biphonemic argument in BP, suggesting that the nasal coda can be eliminated without nasality spreading, making the syllable light.

Reinforcing this interpretation, the data from SVP in (9) and BP show the absence of nasality in a final unstressed position. Moreover, this was not seen in the data in a stressed position, as in (10). Words such as those in (10) retain nasality in a final stressed syllable.

- (10) a. *sim* ['sĩ] *['si] 'yes'
b. *amén* [a'mẽ] *[a'me] 'amen'
c. *som* ['sõ] *['so] 'sound'

It seems that in SVP, in its application, the phenomenon takes into account the stress and the syllable. Considering BP, Lee (2003: 164-165) assumes that final nasality reduction is a product of a process called “brevis brevians” or “iambic shortening”. In such a process, light syllables turn the following syllables also light. Heavy syllables preceded by light stressed syllables lose their final consonant, also becoming

monomoraic. According to the author, this phenomenon was recurrent in Latin and is found in BP.

Lee (2003: 164) assumes that the stress rule in BP (contra Magalhães 2008, Massini-Cagliari 1992, Wetzels 2007) is not sensitive to syllabic weight: an iambic foot is the pattern in non-verbs; a trochaic foot is the default in verbs. According to this perspective, syllabic reduction is related to foot formation. For Lee (2003), an iambic (* -) stress pattern is unmarked in non-verbs, while (- *) is marked. Thus, reductions such as (9) would occur in words with two morae in a marked position, carrying final prominence. Consequently, the “brevis brevians” rule restructures the foot, changing it to a foot with only light syllables (- -), which is an unmarked pattern.

Lee (2003) claims disregard a weight-sensitive stress rule, differing from our analysis for nasality in SVP. However, it should be noted that despite the differences, the brevis brevians explanation does not necessarily differ from a syllable structure interpretation where nasal vowel syllables contain two moras. Thus, syncope of the nasal coda in final syllables occurs because of the need to make both syllables light. Based on SVP, a variety whose alternation of nasal and oral vowels was identified only in final unstressed syllables, we agree with the assumption that syllables with nasalized vowels correspond to heavy syllables and can play a role in stress assignment. Data as in (9) occur because SVP has a trochaic pattern, just as in BP (Wetzels 2007). The final syllable of *homem* ['omẽ] ‘man’ has a coda and is nasalized; therefore, it is heavy and should carry the stress. However, since this does not occur, the final syllable is changed into a light syllable so that the pre-final stress pattern applies. Naturally, this is a generalized hypothesis, and many other theoretical and descriptive issues need to be discussed to prove it for SVP. We will return to this question in the next question.

As discussed, SVP has five phonetically nasalized vowels: [ĩ], [ẽ], [ẽ̃], [õ], and [ũ]. They occur in unstressed and stressed syllables in different positions within a word and may or may not generate opposition to oral vowels. Arguments such as the non-occurrence of vowel sandhi suggest that there is an underlying vN structure if the target vowels are at the word’s border, in addition to lexical stress, which seems to consider the syllable bearing the nasalized vowel as heavy. However, data disregarding the attribution rules of primary stress and the absence of consonant sandhi, which

promotes CV re-syllabification at word boundary, indicate the need to evaluate vowel nasality in SVP considering new arguments. Thus, following Moraes and Wetzels (1992), we added some phonetic aspects observed in the production of nasalized vowels to the examination of vowel nasality in SVP (Section 4).

4. Acoustic length of nasal vowels in SPV

Moraes & Wetzels (1992) used laboratory phonology as their methodological approach and CV Phonology as a theory to explain the tautosyllabic nasality phenomenon in BP. According to the authors, /N/ in coda spreads its feature to the nuclear vowel, which assimilates nasality. Then, the consonant is eliminated from the segmental tier.⁴ As a result of this elision through the [nasal] feature spreading, the already-nasalized vowel becomes associated with two temporal units in the CV tier. According to Moraes & Wetzels (1992), the segmental tier nasalized vowel tends to be longer than v. The authors suggested this by measuring the low nasalized and oral vowels [ẽ] and [a]. Following their study, the length measurements method has been replicated by others who aimed, on an empirical basis, to clarify the vowel nasality status in BP and EP (Barbosa 1999, Barbosa & Madureira 2015, Rothe-Neves & Valentim 2012, Seara 2000, Sousa 1994). Furthermore, this method has also been used to describe and interpret this phenomenon in ST and LI, the native languages of STP (Balduino, Agostinho, Araujo & Christofolletti 2015).

This section discusses the duration of nasalized and oral vowels in SVP. Section 3 showed that phonological arguments used to deal with vocalic nasality in BP leave some questions open. Our goal here is to analyze the phonological nature of nasalized vowels in SVP, incorporating acoustic aspects into the discussion. Furthermore,

⁴ From a CV phonology perspective, it is possible to consider segmental deletion without implying a temporal loss. Each segment of the syllable, according to this theory, is linked to the CV tier, which is responsible for assigning a temporal unit. Thus, even if /N/ is elided, it would not lose its syllable temporal unit. The oral vowel, having assimilated the [nasal] feature of the consonant coda, would be associated with two temporal units: that of v and that of /N/.

comparing the acoustic patterns found in literature, we will analyze similar studies dedicated to other varieties of Portuguese and ST.

In SVP, tautosyllabic nasality in word-medial position has been studied using a corpus formed by 48 minimal pairs. Among these, 23 pairs corresponded to items whose target structure was present in the stressed syllable, such as in *tanto* ‘so much’ [ˈtẽtɔ] and *tato* ‘tact’ [ˈtatɔ], and another 25 pairs with a pretonic structure, such as in *tapada* [taˈpade] ‘stupid’ and *tampada* [tẽˈpade] ‘covered’. Maintaining the contrast between the stressed and pretonic structures, this dataset was later analyzed considering the antecedent (C₁) and subsequent (C₂) consonants following nasalized and oral vowels. Table 3 shows the results considering murmur. The proportion values were rounded up. D1 and D2 represent, respectively, the difference in percentage and the difference in milliseconds between $\tilde{v}N$ and *v*. Additionally, Table 3 shows both average values of the duration of $\tilde{v}N$ and *v* selected according to the vowel context (that is, the average duration of [i], [e], [a], [o], and [u] and their nasalized counterparts) and the average duration of all informants.

Analysis Criterion	$\tilde{v}N_{ms}$	<i>v</i> _{ms}	D1%	D2 ms
<i>Stressed syllables</i>	190	139	37	51
'C ₁ [-VOICE] V	184	137	34	47
'C ₁ [+VOICE] V	180	140	29	40
'V. C ₂ [-VOICE]	174	136	28	48
'V. C ₂ [+VOICE]	179	140	28	39
<i>Non-stressed syllables</i>	180	95	89	85
C ₁ [-VOICE] V	171	87	97	84
C ₁ [+VOICE] V	177	103	72	74
V. C ₂ [-VOICE]	138	93	72	45
V. C ₂ [+VOICE]	167	103	48	64
Average	174	117.5	48.1	56.5

Table 3. Average vowel durations in milliseconds of $\tilde{v}N$ and *v* in SVP. Source: Araujo & Balduino (2019: 46)

In stressed syllables, we noted that $\tilde{v}N$ is 37 % longer than *v* on average. This percentage and the duration of the stressed nasalized vowel (190 ms) and the oral

vowel (139 ms) comprise the average value of all criteria specified in Table 3. In turn, the other averages indicate the distinct groups analyzed in stressed syllables. For example, for C₁, we separated the vowel length according to the consonants that preceded the vowels in a stressed context, further considering the average duration of $\tilde{v}N$ and *v* according to the voicing of this consonant in a tautosyllabic onset. Therefore, as Table 3 shows, the $\tilde{v}N$ that followed 'C₁ [-VOICE]' was 34% longer than the *v* that followed 'C₁ [-VOICE]', and the $\tilde{v}N$ that followed 'C₁ [+VOICE]' was 29% longer than the *v* that followed 'C₁ [+VOICE]'. Based on these values and comparing them to the general average of lengthening (37%) in the stressed position, we noted that the consonant preceding the target vowel in a stressed context and independently of voicing retains the lengthening of $\tilde{v}N$ over *v*.

As Moraes & Wetzels (1992) demonstrated, the following consonant is a factor that affects syllabic length, and a consonant (C₂) that follows an oral vowel is lengthened to an identical C₂ that follows a nasalized vowel. Based on Table 3, we noted that, in stressed syllables, $\tilde{v}N$ was longer (28%) in relation to *v*, independently of the quality and voicing of C₂. This suggests that although the nature of the voicing of C₂ may influence the duration of target vowels, as indicated in BP, in SVP, the measurements do not nullify the proportion of lengthening.

Additionally, by observing the target vowels in pretonic syllables, we found that the difference between $\tilde{v}N$ and *v* is proportionally higher compared to stressed syllables. That is, while $\tilde{v}N$ is 37% longer than *v* in a stressed position, $\tilde{v}N$ is 89% longer when opposed to *v* in a pretonic position. This difference in percentage derives mainly from the duration of the oral vowel in milliseconds. In fact, when *v* has a duration of 139 ms in stressed syllables, *v* has a duration of 95 ms in the pretonic position, which is a difference of 44 ms between the stressed and pretonic oral vowels. In contrast, the difference in duration between nasalized vowels is only 10 ms; $\tilde{v}N$ lasts 190 ms in stressed syllables and 180 ms in the pretonic position (Araujo & Balduino, 2019). Such differences in duration may reflect issues related to syllable weight and, consequently, the primary stress of words in SVP.

Massini (1991) pointed out that, in BP, one of the correlates of the stressed syllable is its longer duration. Thus, upon receiving the primary stress, the vowel of the stressed syllable should be lengthened. According to Wetzels (2007), assuming BP as a language sensitive to syllable weight, the vowel may suffer a phonetic delay upon receiving prominence and, therefore, will be longer than the same vowel without the lexical stress (Wetzels, 2007: 3). In the case of syllables closed by a consonant or a glide, this lengthening would not be necessary, as the presence of the coda characterizes a heavy rhyme and would thereby tend to attract the stress anyway. By applying this assumption to SVP, as there have been no studies on the lexical stress specific to such a variety as of yet, we can explain the longer duration of oral vowels in stressed syllables over oral vowels in pretonic syllables and, consequently, justify the lengthening of $\tilde{v}N$ over v in the latter context.

Furthermore, we observed that the duration of oral vowels in stressed syllables corresponded to the vowel's own duration plus a characteristic lengthening in stressed positions; this assumes the possibility that SVP is sensitive to syllable weight, as Araujo and Balduino (2019) purported regarding SVP and *Príncipe Vernacular Portuguese* (PP). This is shown in Table 4, which displays our inspection of the vowel durations extracted according to the quality and lexical prominence of the vowels. In Table 4, the duration values are presented in milliseconds, and the *SD* is the standard deviation of averages.

	Stressed		Non-stressed		$\tilde{v}N$	Stressed		Non-stressed	
	Duration	<i>SD</i>	Duration	<i>SD</i>		Duration	<i>SD</i>	Duration	<i>SD</i>
[i]	127	21.1	90	16,3	[ĩ]	179	37.2	176	16.8
[e]	146	34.4	92	15.7	[ẽ]	199	26.3	186	19.1
[a]	147	41.2	101	24.1	[ã]	204	38.3	187	23.3
[o]	149	25.9	90	17.5	[õ]	189	26.9	181	20.6
[u]	125	32.2	99	9.8	[ũ]	178	28.3	171	15.2

Table 4. Average durations of $\tilde{v}N$ and v in SVP: stressed syllables x non-stressed syllables

As Table 4 indicates, oral and nasalized vowels in stressed syllables are longer than vowels in unstressed syllables. This suggests that segmental length may be a

possible acoustic correlate to stress in SVP—a hypothesis that, although already pointed out, will not be discussed in this work (see Massini-Cagliari, 1992: for BP). Such lengthening, however, was longer in oral vowels, 44 ms on average, while the difference in milliseconds between the duration of nasalized vowels was only 10 ms, as shown in Table 5.

	ǃN	v	%
Stressed	190	139	37
Pretonic	180	95	89
	10 ms	44 ms	

Table 5. Comparison of duration between stressed and pretonic positions in SVP

To investigate whether ǃN in SVP corresponded to a biphonemic sequence, we contrasted the duration of ǃN to 'v, i.e., a vowel in a stressed syllable. Therefore, the difference would not be large. Thus, comparing the duration of ǃN in a pretonic position could indicate a different durational result. This duration of ǃN in a pretonic position is equivalent to the duration of a syllable closed by a coda (/VN/) and, consequently, corresponds to a heavy and long syllable with the duration of unstressed v. As in this latter case, we compared an already-lengthened syllable rhyme (due to the nasal coda with a rhyme composed only of a nucleus), unstressed and devoid of any compensatory lengthening; hence, ǃN (/VN/) would be even longer than v in this context. Therefore, ǃN is 89% longer in a pretonic position than v, while in a stressed position, the average difference is 37%. The highest proportion of lengthening in pretonic syllables is an empirical argument in favor of a biphonemic interpretation of SVP, as it confirms a vowel duration equivalent to a heavy syllable (Araujo & Balduino 2019: 47-48).

When we disregard the portion equivalent to the nasalized vowel's nasal murmur, the biphonemic hypothesis is endorsed. Table 6 compares the duration of the nasalized vowel (ǃ), discarding the nasal murmur, with the duration of the oral vowel (v). As can be seen, the durational difference between nasalized vowels is annulled since ǃ has a duration equivalent to v, being in some cases shorter. Therefore, the

nasal appendix corresponds to the correlate of a nasal consonant in the coda that triggers nasalization in SVP.

	Stressed		Non-stressed	
	\tilde{v}	v	\tilde{v}	v
[ĩ]	112	127	98	90
[ẽ]	136	146	92	92
[ẽ̃]	132	147	102	101
[õ]	124	149	110	90
[ũ]	122	125	104	99

Table 6. Average duration of \tilde{v} , without nasal appendix, and v in SVP: stressed syllables x non-stressed syllables

In SVP, the fact that nasalized vowel duration, disregarding the murmur, loses its lengthening is quite surprising. Previous studies that do not include the nasal murmur in the measurement of nasal vowels report that nasal vowels are longer than the corresponding oral vowels in different varieties of Portuguese (Rothe-Neves & Valentim 2012). However, in SVP, the presence of a murmur determines such lengthening.

In stressed syllables, $\tilde{v}N$ is 37% longer than v and 89% longer in pretonic contexts. Thus, the presence of a nasal appendix suggests that, in SVP, /N/ in coda triggers nasality spreading. Consequently, the nasality found in vowels has its source in a phonological process of nasality assimilation, which spreads the [nasal] feature, followed by an optional deletion of the nasal trigger. Such a process can be formalized through the representation shown in Figure 2.

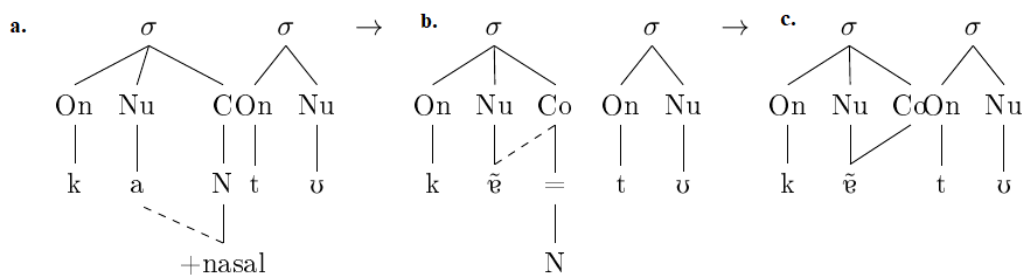


Figure 2. Representation of the nasalization process in SVP

A nasal consonant spreads its nasality feature to the previous vowel, which was initially oral (Figure 2). After this, the resulting nasalized vowel is associated with the temporal tier of /N/ in the coda. Then, this consonant is deleted. This process may explain why, in this context, there is no consonant sandhi, as occurs in rhotics and laterals. The $\tilde{v}N$ sequence corresponds to a two-time unit because it received its nasality feature and is temporally associated with two temporal units—its nucleic unit and the unit referring to the deleted /N/. As a result, even with a segmental loss, the syllable maintains its time unit, which can be observed in the longer duration of nasalized vowels in SVP, especially in pretonic syllables. This assimilation process is regressive (Araujo & Balduino 2019, Balduino 2018). The deletion of the nasal coda occurs in the controlled and semi-spontaneous speech data in SVP. It may even occur before the nasalization process is implemented, as in BP (Lee 2003). In (11), we note that vocalic nasalization may not occur at the word border. In such cases, as discussed in Section 3, the process is rendered unfeasible due to the deletion of /N/, which occurs even before nasality spreading. Coda deletion at the word border is recurrent in Portuguese varieties spoken in STP (Balduino 2020, Balduino & Vieira 2020, Vieira & Balduino 2020). Hence, it is a lexical phenomenon common to all segments licensed in SVP coda.

- | | | | | |
|------|----|----------------|------------------------------------|------------|
| (11) | a. | <i>homem</i> | [ˈomẽ] ~ [ˈomẽj] ~ [ˈomɪ] | ‘man’ |
| | b. | <i>álbum</i> | [ˈaɫbũ] ~ [ˈaɫbu] | ‘album’ |
| | c. | <i>bobagem</i> | [boˈbaʒẽ] ~ [boˈbaʒẽj] ~ [boˈbaʒɪ] | ‘nonsense’ |

The word-final nasality in SVP was analyzed based on 33 lexical items, in which $\tilde{v}N$ was at the word border compared to 33 lexical items where $\tilde{v}N$ was at word and intonational phrase boundaries. In BP, non-nasalization of *v* and the word-final diphthongization of mid-high vowels [e] and [o] are very common (Lee 2003, Wetzels 1997). These processes revealed phonetic characteristics inherent to BP. The loss of word-final nasality can also reinforce the biphonemic interpretation of nasality for this variety (Wetzels 1997). The data were analyzed to test these processes in SVP,

considering perception and spectrogram information. We investigated whether nasality was audibly perceptible and whether there was evidence for a nasal appendix or word-final diphthongization, such as that which we observed in word-medial nasality. Vowel length was not considered as a criterion for this dataset because changes in duration could be found due to intonational differences identified in the $\tilde{v}N$ extracted from the phrase *Eu falo x baixinho* ‘I speak x softly’ and the $\tilde{v}N$ taken from *Eu falo x* ‘I speak x’, where the target item carries the target segment at the word and phrase borders. As (11) shows, non-nasalization and the respective deletion of /N/ were observed in a final unstressed context among mid and high vowels. It was triggered to a lesser extent than other vowels and did not occur in stressed syllables.

In BP, word-final nasality can also result in oral or nasalized items, as shown in Section 3. Non-nasalization in SVP occurs paradigmatically in words with lexical stress that does not fall on the syllable that contains nasality, which is usually pre-final stress. Assuming Portuguese lexical stress is sensitive to syllabic weight, it is noticeable that words bearing the stress in the penultimate syllable have a light last syllable in general (Iosad & Wetzels, forthcoming). Considering that nasalized vowels in BP are characterized by a biphonemic /VN/ structure, words such as *bobagem* ‘nonsense’ [bo'baʒẽ] would be an exception to the rule, as this would not sustain its stronger prominence, even if it contained the last heavy syllable due to the presence of the coda /N/. Thus, the possibility of the oral realization of vowels word-finally, such as in (11.b) and (11.c), could justify the biphonemic argument, as it could indicate an attempt to regularize the stress rule in SVP. Therefore, nasality in the /N/ coda is eliminated without spreading, making the syllable light.

SVP seems to be similar to BP, blocking word-final nasality in unstressed syllables and triggering word-final nasality in stressed syllables. As postulated for the length difference between $\tilde{v}N$ and *v*, nasality is likely to consider stress and syllable structure in its application. Thus, non-performance of word-final nasality in unstressed syllables suggests the nasalized vowels are part of heavy syllables. The sequence [C \tilde{v} .] or [\tilde{v} .] would therefore correspond to a phonological heavy syllable /CvN/ or /vN/, attracting stress. As word-final nasality can be blocked in unstressed syllables, the speaker would apply the stress rule transparently and regularize the word by eliminating nasality.

Additionally, nasal coda deletion is aligned with other consonants in the coda, such as rhotics, sibilants, and lateral consonants, common targets of deletions (Balduino & Vieira 2020, Vieira & Balduino 2020). All these consonants can be deleted as they occupy the weakest position of the syllable (Goldsmith 1990, Selkirk 1982).

Considering the possibility of no vowel nasalization at the word border and the vowel lengthening of *v* followed by *N*, we interpreted vowel nasality in *SVP* as biphonemic. In this study, vowel lengthening of *ǃN* sequences is understood as a phonetic correlate of the underlying presence of a [nasal] coda. This correlate is expressed by the presence of the murmur, produced with an amount of coupling of the nasal passages to the vocal tract (Pruthi & Espy-Wilson 2004). It is widely accepted that nasal murmur distinguishes nasals as a class, with the murmur being mainly a manner cue (Recasens 1983). However, the evidence concerning place cues in murmuring is hard to establish and is not observed in this study.

According to Pruthi and Espy-Wilson (2004: 225), coupling between oral and nasal cavities introduces zeros in the nasal murmur spectrum. It is difficult, then, to examine the spectral properties of nasal murmurs as the resonances feature low amplitude caused by close proximity antiresonances and/or the lossy nasal tract. Although the murmur observed in our data indicates an element performed by the constraints of the airflow in the oral cavity, we did not examine further acoustic cues of the place of articulation — a matter for future studies. In the data, a murmur is not perceptually noted as a full consonant (although nasal consonants in onset are), even though its presence was noticed in all cases where there was nasalization. Thus, we did not interpret it as a full nasal consonant in the segmental tier or in surface representation.

Beyond the difficulty in identifying place clues in the murmur, it is only possible to state, based on the composition of our data, that the nasal appendix occurs in nasalized vowels followed by an occlusive consonant. Furthermore, this is also noticeable at word and phrase borders if the nasal is not deleted before nasality spreading. Considering the articulatory aspects of the data analyzed, we can describe the presence of the nasal murmur only in the specified contexts. Consequently, we

cannot generalize the presence of the nasal appendix in SVP in other contexts. Thus, another interesting approach for future studies would be to investigate data that diversify the types of consonants coarticulated with $\tilde{v}N$ to test whether the appendix appears specifically in a context in which such consonants are occlusive or whether there is a possibility of occurrence in other coarticulatory contexts.

We noted an approximation between STP's varieties of Portuguese and ST — a language whose genesis is related to Portuguese — as nasality in these cases is also a result of a phonological / vN / structure. However, by analyzing the duration of the segments and the difference in duration between $\tilde{v}N$ and v , some peculiarities inherent to SVP are evident in relation to ST, BP, and EP. Contrasting the values obtained for SVP with the analysis carried out for ST (Balduino et al., 2015), EP, and BP (Barbosa & Madureira 2015), it can be observed that while the average percentage difference of ST is close to that of EP (15%), that of BP (55%) is similar to SVP (49%; see Table 7), where D% is the percentage of the difference between the nasal and oral vowels.

Language	$\tilde{v}N$	v	D%
SVP	176	117	50
BP	180	116	55
EP	130	113	15
ST	187	162	15

Table 7. Duration of $\tilde{v}N$ and v in Santome, based on Balduino et al. (2015) and Barbosa & Madureira (2015)

The values shown in Table 7 include the average duration of all the vowels, stressed and pretonic, and also the nasal appendix. This broader analysis revealed that in contrast to one of our initial hypotheses regarding the percentage difference between $\tilde{v}N$ and v , there is no approximation between ST and SVP. However, the similarity between SVP and BP is latent. Both varieties establish, in a more marked way, the difference in duration between $\tilde{v}N$ and v . This correlates to the social-based affinities in the development of SVP and BP, given that both the former and the latter correspond to Portuguese language varieties emerging in Portuguese colonial or post-

colonial contexts, whose multilingualism during the colonization period was the natural and familiar situation. For an extended period, these varieties were acquired as L2s and transmitted to the younger generations.

Regarding the duration of nasal and oral vowels, we observed that $\tilde{v}N$ and v have a shorter duration in EP. Although the closest language to EP in percentage terms, ST is also the language that distances itself the most from EP when we observe the duration of v and $\tilde{v}N$ alone. Using EP as a basis, this particularity points to the possibility that creole languages do not necessarily evince the linguistic characteristics of their superstrate. Finally, oral vowels in BP and SVP are longer than v in EP. However, this difference is rather subtle, as the duration of nasalized vowels in ST, BP, and SVP is longer on average.

5. Final Remarks

SVP is a variety of Portuguese spoken in STP that does not have phonological nasal vowels, even though it has vowel nasality, as do BP, EP, and ST. We have demonstrated that vowel nasality in this variety is better explained as vowel nasalization. Therefore, nasalized vowels, which can contrast with oral vowels, are equivalent to the sequence of an oral vowel followed by a nasal consonant $/vN/$.

We found that $\tilde{v}N$ was 37% longer than v in stressed positions and 89% longer than v in pretonic positions through investigating the duration of nasalized vowel segments and oral vowel segments. Unlike varieties such as BP, however, the murmur is responsible for the vowel lengthening. According to CV phonology (Clements & Keyser 1983), the vowel lengthening identified in $\tilde{v}N$ is better described as a double association of a nasalized vowel with the CV layer. This process is the result of spreading a [nasal] feature from an unspecified nasal coda $/N/$ to a previous vowel ($vC[nasal]$). In other words, by assimilating the nasality of $/N/$, $/v/$ is realized as a nasalized vowel and is associated with the temporal unit of the nucleus and coda. Therefore, it is longer than a similar oral vowel. In turn, $/N/$ is dissociated from the

segmental layer and therefore is not phonetically implemented as a fully specified consonant. The non-nasalization of final unstressed vowels further reinforces this interpretation. It suggests that the syllable bearing nasality behaves as a heavy one and is used for stress assignment. Furthermore, we noted that even though the nasalized vowel is phonologically formed by two phonemes in SVP (as also observed for ST), the duration in each language is different. Therefore, regarding the process of vocalic nasality, this suggests that there is no evidence to support a structural linguistic influence of ST on SVP.

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