Title

Nasalization in Paraguayan Guaraní

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Abstract: I investigate nasalization processes in Paraguayan Guaraní, a Tupi-Guaraní language spoken in Paraguay. I argue that the language displays three distinct types of nasalization: productive regressive nasal harmony, lexically specific progressive pre-nasalization of a root-initial consonant, and morpheme-specific progressive nasalization of suffixes and enclitics. I identify and present evidence for a historical explanation of the differential behavior of morphemes within progressive nasalization. I additionally connect the nasal spreading patterns to lexical borrowings from Spanish, and present evidence suggesting that the incorporation of Spanish loans into the various systems of nasalization serves as a novel example of long-distance nasal harmony.

Keywords: nasality, Tupi-Guaraní, harmony, phonology-morphology interface, language contact

1 Introduction

Nasalization processes spreading both leftward and rightward are attested in Paraguayan Guaraní. Some sources have claimed that this situation provides evidence of bidirectional harmony: that a phonemic nasal vowel in a stressed syllable causes nasality to spread unbounded in both directions within a word (Kaiser 2008; Walker 2000). However, others have noted that progressive nasalization appears to be morpheme-specific and likely dependent on a different mechanism than regressive nasal harmony (Estigarribia 2020; Lapierre and Michael 2018). In this paper, I describe processes of nasalization in Guaraní, disambiguate between regressive nasal harmony and two distinct progressive morpheme-specific nasalization processes, present evidence for the historical origins of progressive nasalization, and connect these nasal spreading patterns to lexical borrowings from Spanish.

The data provided in this paper comes from original work with two native speakers of Paraguayan Guaraní, unless cited otherwise. All examples in Guaraní are written using a version of the Guaraní orthography, with the minor modification of representing nasality everywhere that it occurs on the surface. When use of the Guaraní orthography may be unclear, I include representations in both the IPA and Guaraní orthography, with the orthographic representation in parentheses.[1]

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[1] In the standard Guaraní orthography, nasality is indicated only for certain consonants and for stressed vowels. Graphemes correspond to their IPA equivalents, with some exceptions: <ch> = [ʃ]; <g> = [ɯɻ]; <ñ> = [ɲ]; <r> = [ɾ]; <u> = [w]; <v> = [ʋ]; <y> = [ɨ]; <’> = [ʔ]; <g̃> = [ŋ], <ng> = [ŋg]. Abbreviations include: A= set A agreement, B= set B agreement, AGD= agent demoter, AGT= agentive, CAUS= causative, COLL= collective, DEM= demonstrative, DESID= desiderative, DOM= differential object marking, FRUS= frustrative, FUT= future, INCIP= incipient, INCL= inclusive, INTENS= intensifier, LOC= locative, NFUT= nominal future, NMLZ= nominalizer, NPST= nominal past, PASS= passive, PL= plural, PLEA= plea, PQ= polar question, PST= past, QUAL= quality, RECIP= reciprocal, REQ= request, TOTAL= totalitative.

This paper is structured as follows: in Section 2, I provide an overview of the three distinct nasalization processes I identify in Guaraní. I first describe the system of regressive nasal harmony in 2.1, then describe and disambiguate two types of progressive nasalization in 2.2. In 2.2.3, I present a historical explanation for the differential behavior of morphemes with respect to nasalization. I compare the properties of the three types of nasalization in 2.3, and proceed to discussion of potential analyses in 3. I introduce novel data involving the interactions of loaned lexical items from Spanish with Guaraní nasal harmony in 3.1. Finally, I conclude in 4 and offer potential avenues for future research.

2 Nasalization in Guaraní

2.1 Regressive nasal harmony

Languages of the Tupi-Guaraní family, including Paraguayan Guaraní, are well known for exhibiting long-distance regressive nasal harmony systems (Lapierre and Michael 2018). The harmony system in Guaraní has been the subject of extensive description and analysis in the theoretical literature for decades (Beckman 1998; Goldsmith 1976; Gregores and Suárez 1967; Kaiser 2008; Piggott 1992; Rivas 1974; Steriade 1993; Walker 1999, 2000).

There are two possible triggers of nasal harmony in Guaraní: phonemic nasal vowels and nasal consonants. Consonants and vowels to the left of a phonemic nasal segment (underlined) surface as nasal within the phonological word (1). For vowels, nasality is contrastive only on the vowel which bears stress — in the vast majority of cases, the stressed vowel is the root-final vowel (Cabral and Rodrigues 2011). I interpret this generalization as evidence that only a stressed vowel may be specified phonologically as either oral or nasal, and all other vowels within the phonological word are underlyingly unspecified for nasality.

(1) a. mõr̃õt̰ı́
white
'white'

b. ha'e õ-ñẽ-mbo-vy'á
3 3SG.A-AGD-CAUS-happy
'He made himself happy.'

Voiceless obstruents are transparent to regressive nasal harmony, while all other segments in the inventory show the effects of nasalization (2).[2] The voiceless stops /k/ and /t/ of the verb in (2a) do not become nasal, nor do they block the spread of nasality. The same pattern can be observed for the voiceless stop /p/ in (2b). There are no consonants in the inventory which block the spread of nasality.

(2) a. ãĩ-kỹt̰ı́ yvyrá kysé=pe
1SG.A-cut wood knife=LOC
'I cut the wood with a knife.'

[2] There is one exception to this generalization: the alveolar lateral, which is voiced, does not show any effect of nasalization. However, this segment has a unique distribution in Guaraní: it is found only in ideophones and loanwords (Estigarribia 2020).

b. õ-ñẽ-nũpã́
3.A-AGD-hit
'He was hit.'

I present the attested consonant alternations in regressive nasal harmony contexts in Table 3, below. The first group — the voiced stops — are underlyingly nasal, and surface as post-oralized before oral vowels. The status of the segments of mixed nasal and oral articulation has long been debated in the Tupi-Guaraní literature. While it is generally understood that these constitute single segments, as opposed to consonant clusters, analyses vary between positing that they result from the pre-nasalization of stops (Daviet 2016; Gregores and Suárez 1967; Rose 2008) and arguing that they result from the post-oralization of nasal consonants (Cardoso 2009; Lapierre and Michael 2017; Piggott 1992). Yet other analyses posit that sets of both fully nasal consonants and partially nasal consonants are phonemic (Kaiser 2008; Robboy 1987). I take the position here that underlying nasal stops surface as partially oralized allophones before oral vowels (Estigarribia 2021; Lapierre and Michael 2018; Stanton 2017). The second group — the approximants — are underlyingly oral, and surface as nasalized before nasal vowels.

(3)

oral	**nasal**
mb	m
nd	n
ŋg (ng)	ŋ (g̃)
ŋg^{w} (ngu)	ŋ^{w} (g̃u)
r	r̃
v	ṽ
j	ɲ (ñ)
ɯ̨ (g)	ɯ̨̃ (g̃)

The presence of a phonemic nasal consonant (underlined) triggers leftward nasal spreading within the word. This pattern is visible in the example provided in (4a): the stressed vowel in the verb 'listen' is specified as oral, resulting in the post-oralization of the phonemic nasal consonant *n*, which nasalizes the segments to its left. In (4b), the consonant of the causative morpheme is a phonemic bilabial nasal, which nasalizes the prefix to its left.

(4) a. r̃õ-hẽn̲dú
1>2-listen
'I am listening to you.'

b. ñã-m̲bo-jeroký chupé
1PL.INCL.A-CAUS-dance DOM
'We made him dance.'

The domain of regressive nasal harmony in Guaraní is the root and its prefixes, which constitutes the phonological word (Lapierre and Michael 2018). All prefixes show effects of regressive nasal harmony. A nasal consonant within a prefix nasalizes vowels and consonants to its left (5a). However, a nasal vowel or consonant within a suffix does not trigger regressive nasal harmony (5b).[3]

[3] There is one apparent exception to this generalization: the presence of a suffix with an initial alveolar flap

(5) a. ha'e õ-ñẽ-mbo-vy'á
3 3SG.A-AGD-CAUS-happy
'He made himself happy.'

b. che a-vy'a-mõ'ã́
1SG 1SG.A-happy-FRUS
'I was almost happy.'

In summary, nasality spreads from a phonemic nasal vowel or consonant within the phonological word in Guaraní. This nasal harmony process takes places from right to left, as it affects segments to the left of the trigger. Regressive nasal harmony targets all segments except voiceless obstruents, which are transparent to harmony.

2.2 Progressive nasalization

Nasalization in Guaraní has a limited rightward spread, as exemplified in (6b). Following a phonemic nasal vowel, a suffix or enclitic further to the right may nasalize. As is visible from the minimal pair below in (6), the underlying form of the locative enclitic is /pe/, which surfaces as [mẽ] following a nasal vowel.

(6) a. tupá=pe
bed=LOC
'to the bed'

b. tũpã́=mẽ
god=LOC
'to God'

While an understanding of regressive nasal harmony in Guaraní has been crucial in helping to form the foundations of theoretical phonology, progressive nasalization has remained understudied and dismissed as idiosyncratic. I propose that there are actually two distinct processes of progressive nasalization in Guaraní: one initiated by the causative prefix onto a root, and one from a root-final nasal vowel onto a suffix or enclitic.

Both types of progressive nasalization crucially differ from the properties of regressive nasal harmony I have described in 2.1. While we have seen that voiceless stops are transparent to regressive nasal harmony and do not nasalize, all examples of progressive nasalization in fact target morphemes with initial voiceless stops. While regressive nasalization spreads indiscriminately throughout roots and prefixes, progressive nasalization occurs only with a select group of targets — approximately 25 roots and five affixes. Finally, while regressive nasal harmony is constant, the rate at which progressive nasalization applies is variable and morpheme-specific.

2.2.1 Root nasalization

A limited process of progressive nasalization, triggered by the causative morpheme, affects some root-initial voiceless stops. Generally, the causative morpheme in Guaraní is realized as [mõ] in

and following nasal vowel results in the spreading of nasality one segment to the left — for instance, /che-roga-rã/ is pronounced as [ʃeroɰãr̃ã́] 'my future house'. However, this surface form is likely phonetically, rather than phonologically, driven.

nasal contexts and as [mbo] in oral contexts. The nasal consonant of this morpheme spreads its nasality leftwards, as expected (7b).

(7) a. che a-puká
1SG 1SG.A-laugh
'I laughed.'

b. chẽ-mbo-puka-mí=na
1SG.B-CAUS-laugh-PLEA=REQ
'Please make me laugh.' (Estigarribia 2020:48)

However, with a set of approximately 25 individual lexical items (Estigarribia 2020, 2021), all of which include exclusively oral vowels, the causative morpheme unpredictably surfaces as fully nasal, and additionally triggers the pre-nasalization of a following voiceless stop (8b).[4] This phenomenon of progressive nasalization triggered by the causative affects only roots with initial voiceless stops. However, as is visible from (7b) above, not all root-initial voiceless stops are affected.

(8) a. che a-paý
1SG 1SG.A-wake.up
'I woke up.'

b. ha'e chẽ-mõ-mbáy
3 1SG.B-CAUS-wake.up
'She woke me up.'

Nasal roots, including those which have initial voiceless stops, never undergo progressive nasalization (9). This is not unexpected on articulatory grounds, as the environment in between two nasal vowels would not be suitable for a stop with mixed oral-nasal articulation.

(9) a. che chẽ-kãnẽ'ő
1SG 1SG.B-tired
'I am tired.'

b. pe je-dipará õ-mõ-kãnẽ'õ-itereí chupé
DEM AGD-run 3.A-CAUS-tired-INTENS DOM
'Running makes him tired.'

c. *pe je-dipará õ-mõ-ngãnẽ'õ-itereí chupé
DEM AGD-run 3.A-CAUS-tired-INTENS DOM
intended: 'Running makes him tired.'

Estigarribia (2021) considers these exceptional instances of root-initial consonant nasalization to be 'vestiges of earlier phonological rules from pre-Proto-Tupi-Guarani but not active in Paraguayan Guarani'. This analysis is supported by findings from elsewhere in the Tupi-Guaraní family: in Tupinambá, an extinct language documented in 1595 by Jesuit missionary Joseph de

[4] I refer to this alternation as pre-nasalization, as opposed to the post-oralization of nasal consonants I have described earlier, as the underlying consonant in these contexts is clearly an oral stop: /p/ becomes [mb].

Anchieta, a nasal consonant triggered the nasalization of a following morpheme-initial voiceless consonant within the same phonological word (Jensen 1998). Estigarribia proposes that this productive process of progressive nasalization was lost in the passage from pre-Proto-Tupi-Guaraní to Proto-Tupi-Guaraní (PTG), and regressive oralization later appeared, resulting in the oral allomorph [mbo] of the causative morpheme. The exceptional progressive nasalization pattern attested in examples like (8b) is a remnant of this older nasalization rule, which has survived only in a small collection of roots. This analysis in which vestiges of a historically productive rule are maintained only with a few lexical items is further supported by semantic drift in Guaraní. Some roots, like *karaí* 'man', allow for both the irregular formation of the causative described here, as well as the regular construction with no nasalization (10). However, these formations differ in their interpretations. The form with progressive nasalization (10a) has gained an idiomatic meaning, while the regular form (10b) has a compositional meaning.

(10) a. pe pa'í õ-mõ-ngaraí pe mĩtã́=mẽ
DEM priest 3.A-CAUS-man DEM child=LOC
'The priest baptized the child.'

b. pe i-vigóte õ-mbo-karaí pe mĩtã́=mẽ
DEM 3.B-mustache 3.A-CAUS-man DEM child=LOC
'The mustache makes the boy look like a man.'

To summarize, progressive nasalization involving root-initial consonants is exceptional: the causative morpheme triggers allomorphy in some roots, in which the root-initial voiceless stop surfaces as pre-nasalized. These synchronically unproductive forms represent vestiges of a much older system of progressive nasalization from prefixes onto roots.

2.2.2 Suffix nasalization: differential behavior of morphemes

Another type of progressive nasalization present in Guaraní manifests in the progressive spreading of nasality from a nasal vowel onto a suffix or enclitic (11). The oral form of the totalitative suffix in (11a) is /pa/, and the oral form of the locative enclitic in (11b) is /pe/. Following a phonemic nasal vowel, /pa/ surfaces as /mba/ with an initial pre-nasalized voiced stop and oral vowel, while /pe/ surfaces as /mẽ/ with an initial nasal consonant and nasal vowel.

(11) a. ã-ñẽ'ẽ-mbá
1SG.A-talk-TOTAL
'I finished talking.'

b. ã-ĩmé̋ nẽ-rõké̋=mẽ
1SG.A-be.LOC 2SG.B-door=LOC
'I am at your door.'

This nasalization process, like progressive nasalization of root-initial consonants, is morpheme-specific: some suffixes may undergo harmony while others never do. Estigarribia (2020) lists 12 suffixes and enclitics which are affected by progressive nasal spreading. However, in my work with

native speaker consultants, only five suffixes and enclitics productively undergo nasalization (12).[5] All five have initial voiceless stops in their oral forms.

(12)

oral	**nasal**	**gloss**
-pa	-mba	TOTAL
=pe	=mẽ	LOC
=peve	=mẽve	'until'
-pota	-mbota	INCIP
-kue	-g̃uẽ	NPST

A stressed nasal vowel can trigger progressive nasalization (13).[6]

(13) a. ã-ñẽ'ẽ-mbá
1SG.A-talk-TOTAL
'I finished talking.'

b. ã-ĩmé̋ nẽ-r̃õké̋=mẽ
1SG.A-be.LOC 2SG.B-door=LOC
'I am at your door.'

c. nd-a-ha-mõ'á̋-ĩ r̃ẽ-ñẽ'é̋=mẽve
NEG-SG.A-go-FRUS-NEG 2SG.A-talk=until
'I won't leave until you talk.'

d. ã-ñẽ'ẽ-mbota-ité
1SG.A-talk-INCIP-INTENS
'I am about to talk.'

e. õkẽ-g̃ué̋
door-NPST
'a former door'

If a nasal consonant is followed by an oral vowel, and therefore surfaces as post-oralized, nasality cannot spread rightwards (14). This is expected on articulatory grounds: nasality cannot spread through the orally articulated portion of the post-oralized consonant. As such, all triggers of suffix nasalization must be nasal vowels.

[5] A sixth, COLL=*kuéra*, nasalizes only following a few frequent lexical items, like *mĩtã* 'child' and *kũñã* 'woman'. Other suffixes and enclitics listed by Estigarribia as having nasal allomorphs include three forms of the passive nominalizer – NMLZ.PASS *-py/mby*, NMLZ.PASS.PST *-pyre/mbyre*, NMLZ.PASS.FUT *-pyrã/mbyrã* – COLL.PL *-ty/ndy* and 'towards' *-got(y)o/ngot(y)o* (Estigarribia 2020:314). These alternations were unproductive for the two speakers with whom I consulted.

[6] Importantly, there is a great deal of variation within and across speakers as to whether the oral or nasal allomorph of a suffix is used. In preliminary studies of a corpus of Paraguayan newspaper articles (Chiruzzo, Amarilla, Ríos, and Lugo 2020), I have found that certain suffixes, like LOC=*pe*, nasalize significantly more frequently than others, like 'until' =*peve*. Additionally, factors like word and construction frequency seem to be relevant in rates of suffix nasalization. I leave specific details of this variation for future work.

(14) a. ã-hẽndú
1SG.A-listen
'I listened.'

b. ã-hẽndu-pá
1SG.A-listen-TOTAL
'I finished listening.'

c. *ã-hẽndu-mbá
1SG.A-listen-TOTAL
intended: 'I finished listening.'

There does not appear to be any clear natural class on phonological, morphological, or semantic grounds with which we can isolate only those suffixes and enclitics which undergo progressive nasalization. Additionally, within those that do nasalize, the actual effect of progressive nasalization is morpheme-specific: some suffixes and enclitics fully nasalize, while others only undergo partial nasalization, as the initial consonant becomes pre-nasalized (15).

(15)

	oral	**nasal**	**gloss**
pre-nasalization	-pa	-mba	TOTAL
	-pota	-mbota	INCIP
full nasalization	=pe	=mẽ	LOC
	=peve	=mẽve	'until'
	-kue	-g̃uẽ	NPST

Notably, all morphemes which undergo progressive nasalization begin with voiceless stops. However, it is not the case that all voiceless stop-initial morphemes may nasalize: for instance, the totalitative suffix /-pa/ nasalizes, while the segmentally identical interrogative enclitic /=pa/ may not (16).

(16) a. ã-ñẽ'ẽ-mbá
1SG.A-talk-TOTAL
'I finished talking.'

b. ã-ñẽ'é=pa
1SG.A-talk=PQ
'Am I talking?'

A natural next step is to examine the stress properties of affixes, as stress appears to be relevant in distinguishing between the morphemes highlighted in (16). Affixes in Guaraní can be classified as either stress-bearing or non-stress-bearing. Stress-bearing suffixes form a single prosodic word with the base, while non-stress-bearing ones are prosodified separately (Dąbkowski 2021). Since the final syllable of the prosodic word is the target of final stress assignment in Guaraní, a stress-bearing affix bears stress when it is word-final. However, there does not appear to be any correlation between whether a morpheme bears stress and whether or not it can undergo progressive nasal harmony. Among the five affixes that may show the effects of progressive nasalization, three are stress-bearing (TOTAL, INCIPand NPST) and two are non-stress-bearing (LOCand 'until').

I conclude, therefore, that there is no predictable phonological property of a morpheme that can conclusively determine whether it not it may undergo progressive nasalization. This is further supported by the observation that several morphemes which Estigarribia (2020) lists as undergoing progressive nasalization are deemed unproductive for the consultants with whom I have worked.

2.2.3 Diachronic origins

The question remains, however: is it possible to identify why some morphemes become fully nasalized and others become pre-nasalized? For instance, the totalitative suffix /-pa/ pre-nasalizes following a nasal vowel, while the nominal past suffix /-kue/ fully nasalizes in the same phonological context, despite the two suffixes sharing the same properties with respect to stress. We can gain some insight into these processes by consulting reconstructions of morpheme origins in PTG. The suffixes which pre-nasalize in progressive nasalization contexts are historically derived from standalone roots, while the suffixes which fully nasalize are reconstructed by Jensen (1998) as affixal morphemes in PTG.[7]

(17)

	oral	**nasal**	**gloss**	**PTG origin**
pre-nasalization	-pa	-mba	TOTAL	*pav ‘finish’
	-pota	-mbota	INCIP	*potar ‘want’
full nasalization	=pe	=mẽ	LOC	*pe ‘to’
	=peve	=mẽve	‘until’	*pe ‘DEM’ + *pe ‘to’
	-k^{w}	-ŋ^{w}ẽ	NPST	*p^{w}er ‘NPST’

Both affixes that surface as pre-nasalized are derived from roots, and are, in fact, synchronically roots of their own (18a; 19a).[8] The initial consonant of each root also appears as pre-nasalized in certain morphophonological contexts (18b; 19b).

(18) a. o-pá la ý
3.A-finish DEF water
‘The water is finished.’

b. õ-mõ-mbá teko-jojá pỹtỹvõ-hára
3.A-CAUS-finish NMLZ.QUAL-equal help-AGT
‘He finished his law degree.’

c. õ-ñẽ’ẽ-mbá
3.A-talk-TOTAL
‘He finished talking.’

[7] The stress facts — whether or not an affix can bear stress — fall out from the presence or absence of a final consonant in the reconstructed PTG form. The totalitative, incipient, and nominal past suffixes are stress-bearing in present day Paraguayan Guaraní, while the locative and ‘until’ enclitics are non-stress-bearing.
[8] It does not seem to be the case that these affixes could be analyzed synchronically as serial verb constructions. If these behaved like typical serial verb constructions in Guaraní, we would expect to see subject agreement on both roots.

(19) a. ai-potá che-tasã-ɾ̃á̵
1SG.A-want 1SG.B-cup-NFUT
'I want a cup for myself.'

b. che-remi-mbotá
1SG.B-NMLZ-want
'my will' (Estigarribia 2020:316)

c. ã-ñẽ'ẽ-mbota-ité
1SG.A-talk-INCIP-INTENS
'I am about to talk.'

The historical pre-nasalization of these affixes, then, is consistent with the earlier phonological rule discussed in the context of exceptional causative nasalization. Historically, a nasal segment triggered the pre-nasalization of a following morpheme-initial voiceless consonant within a phonological word (Estigarribia 2021). The pre-nasalization of affixes with origins as roots, then, is likely attributable to this historically productive progressive nasalization process. The full nasalization of the remaining morphemes may be attributable to an even older process of progressive nasalization, as attested in Tupinambá.

2.3 Comparison of nasalization processes in Guaraní

I have described and defined three distinct processes of nasalization in Guaraní: regressive harmony, progressive root nasalization, and progressive suffix pre-nasalization. I have introduced data to support the conclusion that these should be considered distinct processes, contrary to the claim previously made for Guaraní that these are reflections of a single bidirectional harmony system. Rather, Guaraní provides an example of a language with a robust regressive system of nasal harmony and two distinct morpheme-specific processes of progressive nasalization across a morpheme boundary. In (20), below, I compare several properties of these three processes. Regressive harmony differs from root and suffix nasalization in directionality. All three differ in what may be a possible trigger of nasalization: a phonemic nasal vowel or consonant triggers regressive nasal harmony, while root nasalization may only occur following a prefix which includes a nasal consonant. Suffix nasalization, on the other hand, may only be triggered by a nasal vowel. Regressive harmony targets all previous segments except for voiceless obstruents, which are transparent. Root and suffix nasalization, on the other hand, target exclusively initial voiceless stops. The effects of regressive harmony and suffix nasalization are full nasalization of segments, e.g. /j/ surfacing as [ɲ] and /p/ surfacing as [m], respectively. The effect of root nasalization, on the other hand, is the pre-nasalization and voicing of a voiceless stop. Finally, regressive harmony is fully productive, while both root and suffix nasalization processes are limited to a very small number of specific morphemes.

(20)

	harmony	**root nasalization**	**suffix nasalization**
Direction	R-to-L	L-to-R	L-to-R
Trigger	nasal V or C	CAUS for roots, nasal V for suffixes	nasal V
Target	all segments except voiceless obstruents	root-initial voiceless stop	suffix-initial voiceless stop
Effect	full nasalization	pre-nasalization	full nasalization
Domain	root + prefixes	initial segment	initial syllable
Frequency	fully productive	∼25 roots + 2 suffixes	2 enclitics + 1 suffix

3 Proposals and discussion

An account of nasalization in Guaraní must be able to account for the distribution of these three patterns. However, these are sometimes contradictory: nasality always spreads leftwards within the domain of a root and its prefixes, but appear to spread rightwards onto only some roots and some suffixes. Voiceless obstruents are transparent to the leftward spread of nasality, but are the targets of the rightward spread of nasality. A single unified analysis of nasal spreading in Guaraní would not reflect the reality of the data, as I have demonstrated that there are in fact three distinct processes at work. Instead, I propose that the three processes I have described are most appropriately treated as distinct phenomena.

First, regressive nasal harmony can be straightforwardly handled in an Optimality Theory framework, with constraints referencing agreement across adjacent syllable nuclei, as well as coarticulation within syllables (Thomas 2014).[9] An allomorphy-based analysis, however, is most appropriate for progressive nasalization phenomena in Guaraní. Exceptional root-initial voiceless stop pre-nasalization is attributable to a historical nasalization process that has ceased to be productive in Guaraní, and is retained with only a small number of roots and two affixes derived from verbs. Nasality spreading from a root onto a suffix or enclitic is best viewed as allomorphy as well: the nasal allomorph of a morpheme is triggered by the presence of a phonemic nasal vowel in the root to which it attaches. Further evidence for an allomorphy account comes from contexts such as (21). A phonemic nasal vowel can trigger the nasalization of a suffix, even though the trigger is not linearly adjacent to the target. Here, the nasal allomorph of the suffix appears after a fully oral vowel: this realization is unexpected articulatorily, as nasality would not be predicted to spread through an oral vowel. I propose that the choice of suffix allomorph is dependent on the value of nasality of the stressed vowel in a root: in other words, the presence of a phonemic nasal vowel triggers the potential for nasal allomorphy in a suffix. The actual phonological forms of the allomorphs are morpheme-specific vestiges of diachronic nasalization processes.

(21) a. õ-ñẽ'ẽ-se-**mb**á
3.A-talk-DESID-TOTAL
'He wanted to finish talking.'

[9] I do not provide a full constraint-based account of Guaraní regressive nasal harmony here, but rather leave this for future work.

b. õ-ñẽ'ẽ-**mb**a-**mb**otá
3.A-talk-TOTAL-INCIP
'He is about to finish talking.'

3.1 Interactions with loanword morphophonology

Due to colonization, Guaraní has been in extensive contact with Spanish for more than five hundred years. As a result of this contact, a wide range of lexical items from Spanish have been borrowed into Guaraní. Much work on the interplay between Guaraní and Spanish has focused on description as well as the comparative uses of the two languages in different spheres (Choi 2005; Fernández-Barrera 2015; Gynan 1998; Thun 2005; Zajícová 2009): however, relatively little theoretical investigation has been carried out into the morphophonology of language mixing between Guaraní and Spanish. The existing theoretical work on the interactions of lexical borrowings with Guaraní morphophonology has centered on the phonological adaptation of loanwords from Spanish into Guaraní (Pinta and Smith 2017). Pinta and Smith identify five lexical stratal grammars, classified on the basis of the degree to which phonological structure is repaired. Progressively more phonological structure is allowed as strata become more peripheral.

Spanish has phonemic nasal consonants (bilabial /m/, alveolar /n/, and palatal /ɲ/), but no phonemic nasal vowels (Harris 1984). As such, Spanish loanwords contain surface phonological environments that never occur natively in Guaraní, since underlying nasal consonants always surface as partially oralized allophones before oral vowels. Some VN sequences in Spanish loanwords have been reinterpreted in Guaraní as phonemic nasal vowels, and obey nasal harmony within the root. These items maintain the relationship between stress and contrastive nasality that is found in Guaraní.

(22) a. che ã-ñãndú chẽ-kõrãsó=mẽ
1SG 1SG.A-feel 1SG.B-heart=LOC
'I feel it in my heart.' (cf. Spanish *corazón* 'heart')

b. õ-í pẽtẽĩ tã'ýĩ limó=mẽ
3.A-be.LOC one seed lemon=LOC
'There is a seed in the lemon.' (cf. Spanish *limón* 'lemon')

Most loanwords containing nasal consonants, however, are pronounced approximately as they are in Spanish (23).

(23) a. a-kosiná
1SG.A-cook
'I cooked.' (cf. Spanish *cocinar* 'to cook')

b. *ã-kõsĩndá
1SG.A-cook
intended: 'I cooked.'

c. *ã-kõsĩná
1SG.A-cook
intended: 'I cooked.'

The presence of a nasal consonant (in bold) can trigger nasalization in morphemes further to the left, even when the vowels and consonants in between are oral (24). The presence of a nasal consonant can also trigger the choice of a nasal allomorph in morphemes to the right, even when the vowels and consonants in between are oral (24b).

(24) a. ñã-ñõ-traisjo**n**á=ta
1PL.INCL.A-RECIP-betray=FUT
'We will betray each other.' (cf. Spanish *traicionar* 'to betray')

b. õ-ñẽ-**m**akiʎá=mẽve che n-ã-reko**n**osé-i chupé
3.A-AGD-makeup=until 1SG NEG-1SG.A-recognize-NEG DOM
'Until she put on makeup, I didn't recognize her.' (cf. Spanish *maquillarse* 'to put on makeup' and *reconocer* 'to recognize')

c. n-ã-ga**n**á-i
NEG-1SG.A-win-NEG
'I didn't win.' (cf. Spanish *ganar* 'to win')

This data, which involves the interactions of Spanish loanword morphophonology with Guaraní nasalization processes, provides evidence for innovation in Guaraní nasalization. As we can observe in examples like (24a), some familiar properties of regressive nasal harmony are present. For instance, the direction of nasal spreading is from right to left, and prefixes nasalize fully. The trigger is obligatorily a nasal consonant, due to the lack of phonemic nasal vowels within the loaned items. Importantly, though, all previously attested examples of nasalization within Guaraní are local: nasality spreads from one syllable to the syllable directly adjacent to it. The data involving loanword roots, on the other hand, constitutes a novel case of long-distance nasal harmony, a typologically rare phenomenon (Rose and Walker 2011). Similarly, in examples like (24b), the presence of a nasal consonant may trigger the choice of a nasal allomorph in suffixes and enclitics. Here too, the trigger of nasalization differs from the canonical Guaraní cases I have presented earlier. Due to phonotactic constraints in the language, suffix nasalization typically can only be triggered by a nasal vowel. However, due to the novel phonotactic environments found within Spanish loans, there is evidence of innovation in that a nasal consonant within a Spanish loan can trigger progressive nasalization. The interactions of loanword morphophonology with Guaraní nasal harmony is an area of study which is ripe for future work and has the potential to inform our understanding of innovation in phonological processes.

4 Conclusions

There are three distinct processes of nasalization present in Guaraní: long-distance regressive nasal harmony, progressive root nasalization, and progressive suffix nasalization. The three processes differ in trigger, target, effect, and domain. Contrary to prior claims, this data does not support the claim that Paraguayan Guaraní has bidirectional nasal harmony. Both types of progressive nasal spreading are examples of suppletive allomorphy. A subset of roots is lexically specified as having a pre-nasalized allomorph in causative contexts. Suffixes and enclitics with historical origins as roots surface as their pre-nasalized allomorphs when following a nasal root. Several other suffixes and enclitics have fully nasal allomorphs, which appear following a nasal root. Lexical borrowings from

Spanish present novel non-native phonological environments, and the presence of a nasal consonant within a loanword root can trigger the non-local nasalization of morphemes in both directions. Avenues for future research include determining whether non-local nasalization triggered by a nasal consonant within a loanword is best analyzed as allomorphy or discontinuous nasal harmony. This work contributes to furthering our understanding of nasality in Paraguayan Guaraní, as well as to mapping out multiple processes of nasalization that co-exist within a single language. The data I have presented, in which nasal consonants within loanword roots are able to act as triggers of non-local nasalization, serves as an example of further innovation within such a system.

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