Suffix independence in Paraguayan Guarani: stress, nasality, and nasalization

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Abstract

This paper proposes an updated analysis of the nasality and nasalization patterns in Paraguayan Guarani. I use new data collected in virtual and in-situ fieldwork in Coronel Oviedo, Paraguay to show that Guarani suffixes, compared to prefixes, are less cohesive with the patterns of nasality and leftward nasalization characteristic of roots. I argue that Paraguayan Guarani's nasality and nasalization processes are best analyzed as positional faithfulness at the *right edges* of phonological words, that, along with the language's cyclic morphological structure in suffixes, predict the observed suffix independence in Guarani. This is in opposition to analyses that strongly ties nasality to stress, which has been the prominent analysis of Guarani nasality and nasalization for decades (Beckman 1998). These new data ultimately contribute to our understanding of affix asymmetries, where prefix independence is more common crosslinguistically (Hyman 2008; Elkins 2020), but Guarani shows a case of suffix independence.

Keywords: nasal harmony; Paraguayan Guarani; prefix-suffix asymmetries; suffix independence; positional faithfulness

1 Introduction

Crosslinguistically, phonological processes may apply equally to prefixes and suffixes, or these may show asymmetries in their participation in phonological rules. An example of this phenomenon comes from Yaka (Hyman 1995; Elkins 2020). Examples (1a) and (1b) below show that nasal consonants in Yaka roots (bolded) trigger nasal-consonant harmony onto a following suffix (boxed), but, at the surface, nasal consonants in prefixes fail to trigger alternations in roots, as observed in (1c). This is a case of *prefix independence*, wherein the phonology of prefixes is not entirely cohesive with the regular phonology of roots and other affixes.

(1) a. tsúb-i⬚di 'to wander' b. tsú**m**-i⬚ni 'to sew' c. **m**a-⬚dáfú, *ma-⬚náfú 'palm wine'

This paper investigates the phonological behavior of suffixes in Paraguayan Guarani, specifically with regards to stress, nasality, and nasalization, using newly collected fieldwork data. Paraguayan Guarani (henceforth, Guarani) is a language spoken by 5-6 million people in Paraguay and neighboring Argentina and Brazil, and has significantly contributed to developments in phonological theory (Beckman 1998; Piggott 2003; Walker 1998, 2014) and linguistic theory and typology more generally (Velázquez-Castillo 2007; Tonhauser 2011; Zubizarreta and Pancheva 2017; Jun and Zubizarreta 2022:to name a few). I argue that Guarani displays *suffix independence*, wherein the phonological patterns of roots and prefix don't extend, or apply to, suffixes. A brief example is shown in (2) below. (2a) shows that, in the presence of a stressed oral vowel in the root, all preceding vowels in the root and prefix are oral and the first person plural prefix has [ʤ] (boxed) as its initial consonant. And, (2b) shows that, in the presence of a stressed nasal vowel in the root, the first person plural prefix show the initial consonant [ɲ] and all other preceding vowels are nasalized. However, this pattern of leftward nasalization doesn't hold in (2c): the nasal suffix [-ɾ̃õ] fails to trigger leftward nasalization onto the preceding root and prefix, as evidenced by the lack of nasal vowels in the root and prefix and the failure for [ʤ] to alternate to [ɲ] in the root.

(2) a. *ĵa-jeroky*
[ʤa-ʤeroˈkɨ]
1PL.IN-dance
'we dance'[1]

b. *ñ̃a-kosina*
[ɲã-kõsĩˈnã]
1PL.IN-cook
'we cook'

c. *o-ĵehu-rõ*, **o-ñ̃ehu-rõ*
[o-ʤehu-ˈr̃õ], *[õ-ɲẽhũ-ˈr̃õ]
3-happen-if
'if it happens'

Crucially, the new field data on Guarani suffixes presented in this paper challenges prominent analyses of nasality and nasalization patterns of the language. These previous analyses claim that Guarani nasality and nasalization are inherently tied to stress: the oral/nasal contrast of vowels is restricted to stressed syllables, only vowels in stressed syllables trigger regressive nasalization, and stressed syllables may block nasalization triggered by other stressed syllables (Trigo 1993; Flemming 1994; Sportiche 1977; Vergnaud and Halle 1978; Beckman 1998; Walker 1998, 1999, 2000; Kaiser 2008). The new fieldwork data showcasing the phonological behavior of suffixes disentangles nasality and nasalization from stress. The data shows that stressed and unstressed suffixes have the same phonological behavior: both retain the oral-nasal contrast and both fail to nasalize preceding suffixes, roots, and prefixes. This latter point is observed in (2c) above.

Given this observed incohesiveness of the language's suffixes to the regular phonology of roots and prefixes, I instead propose that Guarani nasality is positionally faithful at the *right edges of words*, as opposed to at stressed syllables. This right-alignment of nasality, combined with the the language's cyclic morphological structure in the domain of suffixes, accounts for the independence of suffixes from the regular phonology of nasality and nasalization in roots and prefixes. Right-edge faithfulness is additionally supported by data in the domain of roots and prefixes, since monomorphemic words with non-final stress show full agreement in nasality. All in all, previous analyses propose stressed syllable positional faithfulness because the distribution of stress and nasality are confounded at the surface in Guarani since stress and nasality are both right-aligned and are both sensitive to the language's cyclic morphological structure in suffixes. But, the nasalization patterns of roots with non-final stress and of forms with suffixes both show that nasality is indeed lexically specified at the right edges of words as opposed to at stressed syllables.

Although I analyze the language's cyclic morphological structure via output-to-output faithfulness, wherein morphologically complex forms must remain faithful to their immediate morphological neighbor, I propose a possible prosodic analysis to Guarani suffix independence as an alternative to the morphophonological analysis. However, this prosodic analysis crucially challenges previous prosodic analyses for Guarani that account for other morphonological and phonological phenomena (Dabkowski 2022a,b; Russell 2023a; Dabkowski and Russell 2025), since these previous analyses fail to account for the full facts of Guarani nasality and nasalization. I also show that the proposed analyses are compatible with Guarani's system of progressive (rightward) nasalization, which is ultimately a completely different and independent system of nasalization than regressive nasalization.

This paper is structured as follows. Section 2 briefly provides some background on the language and a description of its basic phonology. Here I also describe the distribution of nasality and the pattern of regressive nasalization, detailing their analysis as stressed syllable positional faithfulness as originally proposed in Beckman (1998). Section 3 reports the nasalization pattern of forms with suffixes from the new fieldwork data, and shows that the stressed syllable positional faithfulness analysis fails to predict the new data on Guarani suffixes. Section 4 proposes the analysis of Guarani suffix independence as right-edge faithfulness and output-output correspondence, and re-evaluates the status of stressed syllable positional faithfulness by revisiting the phonological facts of forms with non-final stress. Section 5 discusses the implications of this analysis for Guarani progressive nasalization, arguing that an analysis of progressive harmony as phonologically conditioned suppletive allomorphy is perfectly compatible with the proposed mechanisms for regressive nasalization. Finally, Section 6 provides some discussion on the status of

[1]The following abbreviations are used in Paraguayan Guarani glosses: AGD = agent demotion; CAUS = causative; CMPL = completive; DES = desiderative; DEST = destinative; DOM = differential object marking; EX = exclusive; FRST = frustrative; FUT = future; IMP = imperative; IN = inclusive; INT = intensifier; INCIP = incipient; LOC = locative; NEG = negation; PL = plural; POS = possessive; PRV = privative; REC = reciprocal; RED = reduplicant; REQ = requestative; TOT = totalitative.

Guarani in the typology of prefix-suffix asymmetries and compared Guarani with the only other potentially attested case of suffix independence. This section also presents the alternative prosodic analysis to Guarani suffix independence, showing that the prosodic structures proposed in previous literature fail to account for the full nasalization facts.

2 Background

2.1 Language background

Paraguayan Guarani (henceforth, Guarani) is a member of the Tupian language family within the Tupi-Guarani subfamily. The Paraguayan variety of Guarani is spoken by 5-6 million people in Paraguay and in neighboring areas of Argentina and Brazil. Both Paraguayan Guarani and Spanish are the official languages of Paraguay, with Guarani acquiring its status as an official language in 1992. The language is learned as a first language for many children, with around 80% of the population speaking Guarani at home (Estigarribia 2020).

Unless otherwise specified, all Paraguayan Guarani language data in this work were collected in consultation with eight native speakers of the language through structured elicitation. All speakers are either bilingual Guarani-Spanish speakers, or speak Spanish as a second language. The data from six speakers were collected in in-situ fieldwork in Coronel Oviedo, Paraguay. Coronel Oviedo is a mid-sized town in south-central Paraguay with a population of around 50,000. The ages of these speakers range from 24 to 70 years old. The data for the remaining two speakers were collected remotely via *Zoom*. These two speakers are from the cities of Asunción and Concepción. Asunción is the capital of Paraguay located along the southeastern border of the country, and Concepción is a city in north-central Paraguay. Both speakers currently live in the United States.

2.2 Basic phonology

The consonant and vowel charts of Guarani are given in (3) and (4) below, with the orthographic transcriptions of the sound of the language given in italics if different from their IPA transcription. Guarani lacks plain voiced stops and instead has nasal-oral contour stops (*mb, nd, ng*), often referred to as “prenasalized stops" in previous (Tupi-)Guarani literature. The phonological status of these nasal-oral stops is discussed in Section 2.3.2 below. The language has a six-vowel system where both oral and nasal version of these vowels contrast, rendering a total of 12 phonemic vowels.

(3)

p	t			k	ʔ ʼ
m^b *mb*	n^d *nd*			$ŋ^g$ *ng*	
m	n		ɲ *ñ*	$ŋ^g$ *g̃*	
			ʤ *j*		
	s	ʃ *ch*			
ʋ *v*	ɾ *r*			ɰ *g*	

(4)

i, ĩ	ɨ, ɨ̃ *y, ỹ*	u, ũ
e, ẽ		o, õ
	a, ã	

All syllables of Guarani are of type (C)V. Nasal-oral stops are possible onsets and may occur word initially. Guarani is predominantly stress final, with only a few morphemes occurring with penultimate and even antepenultimate stress. In morphologically complex words, stress shifts to the rightmost lexically stressed morpheme. (5a) below shows that the future suffix [-ta] is a lexically unstressed suffix since it fails to attract stress from the root. On the other hand, the desiderative suffix [-se] in (5b) is lexically stressed

since it attracts stress from the root. (5c) shows that stress remains at the rightmost lexically stressed suffix, which is desiderative [-se]. Prefixes are never stressed.[2]

(5) a. *a-karú-ta*
[a-ka$^{\text{l}}$ɾu-ta]
1SG-eat-FUT
'I will eat'

b. *a-karu-se*
[a-kaɾu-$^{\text{l}}$se]
1SG-eat-DES
'I want to eat'

c. *a-karu-sé-ta*
[a-kaɾu-$^{\text{l}}$se-ta]
1SG-eat-DES-FUT
'I will want to eat'

Various previous works on Guarani note that lexically stressed syllables retain secondary stress when these are non-final and not immediately adjacent to the rightmost lexically stressed syllable (Gregores and Suárez 1967; Estigarribia 2020; Dabkowski 2022a,b; Russell 2023a; Dabkowski and Russell 2025). However, secondary stress was not consistently perceptible to me among the language consultants whose data I describe here.[3] And, there are no other phonological phenomena that are sensitive to secondary stress. So, in this paper, I refrain from transcribing secondary stress, only noting which syllables are lexically stressed with underlines in the orthography going forward.

2.3 Nasality, nasal harmony, and stressed syllable positional faithfulness

Guarani nasality and nasalization has been described for decades (Gregores and Suárez 1967; Lunt 1973; Rivas 1974, 1975; Humbert and Piggott 1997; Crowhurst 1998), and the pattern benefits from more recent and ongoing descriptive and analytical work (Lapierre and Michael 2018; Estigarribia 2020, 2021; Russell 2021, 2022, to appear; Dabkowski and Russell 2025).

This subsection describes previous analyses of Guarani nasality and nasalization. These argue that Guarani nasalization is tied to stress (Sportiche 1977; Vergnaud and Halle 1978; Trigo 1993; Flemming 1994; Beckman 1998; Walker 1998, 1999, 2000; Kaiser 2008; Dabkowski and Russell 2025), leading to the primary analysis of Guarani nasality and nasalization as stressed syllable positional faithfulness (Beckman 1998). Section 2.3.1 introduces this analysis following Beckman (1998), and Section 2.3.2 and 2.3.3 briefly discuss the status of Guarani nasal-oral stops assumed in this paper. The data in this section have already been described and analyzed in this previous literature, and have been confirmed with the Guarani language consultants whose data is described in this paper.

2.3.1 Positional faithfulness at stressed syllables

In the domain of roots and prefixes in Guarani, the distribution of the oral/nasal contrast in vowels and the process of regressive nasalization are argued to be closely tied to stress. The oral/nasal contrast of vowels is limited to stressed syllables, and the nasality of segments preceding the stressed vowel is completely predictable from the nasality or orality of the stressed vowel. The data in (6) below demonstrates this distribution. (6a) shows that, when the stressed vowel is oral, all preceding segments are oral, while (6b) shows that when the stressed vowel is nasal (bolded), all preceding segments are nasal. Voiceless segments are transparent to nasalization in Guarani: they fail to nasalize in nasal spans and they don't block nasality from spreading onto preceding segments. Finally, (6c) and (6d) show that, within the same root, voiced segments may not disagree in nasality.

[2] All example data in Guarani are represented using a four-line gloss. First, the word or sentence is spelled in the Guarani orthography, followed by the phonetic representation in IPA. The last two lines represent the morphological gloss and the translation to English.

[3] I further confirmed the overall absence of secondary stress by assessing the intonation contour of suffixes forms with various combinations of lexically stressed and unstressed syllables. Guarani's tri-tonal pitch accent (HLH* Jun and Zubizarreta (2022); Jun et al. (2023)) was consistently associated with rightmost lexically stressed syllables in neutral declarative contexts. For more on Guarani prosodic realization and intonation, see Clopper and Tonhauser (2013) and Zubizarreta (2022).

(6) a. *tupa*
[tuˈpa]
'bed'

b. *tup**ã***
[tũˈpã]
'god'

c. *[tuˈpã]

d. *[tũˈpa]

This close relationship between the distribution of nasality and stress is also observed in forms with more than one root. When two underlyingly stressed syllables are present in the same form, lexically stressed oral vowels block nasalization from a stressed nasal vowel to their right, even when the preceding oral vowel has no surface primary stress. The examples in (7) below show this simultaneous triggering and blocking effect of stressed syllables in compounds.[4] Here, the nasality of the rightmost lexically stressed vowel spreads only up to the next lexically stressed syllable to its left. Note that voiced segments nasalize in the presence of root-internal nasal vowels, while voiceless stops remain fully transparent. Lexically stressed syllables are underlined in the IPA transcription when necessary.

(7) a. *avati-mir**ĩ***
[avaṯi-mĩˈr̃ĩ]
corn-small
'wheat'

b. *Ava-ñe'**ẽ***
[aṿa-ɲẽˈʔẽ]
man-word
'Guarani (language)'

c. *py'a-por**ã***
[pɨʔa-põˈr̃ã]
heart-pretty
'kindness'

Although a variety of literature notes the tight relationship between stress, nasality, and nasalization, I follow (Beckman 1998)'s formalization of the facts for Guarani.

Beckman (1998) argues that Guarani nasality is positionally faithful at lexically stressed syllables. Crosslinguistically, languages often maintain segmental contrasts in prominent positions and neutralize contrasts in non-prominent positions, segments in prominent positions trigger phonological processes and, conversely, segments in prominent positions often block phonological processes (Steriade 1994; Beckman 1997, 1998; Fougeron and Keating 1997; Cho and Keating 2009). As showcased in the data above, Guarani exhibits all these three properties of positional faithfulness at stressed syllables: the oral/nasal contrast of vowels is limited to stressed syllables (positional neutralization), only stressed syllables trigger regressive nasal spread (positional triggering), and stressed oral syllables block the spread of nasality (positional blocking).

Beckman (1997, 1998) analyze these positional effects by positing a highly-ranked faithfulness constraint relativized to the prominent position. This faithfulness constraint is then ranked over any markedness constraints that neutralize the relevant segmental contrasts and that trigger other phonological processes. Specifically for Guarani, Beckman (1998) proposes the highly-ranked positional faithfulness constraint IDENT-ó[NASAL] to preserve input [nasal] specifications at lexically stressed syllables. She defines the constraint as follows:

(8) IDENT-ó[NASAL]

Output segments in an (underlyingly) stressed syllable and their input correspondents must have identical specifications for the feature [nasal].[5] (Beckman (1998), p. 165)

Assign one violation for every segment in an underlying stressed syllable that does not have identical values for the feature [nasal] as its corresponding segment in the input.

[4] While all Guarani compounds straightfowardly illustrate this point, other examples include forms with reduplication and noun incorporation. See the data in (18) ahead. Note that compounding, reduplication, and noun incorporation aren't entirely productive processes in Guarani.

[5] Although the original definition of this constraint didn't make reference to underlying vs. surface stress, it is clear from her analysis of compounds that the IDENT-ó[NASAL] constraint also protects lexically stressed syllables without surface stress. See the tableau in (12) of this paper for the analysis of compounds.

Beckman (1998) uses the markedness constraint *ṽ to generally ban nasal vowels for Guarani. This constraint is ranked over general IDENT[NASAL] so that there is, globally, no contrast between nasal and oral vowels. But, the ranking of IDENT-σ́[NASAL] over *ṽ limits this neutralization of the oral/nasal contrast of vowels to lexically unstressed syllables, hence preserving this contrast only in stressed syllables. This is shown in the tableau in (9) below, which analyzes a hypothetical input in which nasality and lexical stress do not coincide.[6] Candidate c is the optimal candidate in this analysis: Candidate b fatally violates IDENT-σ́[NASAL] given its unfaithful nasality at the stressed syllable, and Candidate a, although faithful, has an unstressed nasal vowel. Note that, although stress is overwhelmingly final in Guarani, Beckman (1998) assumes that all primary stress is lexically specified.

(9) Positional neutralization in unstressed syllables (adapted from Beckman (1998), p. 166)

/tũpa/ 'god'	ID-σ́[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
a. tũpa		*!		
b. tũpã	*!	**	*	
☞ c. tupa			*	

These three constraints illustrate positional neutralization in nasality at unstressed syllables, but stressed syllables additionally control the nasality of any unstressed segments to their left. Unstressed syllables do nasalize in the presence of an underlyingly stressed nasal vowel given the process of regressive nasalization. I use ALIGN-L[NAS] as the constraint driving regressive nasalization, as defined below.

(10) ALIGN-L[NAS]

Every nasal specification must be aligned at the left edge of the morphological word.[7]

For each [+nasal] segment, assign a violation for each [-nasal] segment in the output that occurs between the [+nasal] segment and the left edge of the morphological word.

For simplicity, I assume that voiceless segments, which are fully transparent to regressive nasalization in Guarani, may never be specified for nasality, following previous analyses of transparency (Walker 1998). So, voiceless segments in nasal spans don't induce additional violations of ALIGN-L[NAS], and they don't create new nasal spans.[8] ALIGN-L[NAS], a directional constraint, is chosen as the markedness constraint driving nasalization since Guarani nasal spread is directional. Section 2.3.3 will provide evidence for the directionality of nasal spread in Guarani.

Naturally, ALIGN-L[NAS] must be ranked above *ṽ since regressive nasalization introduces unstressed nasal vowels. In the tableau in (11) below, Candidate c is most optimal because it incurs no violations of the nasal harmony constraint since all voiced segments in the word agree in nasality (compared to Candidate a), and the nasality of its stressed vowel is not neutralized to meet the demands of ALIGN-L and *ṽ (Candidate b).

[6] Beckman (1998) and this paper assume no morpheme structure constraints, namely no constraints on possible vs. impossible inputs (Richness of the Base, Smolensky (1996)). Therefore, /tũpa/ is a possible input in Guarani which the phonological grammar rules out.

[7] Evidence for the domain of regressive nasalization will be presented later on in (15).

[8] Walker (1998) derives transparency via the interaction between the demands of nasal spread and markednesss constraints that fail to license nasality for transparent segments (in this case, voiceless stops). Therefore, voiceless stops are transparent to the demands of ALIGN since they may never be [+nasal]. Also see Piggott (2003); Walker (1999) for more comprehensive analyses of transparent/neutral segments in nasal harmony systems.

(11) Positional triggering at stressed syllables (adapted from Beckman (1998), p. 165)

/tupã/ ‘god’		ID-ó[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
	a. tupã		*!	*	
	b. tupa	*!			*
☞	c. tũpã			**	*

The ranking of IDENT-ó[NASAL] over ALIGN-L[NAS] also predicts the pattern of positional blocking previously observed in the compounds in (7). Recall that, in compounds, underlyingly stressed oral syllables block the spread of nasality triggered by stressed nasal vowels to their right. The tableau in (12) below analyzes example (7c). Here, Candidate c wins because it more optimally aligns nasality leftwards compared to Candidate a, and the lexically stressed oral syllable of the first root of the compound remains faithful (compared to Candidate b). The current definition of ALIGN-L[NAS] and its ranking over *ṽ also predicts that the spread of nasalization is local: nasalization does not skip intervening lexically stressed syllables (Candidate d).[9]

(12) Positional blocking at stressed syllables

/pɨʔa-poɾã/ ‘kindness’		ID-ó[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
	a. pɨʔa-poɾã		***!*	*	
	b. pɨʔã-põr̃ã	*!		****	****
☞	c. pɨʔa-põr̃ã		**	**	**
	d. pɨʔa-põr̃ã		**	***!	***

In summary, the distribution of vowel nasality and nasalization in Guarani, specifically in the domain of roots and prefixes, is successfully analyzed as the positional faithfulness of nasality at stressed syllables, as shown in Beckman (1998). This analysis predicts the close distribution between stress and nasality that previous literature reports: the oral/nasal contrast of vowels is limited to stressed syllables, and only stressed syllables trigger regressive nasalization. Additionally, the analysis predicts the fact that, in forms with more than one root, the first root fails to nasalize in the environment of a nasal root to its right since the lexically stressed oral syllable of the first root blocks nasalization from the second root.

2.3.2 The status of nasal-oral stops

The nasal-oral stops of Guarani and related languages are frequently described as “prenasalized stops" in previous literature (Piggott 2003; Kaiser 2008; Thomas 2014; Wetzels and Nevins 2018). These are assumed to be prenasalized voiced stops because the language lacks plain voiced oral stops and instead has nasal-oral contour stops. Instead, I adopt the analysis that Guarani nasal-oral stops are underlyingly full nasal consonants as opposed to plain oral stops, and these post-oralize when followed by an oral vowel (Goldsmith 1976; Piggott 1992; Cardoso 2009; Lapierre and Michael 2018; Estigarribia 2021).

The first piece of evidence that nasal-oral stops are underlyingly full nasal consonants, as opposed to oral stops, is that nasal-oral stops are in complementary distribution with nasal consonants. Specifically,

[9] A candidate that skips the lexically stressed syllable in nasalization (such as Candidate d in (12)) will always have the same number of violations of ALIGN-L[NAS] as a candidate that shows strictly local spread (Candidate c), since they both have a nasal span that is not aligned to the left edge of the word. The *ṽ constraint rules out the candidate with non-local spread of nasality since it globally incurs more violations of *ṽ than a candidate with strictly local spread.

nasal consonants occur when followed by a nasal vowel, and nasal-oral stops occur when followed by an oral vowel, as shown in (13) below. A similar distribution is also found between the affricate [ʤ] and the palatal nasal [ɲ], as shown in (14). These alternations induced by regressive nasalization are reflected in the orthography of the language (boxed).

(13) a. *mbo'a*
[mᵇoˈʔa]
'position'

b. *m̃o'ã*
[m̃õˈʔã]
'almost'; NEG.FUT

(14) a. *dja*
[aˈʤa]
'during'

b. *dñã*[11]
[ãˈɲã]
'evil'; 'bad'

This complementary distribution between nasal-oral stops and nasal consonants, and between [ʤ] and [ɲ], is also found in prefixes. (15) below shows that all nasal-oral stops and [ʤ] alternate to their homorganic nasal consonant when followed by a nasal vowel. These data also show that the domain of regressive nasal harmony is the morphological word, since the nasality of the root fails to spread onto the person pronoun *ñande*. Note that these alternations show that prefixes are clear targets of regressive nasal spread in Guarani: they show the same nasalization and alternations patterns otherwise found in roots.

(15) a. *ñande* *nda-ja-jo-h-ayhú-i*
[ɲãˈnᵈe] [nᵈa-ʤa-ʤo-haⁱˈhu-ⁱ]
1PL.IN NEG-1PL.IN-REC-love-NEG
'we don't love each other'

b. *ñande* *n̂a-ñã-ñõ-heno-i*[12]
[ɲãˈnᵈe] [nã-ɲã-ɲõ-hẽˈnõ-ĩ]
1PL.IN NEG-1PL.IN-REC-call-NEG
'we don't call each other'

The strongest evidence for nasal-oral stops being underlying nasal consonants is that they trigger regressive nasalization. But, unlike nasal vowels, they trigger regressive spread in any position regardless of stress. Nasal-oral stops otherwise follow the familiar pattern of regressive harmony in roots and prefixes: they trigger the nasalization of all preceding segments within the morphological word and induce the familiar segment alternations, which includes the alternation of other nasal-oral stops to their left. The data in (16) shows that nasal-oral stops trigger regressive nasalization in both stressed (16a) and unstressed (16b) positions. And, (17) shows that nasal-oral stops induce segment alternations in preceding prefixes, as equivalently observed in (15) above for nasal vowel triggers.[13]

(16) a. *panambi*
[pãnãˈmᵇi]
'butterfly'

b. *angiru*
[ãŋᵍiˈɾu]
'friend'

(17) *ñande* *n̂a-ñã-ñõ-hendú-i*
[ɲãˈnᵈe] [nã-ɲã-ɲõ-hẽˈnᵈu-ⁱ]
1PL.INCL NEG-1PL.IN-REC-listen-NEG
'we don't listen to each other'

Like nasal spans triggered by nasal vowels, nasal spans triggered by nasal-oral stops are subject to positional blocking: lexically stressed oral vowels block the spread of nasalization triggered by surface nasal-oral stops. Compounds with nasal-oral stops follow the same nasalization pattern as those in (7) above, and this positional blocking is also observed in forms with two roots. Below, (18a) and (18b) show a form with noun incorporation wherein the nasal-oral stop of the verb triggers regressive nasalization only up to the root's boundary, hence failing to nasalize the preceding incorporated noun and preceding prefixes. And, (18c) and (18d) show that, in the reduplication of roots with nasal-oral stops, the nasal-oral

[11] Stressed nasal vowels aren't marked with a nasal tilde in the orthography when they're preceded by a full nasal consonant, since their nasality is predictable in this position. And, vowels that become nasalized due to nasal harmony are also not marked in the orthography as nasal.

[12] The NEG suffix becomes nasalized with an adjacent nasal root due to diphthongization – Guarani high vowels diphthongize, and if their nucleic vowel is nasal then they also nasalize. Diphthongs are transcribed with semivowels.

[13] The underlying form of the [ʤ] ~ [ɲ] alternation must be [ʤ] rather than [ɲ] since [ʤ], a fully oral segment, fails to trigger regressive nasalization unlike nasal-oral stops. [ʤ] is voiced and hence a target of regressive nasalization.

stop of the second root fails to nasalize the first root or any preceding prefixes, as most clearly evidenced by the presence of a nasal-oral stop in the first root as opposed to a full nasal consonant.[14]

(18) a. *o-**j**e-py'a-**m**ongeta*
[o-ʤe-pɨʔa-mõŋᵍeˈta]
3-AGD-chest-converse
'he thought to himself'

b. **o-**ñ**e-py'a-**m**ongeta*
[õ-ɲẽ-pɨʔã-mõŋᵍeˈta]

c. *o-**mb**ota-**mb**ota*
[õ-mᵇotaˈ-mᵇoˈta]
3-knock-knock
'he knocked and knocked'

d. **o-**m**ota-**mb**ota*
[õ-mõtãˈ-mᵇoˈta]

Given the fact that nasal-oral stops trigger regressive nasalization, I argue that Guarani surface nasal-oral stops are underlying nasal consonants as opposed to underlying plain voiced stops, consistent with previous literature (Goldsmith 1976; Piggott 1992; Lapierre and Michael 2018; Estigarribia 2021). I analyze the postoralization of these contour segments with the ranking *NV >> *CONTOUR, where *NV rules out sequences of a full nasal consonant followed by an oral vowel, and *CONTOUR rules out nasal-oral contour stops.[15]

(19) *NV
Assign a violation for each sequence of a nasal consonant followed by an oral vowel.

(20) *CONTOUR
Assign a violation for each consonant linked to both nasal and oral specifications.

The tableau below analyzes an input form with two underlying nasal consonants and a stressed oral vowel. Candidate d is the optimal candidate in this analysis since it contains no sequences of a nasal consonant followed by an oral vowel (Candidate a), it preserves the input orality of the lexically stressed vowel (Candidate b), and it more optimally aligns nasality at the left edge of the word (Candidate c).

(21)

/mimi/ 'radiant'	*NV	ID-σ[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]	*CONTOUR
a. mimi	*!*		*			
b. mĩmĩ		*!		**	**	
c. mᵇimᵇi			*!			**
☞ d. mĩmᵇi				*	*	*

2.3.3 Nasal-oral stops and directional nasal spread

Finally, the last important component of the analysis of nasalization in Guarani is that Guarani nasalization is directional. This directionality of nasal spread is clearly observed in forms with surface nasal-oral

[14] The lack of nasalization in the first root of forms with reduplication could alternatively be analyzed with Base-Reduplicant correspondence (McCarthy 1995), wherein the reduplicant must remain identical in nasality to its base. Regardless, Beckman (1998)'s stressed syllable positional faithfulness predicts the pattern of nasalization without BR-correspondence. See Russell (2023a) for more on Guarani reduplication.

[15] Stanton (2017); Wetzels and Nevins (2018) and subsequent work offer an explanation for why full nasal consonants alternate to nasal-oral stops when followed by a nasal vowel. They argue that nasal consonants are post-oralized to maximize the oral/nasal contrast of their following oral vowel. Postoralization ensures that the natural coarticulation of nasality onto the following contrastively oral vowel is blocked and therefore the following oral vowel remains more perceptually distinct from, and fully contrastive with, a nasal vowel counterpart in the same position. Stanton (2017) also proposes a similar constraint to *NV that rules out a sequence of a nasal consonant followed by an oral vowel, ranked above *CONTOUR.

stop triggers. As shown in the examples in (22) below, nasal-oral stops spread nasality leftwards onto preceding segments, as most clearly evidenced by the alternations of nasal-oral stops and [ʤ] to full nasal consonants. But, these nasal-oral stops fail to spread nasality rightwards, therefore [ʤ] in all examples in (22) fails to alternate to [ɲ]. (22c) shows that this is also the case when the nasal-oral stop and the [ɲ] target to its right are within the same morpheme.

(22) a. *ñande-jagua*
[ñãn^{d}e-ʤa^{ˈ}ɯ^{w}a]
1PL.IN-dog
'our dog'

b. *no-ro-mbo-jeroky-i*
[nõ-r̃õ-m^{b}o-ʤero^{ˈ}kɨ-^{i}]
NEG-1>2SG-CAUS-dance-NEG
'I didn't make you dance'

c. *ne-mbaraka ja*
[nẽ-m^{b}araka^{ˈ}ʤa]
2SG-cat
'your cat'

So, this paper assumes that Guarani nasalization is directional. I formalize the regressive nasalization mechanism with the constraint ALIGN-L[NAS], which is parameterized for leftward nasal spread.[16] Guarani also has a system of progressive, rightward nasal spread, but it's an entirely different phonological process and therefore not part of a bidirectional system of nasalization. Guarani progressive nasalization is discussed in Section 5.

3 Nasality and nasalization in suffixes

Recall from the previous section that prefixes are clear undergoers of regressive nasal harmony in Guarani. In forms with prefixes, nasality spreads at a long distance from a nasal trigger, nasalizing the voiced segments of all prefixes in the morphological word. And, the spread of nasality conditions the alternation between nasal-oral stops (and [ʤ]) and full nasal consonants, wherein full nasal consonants surface in nasal spans and nasal-oral stops surface with oral spans to their right. Examples (15a), (15b) and (17) are repeated in (23) below. In (23b) the trigger is the stressed nasal vowel (not reflected in the orthography), and in (23c) the trigger is the surface nasal-oral stop (an underlying full nasal consonant).

(23) a. *ñande nda-ja-jo-h-ayhú-i*
[ɲãˈn^{d}e] [n^{d}a-ʤa-ʤo-ha^{iˈ}hu-^{i}]
1PL.IN NEG-1PL.IN-REC-love-NEG
'we don't love each other'

b. *ñande na-ña-ño-heno-i*
[ɲãˈn^{d}e] [nã-ɲã-ɲõ-hẽˈnõ-ĩ]
1PL.IN NEG-1PL.IN-REC-call-NEG
'we don't call each other'

c. *ñande na-ña-ño-hendú-i*
[ɲãˈn^{d}e] [nã-ɲã-ɲõ-hẽˈn^{d}u-^{i}]
1PL.IN NEG-1PL.IN-REC-listen-NEG
'we don't listen to each other'

However, new fieldwork data on the pattern of nasality and nasalization in suffixes shows that these do not behave as expected based on the predictions of stressed syllable positional faithfulness. Stressed syllable positional faithfulness makes the general prediction that stressed and unstressed suffixes behave differently with regards to nasality and nasalization. But, this new data on Guarani suffixes such is not

[16] A bidirectional analysis of Guarani nasalization could be formalized under the assumption that the oral contour of surface nasal-oral stops blocks the rightward spread of nasalization. This is argued to be the case in Piggott (2003) for Guarani (and in Thomas (2014) for Mbya, a related language with a similar nasal harmony system). However, this requires arguing that the oral contour of such segment is indeed in the phonological representation of the contour segment and is not a strictly phonetic element. See Section 4.2 for more data and discussion on the directionality of nasalization in Guarani.

the case: although suffixes are unpredictably stressed or stressless in Guarani, these still show the same nasality and nasalization patterns regardless.[17]

The first crucial challenge to the analysis of Guarani nasality and nasalization as tied to stress is that, like stressed suffixes, are contrastively oral or nasal even when lexically unstressed. Since the nasality of unstressed nasal suffixes is not protected by IDENT-ǵ[NASAL], stressed syllable positional faithfulness predicts that Guarani should have no unstressed nasal suffixes at the surface. But, Guarani indeed has unstressed suffixes that preserve the oral/nasal contrast, as shown in (24) and (25) below. Suffixes [-mã] and [-nã] are lexically unstressed since they fail to attract stress from the root, but these still retain their nasality: the suffix vowel remains nasal and the immediately preceding nasal consonants fail to alternate to their corresponding nasal-oral stops. These examples also show that nasal elements in suffixes fail to nasalize preceding roots and prefixes, as evidence by the lack of nasal vowels and of [ʤ] instead of [ɲ] in both roots.

(24) a. *a-japó-mã*
[a-ʤaˈpo-mã̀]
1SG-work-CMPL
'I already worked'

b. **a-japó-mba*
*[a-ʤaˈpo-mᵇa]

(25) a. *e-jú-nã*
[e-ˈʤu-nã̀]
IMP-come-REQ
'please come!'

b. **e-jú-nda*
*[e-ˈʤu-nᵈa]

The tableau below analyzes the form in (24a). Here, the ranking of IDENT-ǵ[NASAL] over *ṽ incorrectly predicts the neutralization of unstressed suffixes: IDENT-ǵ[NASAL] fails to protect unstressed syllables, and *ṽ prefers candidates that have less nasal vowels overall (Candidate b). Therefore, the candidate with a neutralized suffix, Candidate c, is wrongfully predicted as the winner. Candidate a shows that forms with full nasalization, such as (24b) and (25b) above, are successfully ruled out: nasal suffixes, regardless of stress, fail to nasalize immediately preceding roots given their protection by IDENT-ǵ[NASAL]. In subsequent tableaus, 💣 indicates a candidate that wins under the current analysis but is not the right prediction, and ☹ indicates a candidate that should be predicted as the winner but fails to win under the current analysis.

(26) ǵ positional faithfulness predicts neutralization in unstressed nasal suffixes.

/a-ʤapo-mã/ 'I already worked'		ID-ǵ[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
a.	ã-ɲãpõ-mã	*!		****	***
☹ b.	a-ʤapo-mã		****	*!	
💣 c.	a-ʤapo-mᵇa		****		*

This neutralization of nasality in unstressed suffixes is also wrongfully predicted for bisyllabic unstressed suffixes. As shown in (27) below, the rightmost vowel of the suffix retains its nasality even when unstressed, and such nasal vowel spreads nasality up to the left edge of the suffix.

[17] Although previous Guarani literature does show subtantial data on suffixes (Estigarribia 2020; Dabkowski 2022a,b; Russell 2021, 2022; Dabkowski and Russell 2025), their behavior specifically regarding the oral/nasal contrast and regressive nasalization has not been described and analyzed in detail.

(27) *che-r-ẹ́ndú-ramo*
[ʃẽ-r̃-ẽˈnᵈu-r̃ãmõ]
1SG-POSS-listen-if
'if you hear me'

However, stressed syllable positional faithfulness does make the right prediction for stressed nasal suffixes, such as those in (28) and (29) below. The nasality of these stressed suffixes fails to neutralize under the demands of *Ṽ since this would incur a violation of IDENT-ó[NASAL], and they fail to nasalize preceding roots and prefixes since IDENT-ó[NASAL] also protects the input orality of the root.

(28) a. *h-ẹ́ndu-'ỹ*
[h-ẽnᵈu-ˈʔɨ̃]
3POSS-listen-PRV
'deafness'

b. **h-ẹ́ñu-'ỹ*
*[h-ẽnũ-ˈʔɨ̃]

(29) a. *o-ʝ́ehu-rõ*
[o-ɖʒehu-ˈr̃õ]
3-happen-if
'if it happens'

b. **o-ɲ́ehu-rõ*
*[õ-ɲẽhũ-ˈr̃õ]

Stressed syllable positional faithfulness also predicts only suffix-internal spread of nasalization, as most clearly observed in suffixes with more than one syllable (30 below). The tableau in (31) below shows that the ALIGN-L[NAS] constraint favors candidates wherein nasality is more closely aligned to the left edge of the word, therefore Candidate a wins over Candidate b. Candidates c and d are ruled out by IDENT-ó[NASAL] since they have unfaithful realizations of the lexically stressed syllables in roots and suffixes. Therefore, stressed syllable positional faithfulness predicts that stressed and unstressed suffixes are different: lexically stressed nasal suffixes retain their input nasality and may nasalize preceding syllables up to the next lexically stressed syllable, but unstressed nasal suffixes are predicted to neutralize any input nasality, even when these are bisyllabic (27).

(30) a. *ndᵃ-a-ikatu-mᵒo'ã́-i*
[nᵈa-ⁱkatu-m̃õˈʔã-ĩ]
NEG-1SG-able-NEG.FUT-NEG
'I won't be able to'

b. *re-ʝ́u-va'erã́*
[ɾe-ɖʒu-ṽãʔẽˈr̃ã]
2SG-come-must
'you must come'

(31) Nasal suffixes successfully fail to nasalize roots.

/nᵈ-a-ikatu-mᵇoʔã-i/ 'I won't be able to'		ID-ó[NAS]	ALIGN-L[NAS]	*Ṽ	ID[NAS]
	a. nᵈ-a-ⁱkatu-mᵇoʔã-ĩ		9!	1	
☞	b. nᵈ-a-ⁱkatu-mõʔã-ĩ		4	2	*
	c. n-ã-ĩkãtũ-mõʔã-ĩ	*!		5	****
	d. nᵈ-a-ⁱkatu-mᵇoʔa-ⁱ	*!	4		*

Lastly, the second crucial challenge the stressed syllable positional faithfulness analysis faces in the domain of suffixes is that nasal suffixes fail to nasalize preceding suffixes even when these are unstressed (both underlyingly or at the surface). The data in (24), (25), and (27) above shows cases where the immediately preceding syllable outside the suffix is underlyingly stressed and therefore protected by

IDENT-ó[NASAL]. However, both stressed and unstressed nasal suffixes may occur after other unstressed suffixes in Guarani. As shown in (32) below, the non-final unstressed oral suffixes [-ta] and [-pe] remain oral even when the following nasal suffix is stressed (32b).

(32) a. *a-japó-ta-m**a***
[a-ʤaˈpo-ta-m̃ã]
1SG-work-FUT-CMPL
'I will already work'

b. *che-sy-pe-g̃uar**ã***[19]
[ʃe-si-pe-ɣ̃ʷ̃ãˈr̃ã]
1SG-mother-DOM-for
'for my mother'

Additionally, nasal suffixes in Guarani may also be preceded by bisyllabic suffixes with penultimate stress. In these, the nasalization from a following nasal suffix fails to spread to the unstressed syllables of the preceding suffix. In (33) below, the non-final plural suffix *-nguéra* [-ˈŋgʷera] is followed by the nasal-initial suffix *-ndi* [-nᵈi], but the initial nasal-oral stop in *-ndi* fails to nasalize the final syllable of suffix *-nguéra* even when this final syllable is unstressed.

(33) a. *mit**ã**-nguéra-ndi*[20]
[m̃ĩtã-ˈŋgʷera-nᵈi]
child-PL-with
'with the children'

b. **mit**ã**-nguéra-**nd**i*
[m̃ĩtã-ˈŋgʷer̃ã-nᵈi]

Therefore, the stressed syllable positional faithfulness analysis makes a second incorrect prediction: unstressed syllables in preceding suffixes nasalize when followed by a nasal suffix. The tableau below shows the analysis for (32b). Candidate a is wrongfully predicted as the winner since its nasalization is more closely aligned to the left edge of the morphological word, but Candidate b should be the winner since it is the observed form in the language. Candidates c and d are ruled out by IDENT-ó[NASAL] given their unfaithful realizations of the lexically stressed syllables of the input. If the rightmost nasal suffix is unstressed, as in (32a), stressed syllable positional faithfulness predicts the neutralization of its nasality, as already shown in the tableau in (26) above. The predictions exemplified in the tableau below also hold for forms with non-final suffixes with penultimate stress such as that in (33) above.

(34) ó positional faithfulness predicts nasalization of preceding unstressed suffixes.

/ʃe-si-pe-ɯᵠaɾã/ 'for my mother'		ID-ó[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
💣	a. ʃe-si-pẽ-ũᵠ̃ãr̃ã		**	***	*****
☹	b. ʃe-si-pe-ũᵠ̃ãr̃ã		***!	**	****
	c. ʃe-si-pe-ɯᵠaɾa	*!			*
	d. ʃẽ-sĩ-pẽ-ũᵠ̃ãr̃ã	*!		*****	

But, again, the stressed syllable positional faithfulness analysis successfully predicts that, when preceding suffixes are stressed, these fail to nasalize when followed by a nasal suffix. (35a) and (35b) show that the initial nasal-oral stop of suffix *-**mb**ota* fails to nasalize its preceding suffix *-mba*, as most clearly evidenced

[18] Dabkowski (2022a,b) and Dabkowski and Russell (2025) claim that Guarani shows a case of free suffix order, but that stressed suffixes are always ordered before unstressed suffixes. (32b) is a counterexample to such generalization: the lexically unstressed suffix *-pe* occurs before the lexically stressed suffix *guarã*. See Section 6.2 for more details on these claims as well as how this literature analyzes the somewhat free order of suffixes.

[19] There are reasons to assume that the nasal vowel *ã* is the trigger of the observed nasalization in the root rather than the initial nasal-oral stop of suffix *-nguéra*. As seen in (28) and (29), nasal suffixes fail to spread nasality onto preceding roots.

by the presence of an initial nasal-oral stop in *-mba* rather than a full nasal consonant. This preceding suffix *-mba* is a lexically stressed suffix since it always attracts surface stress from the root, as shown in (35c).[20]

(35) a. *o-ñe'**ẽ**-mba-mbota*
[õ-ɲẽʔẽ-mᵇa-mᵇoˈta]
3-talk-TOT-INCIP
'he started to finish talking'

b. **o-ñe'**ẽ**-ma-**mb**ota*
*[õ-ɲẽʔẽ-mãmᵇoˈta]

c. *o-ñe'**ẽ**-mba*
[õ-ɲẽʔẽ-ˈmᵇa]
3-talk-TOT
'he finished talked (he completely talked)'

In summary, the stressed syllable positional faithfulness analysis previously proposed for Guarani nasality and nasalization (Beckman 1998) predicts an asymmetry between stressed and unstressed syllables. However, this new data on the phonological behavior of Guarani suffixes shows that stressed and unstressed suffixes are no different regarding nasality and nasalization. The data shows that suffixes fail on all three properties of positional faithfulness as proposed by Beckman (1998): unstressed suffixes maintain the oral/nasal contrast (no positional neutralization), unstressed suffixes spread nasality (no positional triggering), and unstressed suffixes fail to nasalize in the presence of nasal suffixes to their right (no positional blocking). These three key properties are predicted to apply only to stressed suffixes, but we also see that unstressed suffixes trigger and block nasalization, and fail to neutralize their contrast in nasality.

Additionally, stressed syllable positional faithfulness also predicts a difference between suffixes with nasal vowel triggers and suffixes with nasal-oral stop triggers. Unstressed suffixes with nasal-oral stop triggers are predicted to nasalize preceding elements since their nasality is not neutralized by *$\tilde{V}$, but unstressed suffixes with nasal vowel triggers may never surface since they nasality is neutralized by *$\tilde{V}$. This is because the distribution of nasality for vowels is tied to stress in the ranking of IDENT-ó[NASAL] over *$\tilde{V}$, but there is no equivalent constraint ranking in the stressed syllable positional faithfulness analysis that ties the oral/nasal contrast of stops to lexical stress. The data on Guarani suffixes shows that nasal vowel triggers and nasal-oral stop triggers show the same nasalization pattern in suffixes.

The table below summarizes the main empirical facts of nasalization across different kinds of morpheme boundaries. Notice that the root-suffix and suffix-suffix boundaries indicate suffix independence, where suffixes do not regressively nasalize segments across the suffix boundary. There is also no nasal harmony across root-root boundaries, as evidenced by compounds, noun incorporation, and (potentially) reduplication.

(36)

	$\tilde{V}$ trigger	**N^D trigger**	**example**
prefix-prefix	harmony	harmony	(22b)
prefix-root	harmony	harmony	(15), (17), (22c), (23), (27), (35)
root-root	**no harmony**	**no harmony**	(7), (18)
root-suffix	**no harmony**	**no harmony**	(24), (25), (27), (28), (29), (30), (35)
suffix-suffix	**no harmony**	**no harmony**	(32), (35)

N^D = nasal-oral stop

[20] The data in (35) also showcases the counterbleeding relationship between stress and nasality in Guarani. Namely, stressed nasal vowels still trigger regressive nasalization even when surface stress has shifted away onto a lexically stressed oral vowel. This counterbleeding relationship is indeed predicted by stressed syllable positional faithfulness: the nasality of the lexically stressed syllable of the root is protected by IDENT-ó[NASAL], and ALIGN-L[NAS] prefers candidates with left-aligned nasality.

4 Analysis

I now introduce the two new mechanisms that predict the observed incohesiveness of suffixes to the general stressed syllable positional faithfulness pattern of roots and prefixes. I argue that Guarani nasality is positionally faithful at the right edges of words as opposed to at stressed syllables to ensure that, regardless of stress, all suffixes are contrastively oral or nasal. Additionally, the cyclic morphological structure in suffixes allows these to only show suffix-internal regressive nasalization even when these are preceded by unstressed syllables, therefore suffixes can now contrast in nasality even when they lack lexical stress. I propose the constraints IDENT-R[NASAL] and OO-IDENT[NASAL], following base-derivative correspondence (Benua 1997, 2000), to derive the observed phonological independence of suffixes.

This Section first proposes these constraints in addition to the analysis of stressed syllable positional faithfulness presented in Section 2.3. But, this section also re-evaluates the predictions of stressed syllable faithfulness as the true analysis of nasality and nasalization in roots and prefixes. The addition of right-edge faithfulness and output-to-output correspondence leaves very apparent redundancies in the grammar of Guarani, since now these faithfulness constraints protect the same elements that are otherwise protected by stressed syllable faithfulness. More importantly, empirical data on the pattern of nasalization in monomorphemic words with non-final stress reveals that an analysis with stressed syllable positional faithfulness makes the wrong predictions, and that an analysis solely based on right-edge faithfulness is ultimately supported even without taking into consideration the new data on nasality and nasalization in suffixes.

4.1 Right-edge faithfulness and base-derivative correspondence

As discussed in the previous section, the first challenge posed by the data on suffixes to stressed syllable positional faithfulness is that unstressed suffixes, like stressed suffixes, are contrastively oral or nasal. To prevent the predicted neutralization of unstressed suffixes, I argue that Guarani nasality is positionally faithful at the right edges of words. Installing such faithfulness constraint in the grammar protects the input nasality of any suffix regardless of its lexical specificity for stress. I propose the constraint IDENT-R[NASAL] as defined below:

(37) IDENT-R[NASAL]
Assign a violation to each candidate whose rightmost segment doesn't have identical specification for nasality as its corresponding input segment.

The tableau in (38) below reanalyzes a form with a final unstressed nasal suffix with the proposed right-edge faithfulness constraint, previously analyzed in (26). IDENT-R[NASAL] now successfully rules out the candidate that neutralizes the nasality of the nasal suffix [-mã], whose nasal vowel is at the left edge of the input form (Candidate c). And, Candidate a fatally violates IDENT-σ́[NASAL] given the nasalization of the root's lexically stressed syllable. Note that Candidate a does not violate IDENT-R[NASAL] since the rightmost vowel of the root is not at the right edge of the phonological input.

(38) Right-edge faithfulness protects oral/nasal contrast in suffixes.

/a-ʤapo-mã/ 'I already worked'		ID-R[NAS]	ID-σ́[NAS]	ALIGN-L[NAS]	*Ṽ	ID[NAS]
	a. ã-ɲãpõ-mã		*!		****	****
☞	b. a-ʤapo-mã			****	*	
	c. a-ʤapo-m^{b}a	*!		****		*

Similarly, right-edge faithfulness predicts the lack of neutralization for unstressed bisyllabic nasal suffixes as that in (27). This in turn also predicts that unstressed nasal suffixes trigger nasalization for preceding unstressed syllables. Candidate d is most optimal in the tableau in (39) below since it fails to neutralize the input nasality of the suffix (compared to Candidate b), and it more optimally aligns nasality to the left edge of the word (compared to Candidate a). As in (38) above, lexically stressed syllables are still protected by IDENT-σ́[NASAL] (Candidate c).

(39) Right-edge faithfulness protects the oral/nasal contrast in suffixes.

	/ʃe-ɾ-enu-ɾamõ/ 'if you hear me'	ID-R[NAS]	ID-σ́[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
	a. ʃe-ɾ-end̪u-ɾamõ			9!	1	
	b. ʃe-ɾ-end̪u-ɾambo	*!		9		1
	c. ʃẽ-ɾ̃-ẽnũ-ɾ̃ãmõ		*!		5	6
☞	d. ʃẽ-ɾ̃-ẽnd̪u-ɾ̃ãmõ			4	4	5

The last constraint necessary in the analysis of Guarani suffixes is one that rules out the nasalization of unstressed syllables in preceding suffixes by a following nasal suffix. Recall from the previous section that nasal suffixes only spread nasality suffix-internally, while stressed syllable positional faithfulness predicts that only preceding stressed elements block the spread of nasalization under stressed syllable positional faithfulness.

I argue that Guarani's cyclic morphological structure in suffixes explains the lack of nasalization of preceding suffixes. The data in the previous section showed that suffixes in Guarani are attached in a way where all preceding morphemes, including all preceding suffixes, remain unaltered with respect to nasalization. In other words, the presence of a nasal suffix does not change anything about the nasality of the form in the previous cycle – suffixes are attached in a way that maintains the identity of the base. So, following previous literature in the analysis of "closure effects" (Halle and Kenstowicz 1991) such as that attested in Guarani, I propose the output-output (OO) faithfulness constraint OO-IDENT[NASAL] requiring that the nasality of morphologically complex forms must remain faithful to their corresponding segments in the base, which is the immediate morphological neighbor (Benua 2000).

(40) OO-IDENT[NASAL]

Assign a violation to each segment in an output whose specification for nasality is not identical to its corresponding segment in the base of correspondence.

With OO-IDENT[NASAL], the nasality of preceding suffixes is now preserved since candidates must remain faithful to the nasality features of their base, which includes the nasality of any preceding suffixes. This is especially the case for preceding unstressed suffixes, since lexically stressed suffixes are otherwise protected by IDENT-σ́[NASAL]. The tableau in (41) below shows that a candidate that nasalizes the unstressed suffix *-pe* (Candidate c) fatally violates OO-IDENT[NASAL]. Since the rightmost lexically stressed syllable of Candidate a is at the right edge, its neutralization violates IDENT-R[NASAL] as well as IDENT-σ́[NASAL]. Therefore, Candidate b is the winner in the proposed analysis. The same predictions of (41) hold for forms with a non-final suffix with penultimate stress followed by a nasal suffix, such as in Example (33).

(41) Output-output correspondence blocks nasalization of preceding (unstressed) suffixes.

/ʃe-si-pe-ɣ^{w}arã/ 'for my mother' BASE: [ʃe-si-pe]		ID-R[N]	OO-ID[N]	ID-ó[N]	ALN-L[N]	*ṽ	ID[N]
	a. ʃe-si-pe-ɣ^{w}ara	*!		*			*
☞	b. ʃe-si-pe-ɣ̃$^{w̃}$ãr̃ã				***	**	***
	c. ʃe-si-pẽ-ɣ̃$^{w̃}$ãr̃ã		*!		**	***	****

Essentially, right-edge faithfulness and output-output correspondence work together to prevent the nasalization of preceding unstressed syllables in suffixes. In the example of the tableau above, IDENT-R[NASAL] protects the input orality of the suffix *-pe* in the analysis of the base *che-sy-pe*, and, in the analysis of derivative *che-sy-pe-guarã*, OO-IDENT[NASAL] protects the output orality of *-pe* via output-output correspondence.

The IDENT-R[NASAL] and OO-IDENT[NASAL] constraints also predict the positional blocking effects observed in forms with two roots. Recall that in compounds and forms with noun incorporation and reduplication, the first root fails to nasalize in the presence of a following nasal root: nasality spreads up to and not across the root boundary. Some examples are repeated in (42) below.

(42) Forms with two roots (previously (7c), (18a), (18c))

a. *py'a-porã*
[pɨʔa-põˈr̃ã]
heart-pretty
'kindness'

b. *o-je-py'a-monge ta*
[o-ɠe-pɨʔa-mõŋᵍeˈta]
3-AGD-chest-converse
'he thought to himself'

c. *o-mbota-mbota*
[õ-mᵇotaˈ-mᵇoˈta]
3-knock-knock
'he knocked and knocked'

For this positional blocking effect to be predicted, the two roots must be in different cycles. Specifically, the base of correspondence for forms with two roots is the first root, such that OO-IDENT[NASAL] protects its nasality or orality at the next cycle. The tableau below reanalzes the compound in (42) above, previously analyzed in (12) under stressed syllable positional faithfulness. [21]

(43) Output-output correspondence blocks nasalization of first root from a second root.

pɨʔa-porã/ 'heart-pretty' BASE: [pɨʔa]		ID-R[N]	OO-ID[N]	ID-ó[N]	ALN-L[N]	*ṽ	ID[N]
	a. pɨʔa-porã				***!*		
	b. pɨ̃ʔã-põr̃ã		*!	*			
☞	c. pɨʔa-põr̃ã				**		
	d. pɨ̃ʔa-põr̃ã		*!		**		

The same analysis applies to forms with noun incorporation and reduplication (42b, (42c)). For noun incorporation, the base of correspondence is the incorporated noun so that OO-IDENT[NASAL] protects the spread of nasality from the following nasal verb. In forms with reduplication, the base of correspondence is the first root copy. [22]

[21] Note that this analysis seems redundant – spreading nasality onto the first root violates both IDENT-ó[NASAL] and OO-IDENT[NASAL] simultaneously. This redundancy will be discussed in Section 4.2 below.

[22] For compounds and forms with reduplication, the base of correspondence is the morphosyntactic head of these constructions. In

Finally, prefixes can, in theory, be ordered anywhere in the derivation and the proposed analysis will still predict that they are full targets of regressive nasalization. In other words, prefixes may be in or outside the base of correspondence. Even when prefixes are not present in the base of correspondence, ALIGN-L[NAS] prefers candidates that more closely align nasality at the left edge of the morphological word, hence predicting that prefixes always nasalize in the presence of a nasal root (or a prefix with a nasal-oral stop) to their right. This is shown in the tableau in (44) below. Candidate b wins over Candidate a since the stressed vowel of the root fully aligns its nasality to the left edge of the word, and this vowel's nasality cannot neutralize to remove the need for nasal spread given output-output faithfulness (Candidate c).

(44) Prefixes may be outside the base of correspondence.

ja-jo-henõi-se/ 'we want to call e.o.' BASE: [hẽnõĩ]	ID-R[N]	OO-ID[N]	ID-ó[N]	ALN-L[N]	*ṽ	ID[N]
a. ja-jo-hẽnõĩ-se				*!***	1	1
☞ b. ɲã-ɲõ-hẽnõĩ-se					4	5
c. ja-jo-hen^{d}o^{i}-se		*!	*	***		1

However, prefixes should be ordered first in the derivation, before the cyclicity of suffixes, for two main reasons. First, the domain of the IDENT-R[NASAL] constraint cannot just be any morpheme. Prefixes cannot be protected by any faithfulness constraints (IDENT-R[NASAL] or IDENT-ó[NASAL]) because these fully neutralize any contrast in nasality and are full targets of regressive nasalization. So, IDENT-R[NASAL] must only protect the right edges of roots and suffixes, which is achieved when prefixes are never at the right edge of some domain.

Prefixes should also be ordered first in the derivation because the base of correspondence in any base-derivative correspondence analysis must be a legal output in the language (Benua 2000; Mascaró 2016). Most if not all Guarani verbal forms with roots and suffixes require the presence of at least one person prefix. Any verbal form with two or more suffixes would require the root and all preceding suffixes in the base of correspondence, but such bases are illegal outputs in Guarani without prefixes. For example, the analysis of the form in (45a) below cannot have *[hẽnõĩ-se] as its base - it requires the presence of at least the person prefix to be a legal output, as shown in (45b). But, this is not the case for verbal forms without suffixes or with just one suffix, or for nominal forms with multiple suffixes. The base of correspondence for verb forms with at most one suffix can just be the verb root without prefixes, which is a legal output in the language since it is the infinitive form of the verb. And, nominal roots with multiple suffixes always have a base (with or without prefixes) that is a real output in the language. For example, [si-pe] 'mother-DOM' is a legal output form and therefore a possible base for the input form in (41) above.

(45) a. *ña-ño-hen**o**i-sé-ma*
[ɲã-ɲõ-hẽnõĩ-ˈse-mã]
1PL.IN-REC-call-DES-CMPL
'we already want to call each other'

b. Illegal base: *[hẽnõĩ-se]
Legal base: [ɲã-ɲõ-hẽnõĩ-se]

Guarani, the first root of a compound is always the head since it contributes the grammatical category and the main semantic meaning the compound. And, in forms with reduplication, the first root is the base and the second is the reduplicant (Russell 2023a). However, the same cannot be said for noun incorporation. Forms with noun incorporation are verbs and show verbal morphology, therefore the morphosyntactic head of the noun-incorporated phrase is the verb, but the base of correspondence in this analysis must be the noun that precedes the verb in order for the nasalization facts to be predicted.

4.2 Reevaluating stressed syllable positional faithfulness

The analysis above introduced two new constraints added to the existing stressed syllable positional faithfulness analysis proposed in Beckman (1998). I proposed right-edge faithfulness in nasality to prevent the neutralization of nasality in unstressed suffixes, and transderivational faithfulness to prevent nasal suffixes from nasalizing preceding suffix-external syllables. These two constraints mainly serve to disentangle nasality from stress in the domain of suffixes: unstressed suffixes behave like stressed suffixes in the sense that they fail to neutralize their nasality and that they trigger regressive nasalization only suffix-internally.

However, the introduction of right-edge faithfulness and output-output faithfulness to the analysis of regressive nasalization leads to various redundancies with stressed syllable positional faithfulness. IDENT-R[NASAL] protects nasality at the right edges of words, but recall that stress is overwhelmingly final, so occurs at the right edges of words, in Guarani. So, in forms with a final lexically stressed syllable, the IDENT-σ́[NASAL] and IDENT-R[NASAL] constraints completely overlap in their violations. So, assuming lexical stress is always right-aligned, roots and final lexically stressed suffixes no longer need the protection of IDENT-σ́[NASAL].

Additionally, recall from Beckman (1998)'s positional faithfulness analysis that evidence for IDENT-σ́[NASAL] also comes from positional blocking effects, as observed in forms with two roots. In these, the first root fails to nasalize in the presence of a nasal trigger in the second root. However, with OO-IDENT[NASAL], roots are now completely protected from nasalization triggered by nasal segments to their right either in roots or suffixes. So, the nasalization of a root triggered by a following root or suffix induces a violation of both IDENT-σ́[NASAL] and OO-IDENT[NASAL] simultaneously. With OO-IDENT[NASAL], roots no longer need protection from IDENT-σ́[NASAL] in blocking nasalization from following nasal elements.

The tableau in (46) below provides a concrete example of the redundancy between OO-IDENT[NASAL] and IDENT-σ́[NASAL]. OO-IDENT[NASAL] already protects the lexically stressed syllable in the input (/nu/) from nasalizing in the presence of the following nasal suffix, thus ruling out Candidate a. At the previous cycle, in the evaluation of the input /ʃe-ɾ-enu/, IDENT-R[NASAL] prevents the rightmost vowel of the root from nasalizing without the need for IDENT-σ́[NASAL], since in this form the rightmost vowel and the stressed syllable overlap. Therefore, IDENT-σ́[NASAL] no longer rules out candidates that either IDENT-R[NASAL] or OO-IDENT[NASAL] cannot rule out. And, as described in the previous section, IDENT-σ́[NASAL] is problematic in the analysis of Guarani nasalization in suffixes to begin with: it predicts an asymmetry between stressed and unstressed suffixes regarding their nasality and nasalization patterns.

(46) Output-output correspondence and σ́ positional faithfulness are redundant.

/ʃe-ɾ-enu-ɾamõ/ 'if you hear me' BASE: [ẽn^{d}u]	ID-R[N]	OO-ID[N]	ID-σ́[N]	ALN-L[N]	*Ṽ	ID[N]
a. ʃẽ-ɾ̃-ẽnũ-ɾ̃ãmõ		*!	*		5	6
☞ b. ʃẽ-ɾ̃-ẽn^{d}u-ɾ̃ãmõ				4	4	5

In addition to these redundancies, another source of evidence for why the positional faithfulness analysis is no longer supported is that a lexical specification of stress in the domain of roots and prefixes is not required for Guarani. Recall that Guarani stress in monomorphemic forms is overwhelmingly final, and, under stressed syllable positional faithfulness, prefixes can never be lexically stressed because they are clear targets of regressive nasalization. Therefore, Guarani stress in this domain is derivable by rule. Naturally, the fact that Guarani stress might not be lexically specific has strong consequences for the analysis of stressed syllable positional faithfulness since all positional effects in Guarani nasality and nasalization (neutralization, triggering, and blocking) are dependent on the lexical specification for stress, a stated in the definition of IDENT-σ́[NASAL] in (8).

However, it seems that Guarani stress is indeed lexically specified for roots, at least for some forms. First, Guarani has a few words with penultimate stress (and even antipenultimate stress), and, more importantly, there are also a handful of stress-based minimal pairs, as shown in (47) to (50) below. And, stress must be lexically specified for suffixes, since these are are "stressable" or "unstressable" in an unpredictble manner. Interestingly, this leaves prefixes and suffixes with another phonological asymmetry. On the one hand, prefixes may never be lexically stressed because, under stressed syllable positional faithfulness, they would preserve the oral/nasal contrast and positional block nasalization from following nasal elements, but on the other hand, suffixes require a lexical specification for stress to account for primary stress placement.

(47) a. *ava* [aˈʋa] 'person' b. *áva* [ˈaʋa] 'hair'

(48) a. *eira* [eʲˈɾa] 'wild cat' b. *eíra* [eˈiɾa] 'honey'

(49) a. *ape* [aˈpe] 'surface; skin' b. *ápe* [ˈape] 'here'

(50) a. *mboi* [mᵇoˈi] 'to undress' b. *mbói* [mᵇoⁱ] 'snake'

This asymmetry between prefixes and suffixes in their lexical specification for stress leaves us with an interesting conundrum. Assuming stress is not lexically specified for roots and prefixes (and the handful of roots with penultimate and antepenultimate stress are just exceptions in the Guarani lexicon), suffixes are the only morphemes that truly require a lexical specification for stress. But, suffixes are also the only morphemes that fail to show the stressed syllable positional faithfulness pattern otherwise observed in roots and prefixes: unstressed suffixes retain the oral/nasal contrast and they fail to nasalize in the enviroment of nasal suffixes. The analysis of nasality and nasalization as stressed syllable positional faithfulness would garner more support if the morphemes that require a lexical specification for stress (to account for primary stress placement) are also those that show positional effects in nasality at stressed syllables. Ultimately, the presence of Guarani lexical stress seems orthogonal to the pattern of nasality and nasalization – the affixes that are specified for stress are exactly those that fail to show stressed syllable positional faithfulness effects. And, the presence of lexical stress doesn't imply that stressed syllable positional faithfulness is a property of the phonological grammar of Guarani. The data on suffixes presented in this paper shows that this is the case.

The last point of consideration in the existence of stressed syllable positional faithfulness for Guarani is to investigate the predictions the proposed analysis makes for morphemes with non-final stress, compared to those of Beckman's original analysis. Consider the hypothetical input wherein lexical stress is penultimate but input nasality is at the rightmost syllable. Without stressed syllable positional faithfulness (grayed IDENT-ó[NASAL]), nasality is predicted to spread from the rightmost segment onto the stressed syllable, therefore the whole form becomes nasal (Candidate b). However, with stressed syllable positional faithfulness, nasality fails to spread onto the penultimate syllable given its protection by IDENT-ó[NASAL], leaving the winner with syllables that disagree in nasality (Candidate a).

(51)

/CVCṼ/			ID-R[NAS]	ID-ó[NAS]	ALIGN-L[NAS]	*ṽ	ID[NAS]
w/ ID-ó ☞	a.	CVCṼ			*(!)	*	
w/o ID-ó ☞	b.	CṼCṼ		*!		**	*
	c.	CVCV	*!				*

An additional hypothetical input to consider is one where nasality and stress overlap at a non-final syllable, as in the tableau in (52) below. In this case, the analysis without IDENT-ó[NASAL] predicts the neutralization of such input nasality in the stressed syllable (Candidate c), while the analysis with stressed

syllable positional faithfulness predicts its faithful realization while preserving the orality of the rightmost syllable given IDENT-R[NASAL] (Candidate a). So, as with the example input in (51) above, the analysis without stressed syllable positional faithfulness for forms with non-final stress predicts full agreement in nasality or orality within a word, while the analysis with IDENT-ó[NASAL] predicts disagreement in nasality within a word.

(52)

/CṼCV/			ID-R[NAS]	ID-ó[NAS]	ALIGN-L[NAS]	*Ṽ	ID[NAS]
w/ ID-ó ☞	a.	CṼCV				*(!)	
	b.	CṼCṼ	*!			**	*
w/o ID-ó ☞	c.	CVCV		*!			*

Rather unfortunately, the lexicon of Guarani contains only a few words that allow us investigate which prediction is consistent with the empirical facts. Estigarribia (2020) includes a total of around 45 monomorphemic items (roots, suffixes, or clitics) with penultimate or antepenultimate stress, and only around 14 of these have phonemic nasal triggers. These 14 monomorphemes are listed in (53) below. Stressed syllables are indicated with an acute accent or nasal tilde in the orthography.

(53) Nasal monomorphemes with penultimate stress.

a.	*hikóⁿi*	[hĩˈkõnĩ]	frequentative asp.	*máraᵐo*	[ˈmãɾãmõ]	‘never’
	híⁿa	[ˈhĩnã]	progressive asp.	*méⁿa*	[ˈmẽnã]	‘husband’
	káᵐa	[ˈkãmã]	‘scrabies’	*nahániri*	[nãˈhãnĩɾĩ]	‘no’
	liméta	[l̃ĩˈmẽtã]	‘bottle’[23]	*ne’ĩra*	[nẽˈʔĩɾã]	‘yet’
	mamóⁿe	[mãˈmõnẽ]	‘papaya’	*pohãⁿo*	[põˈhãnõ]	‘cure’
	máva	[ˈmãṽã]	‘who’	*tẽra*	[ˈtẽɾã]	‘or’
b.	*ánga*	[ˈãŋᵍa]	‘soul’	*ténge*	[ˈtẽŋᵍe]	‘slowly’

The crucial characteristic of the monomorphemes in (53a) above is that they have full agreement in nasality throughtout the word even when stress is non-final. This is more clearly evidenced by forms that have full nasal consonants, as opposed to nasal-oral stops, to the right of the stressed syllables (boxed). According to the general phonotactic pattern of nasal consonants and nasal-oral stops, nasal consonants may only surface as fully nasal when the following vowel is nasal, which means that the rightmost vowels in the words in (53a) above must be nasal. If the rightmost vowels were oral, we would expect nasal-oral stops and full oral vowels to the right of these non-final stressed nasal syllables. Therefore, an analysis with both stressed syllable faithfulness and right-edge faithfulness is immediately ruled out since it predicts disagreeing nasality within a word when stress is non-final (Candidate a in (51) and (52) above), but such is not the case in Guarani.

Moreover, the two forms in (53b) serve as further evidence against stressed syllable positional faithfulness. When a non-final stressed vowel is followed by a nasal-oral stop, the stressed vowel is a clear target of regressive nasalization from the nasal-oral stop. This is most clearly observed when such words have prefixes to their left, as in (54) and (55) below. Here, the prefixes are clear targets of regressive nasalization from the following nasal-oral stop, which can only mean that the root’s lexically stressed vowel also nasalizes. Stressed syllable positional faithfulness wrongfully predicts that this stressed vowel blocks regressive nasalization from the following nasal-oral stop given its protection by IDENT-ó[NASAL].[24]

[23] Guarani natively does not have the phoneme /l/ in its inventory, though it has been introduced through borrowings from Spanish such as for *liméta* ‘bottle’.

[24] An alternative analysis to the data in (54) and (55) above is to assume that there is some morpheme structure constraint that only

(54) a. *ña**nd**e-jagua*
[ɲãn$^{\overleftarrow{\text{d}}}$e-ʤaˈɯɥ$^{\text{w}}$a]
1PL.IN-dog
'our dog'

b. *ña**n**e-**ánga***
[ɲãnẽ-ˈãŋ$^{\text{g}}$a]
1PL.IN-soul
'our soul'

(55) a. *pe**nd**e-jagua*
[pẽn$^{\overleftarrow{\text{d}}}$e-ʤaˈɯɥ$^{\text{w}}$a]
2PL-dog
'your (pl) dog'

b. *pe**n**e-**ánga***
[pẽnẽ-ˈãŋ$^{\text{g}}$a]
2PL-soul
'your (pl) soul'

However, an alternative explanation for the nasalization of segments to the right of non-final stressed nasal syllables is that Guarani stressed nasal vowels trigger bidirectional nasal spread up to the root boundary. This explains the nasalization of elements to the right of the stressed syllable since now nasality from stressed nasal vowels spreads both leftwards and rightwards. Recall from Section 2.3.3 that evidence for the directionality of nasalization came exclusively from forms with surface nasal-oral stop triggers (underlying nasal consonants), not from forms with non-final stressed nasal vowels. Nasalization triggered by nasal-oral stops is clearly directional since they have oral spans to their right and nasal spans to their left in both stressed and unstressed positions. Still, it could be the case that only underlying nasal consonants show leftward (hence directional) spread, while nasal vowels show bidirectional spread.

However, I argue that this alternative analysis is unfavorable. First, it requires positing that underlying nasal consonants and nasal vowels are, phonologically, different kinds of triggers of nasalization: the former triggers leftward spread and the latter triggers bidirectional spread. This would ultimately leave Guarani with at least three different nasalization mechanisms (namely, regressive, bidirectional, and progressive) with the regressive and bidirectional mechanisms only differing in the type of trigger. This would require positing markedness constraints for nasal spread that are parameterized for the kind of segmental trigger (nasal vowel or consonant) even when both of these segments are phonologically nasal). But, more importantly, this bidirectional spread poses problems for the proposed right-edge faithfulness analysis since now the rightmost syllable must agree in nasality with the non-final lexically stressed syllable, hence violating IDENT-R[NASAL]. As shown in this section, IDENT-R[NASAL] is otherwise crucial to the analysis of nasality and nasalization in suffixes. So, I argue that nasality is indeed lexically specified at the rightmost syllable, as opposed to at the lexically stressed syllable, even in words with non-final stress.

To conclude, regardless of the analysis of Guarani stress as being lexically specified in the domain of roots and prefixes or fully derivable by rule, it is clear that stressed syllable positional faithfulness is no longer an adequate analysis for Guarani nasality and nasalization. This analysis is challenged by the phonological behavior of Guarani suffixes as discussed in previous sections, and also by the handful of nasal monomorphemes with non-final stress. Instead, Guarani nasality is specified at the right-edges of words, and its cyclic morphological structure explains the observed independence of suffixes from the phonological behavior of roots and prefixes.

5 Implications for Guarani progressive nasalization

So far, this paper has focused on the status of suffixes in Guarani leftward nasal spread. But, Guarani also has a system of rightward (progressive) nasal spread. Guarani's progressive nasalization mechanism is strikingly different from its regressive nasal harmony pattern: its triggers, targets, locality, and productivity all differ (Lapierre and Michael 2018; Russell 2021, 2023b, to appear). The table in (56) below summarizes the major differences between regressive and progressive harmony in Guarani. While in regressive harmony all sonorant segments nasalize in nasal spans, only voiceless stops are targets of progressive harmony. Additionally, only nasal vowels in roots trigger progressive harmony alternations, while underlying nasal consonants, in addition to nasal vowels, trigger regressive spread. Progressive harmony in Guarani is also non-local: nasality spreads to non-adjacent segments at a long distance, while in regressive nasalization adjacent segments nasalize. Finally, progressive harmony in Guarani not entirely productive since only

allows input stressed nasal vowels before a nasal-oral stop. This approach is unfavorable, since, following Richness of the Base, any surface generalization must follow from the grammar rather than states as constraints in possible inputs to the grammar.

certain roots and suffixes show alternations induced by the process, and there is variation as to how these root and suffix targets are affected by progressive nasalization.

(56)

	regressive nasalization	**progressive nasalization**
triggers	rightmost nasal vowels, nasal consonants	nasal vowels
targets	voiced segments	voiceless stops
locality	local	non-local
productivity	productive, exceptionless	morpheme-specific

This section provides a brief description of Guarani progressive nasalization to show that an analysis of progressive harmony as phonologically conditioned allomorphy is perfectly compatible with the right-edge faithfulness and output-output correspondence constraints proposed for Guarani regressive nasalization. The data and descriptive generalizations in this section have been described in previous literature (Estigarribia 2020; Russell 2021, 2022, 2023b, to appear) and verified with the language consultants.

Guarani progressive harmony is often described as phonologically conditioned allomorphy because only a handful of stop-initial morphemes undergo progressive harmony alternations in the presence of phonemic nasal vowels (Russell 2021, 2023b, to appear). And, morpheme targets are affected differently by progressive nasalization. For example, most suffixes exhibit the alternation of their initial voiceless stop to a nasal-oral stop, as in (57) below, while others show the alternation of the initial voiceless stop to a full nasal consonant along with the nasalization of the following vowel, as in (58) below.[25]

Other stop-initial suffixes fail to show progressive harmony alternations even in the presence of roots with nasal vowels, as in (59), and others preserve their nasality even in the presence of phonemically oral roots, as in (60).

(57) a. *jagua-**k**uéra*
[ʤaɣʷa-ˈkʷera]
dog-PL
'dogs'

b. *mit**ã**-**ng**uéra*
[mĩtã-ˈŋgʷera]
child-PL
'children'

(58) a. *óga-**pe***
[ˈoɣa-pe]
house-LOC
'at the house'

b. *kosin**a**-**me***
[kõsĩˈnã-mẽ]
kitchen-LOC
'at the kitchen'

(59) a. *a-karú-**t**a*
[a-kaˈru-ta]
1SG-eat-FUT
'I will eat'

b. *ai-pytyv**õ**-**t**a*
[ãĩ-pɨ̃tɨ̃ˈṽõ-ta]
1SG-help-FUT
'I will help'

(60) a. *o-pupu-**ma***
[o-puˈpu-mã]
3-hot-CMPL
'it is already hot'

b. *o-ñe'**ẽ**-**ma***
[õ-ɲẽˈʔẽ-mã]
3-talk-CMPL
'he already talked'

Although nasal-oral stops trigger regressive nasalization in any position, they fail to trigger progressive harmony. Guarani progressive nasalization is only triggered by phonemic nasal vowels.

(61) a. *pana**mb**i-**k**uéra*
[pãnãmᵇi-ˈkʷera]
butterfly-PL
'butterflies'

b. **pana**mb**i-**ng**uéra*
[pãnãmᵇi-ˈŋgʷera]

These progressive harmony alternations may stack and occur non-locally. The data in (63) below shows that suffix *-pe/-me* alternates in the environment of a nasal root even across the oral vowels of the

[25] Based on my fieldwork and sources cited in this paper, there are 4 stop-initial suffixes (and many roots) that alternate between initial voiceless stops and nasal-oral stops, 2 stop-initial suffixes that alternate between initial voiceless stop and full nasalization, and 8 stop-initial suffixes (3 oral, 5 nasal) that fail to alternate in the environment of nasal roots.

preceding suffix *-nguéra*. Additionally, (64) shows that these alternation also occur across suffixes that don't participate in progressive harmony, such as the lexically stressed suffix *-se*. As expected from the pattern of regressive nasalization, these nasal-initial allomorphs fail to nasalize preceding segments outside the suffix even when these are unstressed.[26] Therefore, roots control progressive harmony alternations even in the presence of lexically stressed oral suffixes between the root and the alternating suffixes.[27]

(63) a. *jagua-kuéra-pe*
[ʤaɣʷa-ˈkʷɛra-pe]
dog-PL-DOM
'dogs'

b. *mitã-nguéra-me*
[mĩtã-ˈŋgʷɛra-mẽ]
child-PL-DOM
'children'

(64) a. *o-karu-se-pa-potá-peve*
[o-karu-se-pa-poˈta-pɛve]
3-eat-DES-TOT-INCIP-until
'until he is about to finish wanting to eat'[28]

b. *o-ñe'ẽ-se-mba-mbotá-mẽve*
[õ-ɲẽʔẽ-se-mᵇa-mᵇoˈta-mẽṽẽ]
3-talk-DES-TOT-INCIP-until
'until he is about to finish wanting to talk'

The lexically specific nature of progressive harmony alternations, along with the fact that the presence of nasal allomorphs is phonologically conditioned, both show that the progressive harmony mechanism in Guarani is one of phonologically conditioned suppletive allomorphy (Russell 2021, 2023b, to appear; Estigarribia 2021; Cabrera 2025). Specifically, morphemes that show progressive harmony alternations have listed oral-initial and nasal-initial allomorphs. The selection of these allomorphs is phonologically conditioned: nasal-initial allomorph, if available, are selected in the presence of a phonemic nasal vowel in the root. The difference between suffixes whose initial segments alternate to a nasal-oral stop versus a nasal consonant is also lexically specified, and the expected phonotactic constraints governing the complementary distribution between nasal-oral stops and full nasal consonants apply. Namely, suffix allomorphs with initial nasal-oral stops have a following oral vowel and so their initial consonant is a postoralized nasal consonant, and suffix allomorphs with initial nasal consonants have a following nasal vowel and so their initial consonant remains as a full nasal consonant. And, suffixes that fail to alternate under progressive harmony have one listed allomorph. The table in (65) bellow summarizes the three types of stop-initial suffixes and their listed allomorphs.[29]

[26] The fact that progressive harmony alternations occur non-locally suggests that these derived nasal-oral stops cannot come from prenasalization triggered by an immediately preceding nasal vowel.

[27] A possible counterexample to this generalization is the apparent selection of nasal-initial *-nguéra* when it occurs after suffix *-rã* [-r̃ã], as found in Estigarribia (2020). In (62) below, it cannot be the root that controls the selection of *-nguéra* because the root's rightmost syllable is oral. It is likely this form is lexicalized and reflects a previously more productive progressive nasalization system, as argued by Estigarribia (2021) to be the case for Guarani.

(62) *mombe'u-rã-nguéra*
[mõmᵇeʔu-r̃ã-ˈŋgʷera]
tell-DEST-PL
'stories'

[28] My language consultants show variation in stress placement of both (64a) and (64b) - some speakers place primary stress in the final syllable of *-pota*/ *-mbota*, leaving *-peve*/ *-mêve* unstressed, while other place stress on the first syllable of *-peve*/ *-mẽve*.

[29] Russell (2021) explains the difference between the postoralization and full nasalization of initial voiceless stops due to progressive harmony by arguing that, diachronically, Guarani showed two distinct progressive nasalization processes: root nasalization and suffix nasalization. The now suffixes whose initial voiceless stops alternate to full nasal consonants were roots historically, and most may still serve as roots in the language. Under the synchronic analysis of progressive harmony as phonologically conditioned allomorphy, the difference between the two stipulated progressive nasalization processes is just lexically encoded in the allomorphs, and the expected phonotactic restrictions apply that account for the morpheme-initial segment alternations.

(65) Morphemes differ in their lexical specification in three ways (Cabrera 2025)

type	example	listed allomorphs
undergoing (N^DV)	-k^{w}era ~ -ŋ^{w}era PL (57)	{TV, NV} **NV → N^DV**
undergoing (NṼ)	-pe ~ -mẽ LOC; DOM (58)	{TV, NṼ}
non-undergoing	-ta FUT (59)	{TV}
	-mã CMPL (60)	{NṼ}

T = voiceless stop; N = nasal consonant, N^D = nasal-oral stop

Verbal and nominal roots, not just suffixes, also show lexically-specific progressive harmony alternations. Examples of root alternations are found in compounds (66) and in causative constructions (67 and (68)). Here, roots with initial voiceless stops always surface with initial nasal-oral stops in the environment of nasal vowel triggers. Notice that, for the causative constructions in (67) and (68), it is unclear at the surface whether the trigger of regressive nasalization is the nasal vowel of the causative prefix (which also selects for a nasal-initial root allomorph) or the initial nasal-oral stop of the following root. For compounds, the trigger of regressive nasalization is the rightmost vowel of the first root and not the initial nasal-oral stop of the second root since, as previously shown for regressive nasalization, the first root of forms with two roots always fails to nasalize even when followed by a nasal root.

(66) a. *o-*k*y*
[o-ˈkɨ]
3-rain
'it rains'

b. *h-as**ẽ**-*ng*y*
[h̃-ãsẽ-ˈŋᵍɨ]
3POSS-rain
'weep'

c. *h**ũ**-*ng*y*
[h̃ũ-ˈŋᵍɨ]
black-rain
'grey, brown'

d. *am**a**-*ng*y*
[ãmã-ˈŋᵍɨ]
rain-rain
'rain'

(67) a. *o-*p*áy*
[o-ˈpaʲ]
3-wake.up
'woke up'

b. *o-mo-*mb*áy diego-pe*
[õ-mõ-mᵇaʲ]
3-CAUS-wake.up Diego-DOM
'he woke up Diego'

(68) a. *che-*k*aigue*
[ʃe-kaʲˈɣʷe]
1SG-bored
'I'm bored'

b. *nde che-mo-*ng*aigue*
[ʃẽ-mõ-ŋᵍaʲˈɣʷe]
2 1SG-CAUS-bore
'you bored me'

However, most roots in causative constructions fail to show the alternation of the initial voiceless stop, as in (69) below. Regressive nasalization in these non-exceptional constructions proceeds as expected: the causative prefix surfaces with an oral vowel and a nasal-oral stop in forms with oral verb roots (69a), and it surfaces with a nasal vowel and a full nasal consonant in forms with nasal roots (69b). Therefore, the causative constructions that show progressive harmony alternations are exceptional, since the expected pattern of nasalization is the one shown in (69) (Estigarribia 2020, 2021).

(69) a. *a-**mb**o-pupu nde-'y*
[ã-mᵇo-puˈpu]
1SG-CAUS-hot 2SG-water
'I boiled your water'

b. *a-mo-kane'**õ***
[ã-mõ-kãnẽˈʔõ]
1SG-CAUS-tired
'I made (someone) tired'

As already briefly mentioned, there are two possible analyses for the exceptionality of causative constructions (Estigarribia 2021). The first is that nasal-initial verb root allomorphs, if available, are exception-

ally selected in causative constructions regardless of the underlyingly nasality or orality of the causative prefix. This initial nasal-oral stop in turn triggers regressive nasalization and fully nasalizes the causative prefix and other preceding prefixes (for example, (68b) would be [ʃ̃ẽ-mõ-ŋᵍaⁱˈɣʷe]). The second alternative analysis is that the causative prefix in these constructions is exceptionally nasal — /mo/ and /mõ/ are the two allomorphs of the causative prefix, and /mõ/ is idiosyncratically selected for certain roots. Nasal /mõ/ in turn triggers both the selection of nasal-initial root allomorphs (via progressive nasalization) and regressive nasalization onto preceding prefixes (for example, [ʃ̃ẽ-mõ̃-ŋᵍaⁱˈɣʷe]).[30] So, this second analysis collapses the analysis of root nasalization into the analysis of suffix nasalization. But, as noted in previous works, suffix and root nasalization are different processes given evidence that the constructions that show progressive nasalization are lexicalized (Russell 2021; Estigarribia 2021; Cabrera 2025).

Crucially, regardless of the analysis adopted for the exceptional causative constructions, the right-edge faithfulness and output-output correspondence constraints proposed in this paper to account for nasality and leftward nasalization in suffixes are compatible with Guarani's phonologically conditioned allomorphy in progressive nasalization. The segment alternations due to progressive harmony do not violate any of the faithfulness constraints in the phonological grammar (IDENT-R[NASAL] nor OO-IDENT[NASAL]) since, for forms that show alternations due to progressive harmony, allomorph selection is regulated by a progressive harmony markedness constraint (PROGHARM) since the pattern is phonologically conditioned.[31] The tableau below shows how the allomorphy would work for a form such as (78b), which has a nasal root followed by two suffixes that alternate under progressive harmony. The constraint regulating allomorph selection, PROGHARM, is ranked below IDENT-R[NASAL] and OO-IDENT[NASAL] such that preceding elements fail to change specifications for nasality given the demands for agreement in nasality between the root and suffix-initial segments. Although not included in this tableau, assume that ALIGN-L[NAS] and *ṽ are in the grammar.

(70) Unifying regressive and progressive nasalization in suffixes.

/mitã - {kʷera, ŋʷera} - {pe, mẽ}/ BASE: [mĩtã-ˈŋᵍʷera]	*NV	ID-R[N]	OO-ID[N]	...	PROGHARM	*CNTR
a. mĩtã-kʷera-pe			*!		*	
b. mĩtã-ŋʷera-pe	*!				*	
c. mĩtã-ŋᵍʷera-pe					*!	*
☞ d. mĩtã-ŋᵍʷera-mẽ						*

6 General discussion

This paper proposes an updated analysis of the pattern of nasality and nasalization in Paraguayan Guarani, a Tupi-Guarani language spoken by a few millions in Paraguay and neighboring areas. New fieldwork data on the distribution of nasality and nasalization in suffixes shows that these are phonologically independent from roots and prefixes. Unlike prefixes and roots, Guarani suffixes fully retain the oral/nasal contrast and they fail to nasalize preceding elements outside the suffix. Meanwhile, prefixes are entirely cohesive with the basic phonology of roots: they fully neutralize the oral/nasal contrast and all prefixes are clear targets

[30] Recall that I argue that nasal-oral contour stops are postoralized nasal consonants as opposed to prenasalized stops (Section 2.3.2 of this paper), therefore the nasal contour does not originate from the causative prefix. This is also apparent from the fact that suffix allomorphs with initial nasal-oral stops are selected in the environment of an oral root, therefore its phonological representation is somehow nasal, and the fact that nasal-oral stops may occur between two oral vowels if they are suffix initial (as in (64b)).

[31] I leave investigation into exact mechanism underlying the PROGHARM constraint to future work. But, it is clear that this constraint is non-local: it relies on some long-distance correspondence between the root's rightmost vowel and the initial segments of suffixes. And, Section 6.3 of this paper shows that this constraint is also violable for speakers of certain dialects of Guarani.

of leftward nasalization triggered by roots or other prefixes to their right. I formalized the independence of suffixes as output-to-output correspondence (Benua 1997, 2000) in a constraint-based analysis, requiring morphological complex forms to remain faithful in nasality to their immediate morphological neighbor, which includes all preceding suffixes, roots, and prefixes. .

An additional argument presented here is that Guarani nasality for vowels is specified (i.e. positionally faithful) at the right edges of words, as opposed to at stressed syllables (Beckman 1998). This right-aligned specification of nasality fully predicts the previously documented pattern of nasality and leftward nasalization in roots and prefixes and also that in newly collected fieldwork data on Guarani suffixes. Two pieces of Guarani nasalization support the analysis of right-edge faithfulness. First, in Guarani, lexically unstressed suffixes show the exact same nasalization pattern as stressed suffixes: they both fail to neutralie the oral/nasal contrast and both trigger only suffix-internal nasalization. And second, nasal monomorphemes with non-final stress show full word-internal agreement in nasality, as opposed to only showing leftward nasalization from the non-final stressed syllable. Earliest descriptions of Paraguayan Guarani refer to words with “nasal stress" or “oral stress" (Gregores and Suárez 1967) because the contrastive positions of both stress and nasality are often at right edges of words. But, new data on Guarani suffixes, as well as existing data on roots and prefixes, reveal that the relationship between Guarani stress and nasality is not phonologically defined – it is only confounded at the surface given that both are right-aligned processes that interact with the cyclic morphological structure of suffixes.

Ultimately, the data and analysis presented here bears on questions regarding Guarani’s place in the typology of prefix-suffix asymmetries, and the predictions the proposed analysis makes about such typology. Guarani presents an interesting case of prefix-suffix asymmetries since, crosslinguistically, prefix independence is much more common than suffix independence (Hyman 2008; Elkins 2020). Prefix-suffix asymmetries are also often analyzed as prosodic asymmetries (Elkins 2020; Bennett 2018), wherein the affixes that exhibit phonological independence are outside the prosodic domain within which the expected phonological processes are active, therefore also posing questions about how Guarani suffix independence could be analyzed under a prosodic analysis without appealing to the language’s cyclic morphological structure in suffixes.

6.1 Guarani in the typology of prefix-suffix asymmetries and edge faithfulness

This paper shows that Guarani presents a case of suffix independence, wherein suffixes are less cohesive with the general phonological patterns attested in roots and prefixes. Two main empirical observations contribute to this characterization: suffixes fail to neutralize the contrast in nasality regardless of stress and their ordering in the morphological word, and nasal suffixes fail to nasalize preceding suffixes. On the other hand, prefixes fully neutralize the contrast in nasality, they are clear targets of regressive nasalization, and they never block nasalization from other elements, thus behaving like non-final syllables in roots.

However, Guarani seems to present an interesting typological anomaly. Crosslinguistically, prefix independence is overwhelmingly more common that suffix independence. In other words, it is more common for suffixes, as opposed to prefixes, to be more tightly bound to the phonology of roots and other affixes or show phonological patterns that are more consistent with those attested in roots and prefixes. Across the world’s languages, prefixes, as opposed to suffixes, tend to show less neutralization of segmental contrasts, more complex phonotactics, and independence from harmony processes where prefixes would otherwise be triggers or targets (Houlihan 1975; Steriade 1979; Kaun 1993; Hyman 1995; Beckman 1998; Casali 1998; Ito and Mester 1999; Bakovic 2000; Alber 2001; Finley and Badecker 2009; Nevins 2010; Becker et al. 2012; Wedel et al. 2019; Downing and Kadenge 2020). But, in Guarani, it’s the language’s suffixes that preserve segmental contrasts and that fial to nasalize preceding morphemes in the way that roots and prefixes do.

In line with the analysis of suffix independence presented in this paper, prefix asymmetries are also

analyzed as stemming from word-internal edge asymmetries where initial positions (syllable-initial or word-initial) are protected by high-ranked faithfulness that refer to left domain edges in different ways (Lombardi 1999; Ito and Mester 1999; Broselow 2003; Elkins 2020). Even so, prefix independence is so crosslinguistically common compared to suffix independence that previous works even argued for a universal restriction against constraints that refer to the right edges of words (Bye and de Lacy 2000), but these claims have now been refuted given evidence from languages that show specific patterns at right edges (Krämer 2003).

These constraints that predict prefix independence are often argued to stem from phonetic, prosodic, and psycholinguistic prominence associated with initial positions that, over time, become phonologized in languages (Ussishkin and Wedel 2009). For example, domain-initial positions are found to be articulatorily more robust than non-initial positions (Keating et al. 1997; Wedel et al. 2018), ultimately contributing to easier lexical access (Fougeron and Keating 1997). Initial positional also provide robust informational cues: they contribute more information than those presented later given the incremental nature of word recognition (Marslen-Wilson 1987; Gaskell and Marslen-Wilson 2002; Aylett and Turk 2004; Wedel et al. 2019). Although these word-internal initial prominence effects might not relate to prefix independence directly given that prefixes undergo affix stripping in lexical access (Taft and Forester 1975; Taft 1994), studies show that language learners show a bias for prefix independence in the lab (White et al. 2018).[32] The prevalence of prefix independence has also been attributed to the fact that, crosslinguistically, languages tend to be more suffixing than prefixing (Greenberg 1957; Hawkins and Gilligan 1988; Bybee et al. 1990; Cysouw 2006; Hupp et al. 2009): because suffixes are more common, they become more integrated to the root and seem to form a unit along with roots that is then the locus for phonological processes.

By contrast, the functional motivations for right-edge faithfulness remain unclear – right edges or domain-final elements don't seem to benefit from the phonetic, prosodic, or psycholinguistic prominence that left edges benefit from. So, given the variety of phonetic, phonological, and psycholinguistic evidence for the prominence of initial positions, right-edge phenomena are expected to be highly unlikely. However, it is indeed the case that edges in general, including right edges, are privileged in languages over the interiors of words (Krämer 2003), and this effect has been replicated experimentally in artificial grammar learning studies in the lab (Endress and Mehler 2010).

According to Elkins (2020)'s in depth typological study on prefix independence, there is only one language with a potential case of suffix independence, as evidenced in its stress assignment and obstruent agreement patterns. In Kabardian, stress falls on the final heavy CVC or CVV syllable, and otherwise stress is penult (71a), but suffixes that introduce heavy syllables fail to attract stress (71b). Notice that prefixes are in the domain of stress assignment: [ˈsə-tɕə-s] shows that, although the suffix [-s] introduces a heavy final syllable, the suffix is not in the stress domain, so stress falls in the prefix. And, in Kabardian, two adjacent consonants agree in voicing and laryngeal activity (ejective vs. plain, (71c)), but this agreement does not occur across the root-suffix boundary (71d).

[32] In affix stripping, a prefixed word is interpreted by its root first, followed by the interpretation of the whole material. So, since prefixes are stripped in initial interpretation, the position that is most likely protected by psycholinguistic considerations is the root-initial position, not word-initial.

(71) Kabardian suffix independence in stress assignment and obstruent voicing agreement (Elkins 2020; Gordon and Applebaum 2010).

a. Typical stress assignment

məʔɐˈrəsɐ	'apple'
saːˈbiː	'baby'
wə-lɐˈʑaːs	2ABS-work-PST-DCL

b. Suffixes fail to attract stress

ˈqʼaːlɐ-kʲɐ	city-INSTR
ˈməʃɐ-hɐ-kʲɐ	bear-PL-INSTR
ˈdaːmɐ-hɐ-m	wing-ERG-PL
ˈsə-tɕə-s	1ABS-write-DCL

c. Prefix consonants agree

s-oːʃ-ç	'I eat it (HAB)'
z-daː-s	'I sewed it'
f-ɬɐʷɐː-s	'you (PL) saw him'
v-daː-s	'you (PL) sewed it'

d. Suffix consonants fail to agree

/məz-t/	→	məz-t	forest-PST
/ʃəd-s/	→	ʃəd-s	donkey-PRES
/fəz-kʲɐ/	→	fəz-kʲɐ	woman-INSTR

Elkins (2020) and Applebaum (2013) argue that this suffix independence is actually illusory since it can be explained by other means that do not require positing an explicit asymmetry between prefixes and suffixes. Regarding obstruent agreement (71c) and {kab-d, they argue that it arises from a ban on voicing disagrement in onset position specifically. In Kabardian, the agreeing segments form part of a complex onset, while the disagreeing segments (root-final and suffix-initial segments) are in coda position, hence not required to repair. Therefore, under this analysis, the phonological processes extend to both prefixes and suffixes symmetrically, and the illusory suffix independence comes from an asymmetry between onsets and codas that builds up to an asymmetry between prefixes and suffix at the surface.

However, regarding Kabardian stress assignment, Elkins (2020) argues that suffixes fail to attract stress due to output-output correspondence, i.e. faithfulness to the base. Suffixes are attached such that their base forms are unaltered with respect to stress, thus maintaining identity to the base. Notice that this is strikingly similar to the pattern we see for suffixes in Guarani regarding nasality and nasalization. As shown in Section 3 of this paper, Guarani suffixes are attached in a way that keep the base unaltered in nasality since nasal suffixes fail to nasalize suffix-external elements. And, the analysis Elkins (2020) proposes for stress assignment is the same as in this paper given the empirical facts.[33] Guarani just has the additional component of right-edge faithfulness argued for in this paper. So, as with the Kabardian analysis of both stress assignment and obstruent voicing agreement, there is nothing explicit in the phonology that targets suffixes specifically: the fact that suffixes are independent in both languages stems from edge constraints (codas for Kabardian and the word's right edge for Guarani) along with output-output correspondence.

Interestingly, Guarani also shows suffix independence in stress assignment: prefixes in Guarani are never stressed but suffixes are unpredictably "stressable" or "unstressable", hence requiring some lexical specification for stress. On the other hand, prefixes are never stressed in Guarani since stress always falls on the root in Guarani, therefore a lexical specification of stress for prefixes is completely unneccessary. As previously discussed in Section 4, this might be another reason why nasality and nasalization in Guarani have historically been tied to stress, in addition to both these processes being right-aligned. However, the fact that suffixes show more independence regarding stress (because they require a lexical specification for stress). The proposed morphophonological analysis of suffix independence in nasality does not predict anything about the independence of suffixes regarding stress – this independence is just encoded in the lexicon.

[33] Applebaum (2013) also argues that Kabardian is not a true case of suffix independence since suffixes are subject to other word-internal phonological processes characteristic of roots and prefixes. But, this is also the case for Guarani. For example, suffixes show the same complementary distribution between nasal consonants and nasal-oral stops and between [ʤ] and [ɲ], regressive nasalization up to the suffix boundary, etc. And, suffixes in Guarani are not independent regarding stress assignment and progressive nasalization. I assume that, even if other morphophonological phenomena provides evidence for the cohesiveness of affixes with other domains, affixes can still be independent from other phonological patterns.

Finally, the proposed IDENT-R[NASAL] and OO-IDENT[NASAL] constraints can be extended to predict prefix independence. Namely, a higher ranked faithfulness constraint that protects left edges (IDENT-L[F]), plus cyclic morphological structure in prefixes, would predict the full contrast of feature [F] at the left edge of prefixes, as well as the spread of [F] if a markedness constraint preferring its spread is ranked above a general IDENT[F] constraint. Crucially, note that this analysis doesn't inherently connect right-edge faithfulness with the independence of suffixes. In other words, the independence of suffixes in nasality and nasalization is not predicted by a single mechanism. So, the proposed analysis of edge faithfulness and output-output correspondence potentially predicts languages with differences in the location of contrasts and affix independence: for example, this analysis predicts hypothetical languages with left-edge faithfulness with cyclicity in suffixes, or languages with right-edge faithfulness and cyclicity in prefixes. Further work on the typology of prefix-suffix asymmetry patterns and their analysis are required to assess if such patterns are indeed typologically attested. For example, if it's the case that edge faithfulness is always transparently tied to which affixes (prefixes or suffixes) show independence, then the analysis of both phenomena should be collapsed under the same mechanism to predict this typological regularity.

6.2 A possible prosodic analysis for Guarani suffix independence

The analysis proposed in this paper recruits morphophonological mechanisms to account for the phonological asymmetry between prefixes and suffixes in Guarani. I argued that, due to the language's cyclic morphological structure in suffixes (and not prefixes), these show no neutralization in nasality and they trigger regressive nasalization only suffix-internally. However, prefix-suffix asymmetries are also often argued to stem from asymmetries in prosodic structure, wherein the affixes that exhibit phonological independence are outside the prosodic domain within which the expected phonological processes are active, and elements that cohere phonologically are necessarily included in the same prosodic domain (Nespor and Vogel 1986; Peperkamp 1997; Mackenzie 2016; Bennett 2018; Elkins 2020). Moreover, previous literature on Guarani recruits the language's prosodic structure to account for other phenomena in the language, such as patterns in suffix order and reduplication (Dabkowski 2022a,b; Russell 2023a; Dabkowski and Russell 2025). I now briefly show that a prosodic analysis to Guarani's prefix-suffix asymmetry is just as plausible as the morphophonological analysis proposed in this paper, but under certain assumptions about how prosodic structure works in Guarani, which crucially contradicts that proposed in previous Guarani literature.

Before addressing previous literature regarding Guarani prosodic structure, we should lay out what is the basic prosodic structure that accounts for the suffix independence attested in Guarani nasality and nasalization. This prosodic structure is one wherein both lexically stressed and unstressed suffixes form their own prosodic words (ω), as given in (72) below. Roots must also form their own prosodic words since the second root fails to nasalize the first, as evidenced by Guarani compounds and forms with noun incorporation and reduplication. And, the first root and all prefixes are in the same prosodic word since prefixes are cohesive with the nasality and nasalization patterns attested in roots.

(72) $[\overleftarrow{\text{P} - \text{R}_1}]_\omega - [\overleftarrow{\text{R}_2}]_\omega - [\overleftarrow{\text{S}_1}]_\omega - [\overleftarrow{\text{S}_2}]_\omega - [\overleftarrow{\text{S}_3}]_\omega \ldots$

To predict that all suffixes fail to neutralize the oral/nasal contrast (even when unstressed), we can define the domain of IDENT-R[NASAL] to the prosodic word such that the oral/nasal contrast of the right edges of all prosodic words remain as lexically specified. The domain of ALIGN-L[NAS] does not need to be restricted to the prosodic word since IDENT-R[NASAL] simultaneously protects all rightmost positions of all prosodic words, therefore protecting each prosodic word from regressive nasalization triggered by prosodic words to their right. Since the leftmost root and all prefixes are in the same prosodic word, only the rightmost segment of the root is protected by IDENT-R[NASAL] and nasalization spreads leftwards throughout all segments in the root and prefixes. Note that the proposed IDENT-R[NASAL] constraint

is still necessary under this analysis – the constraints' reference to this prosodic structure in its domain only replaces the mechanism of output-output correspondence, namely OO-IDENT[NASAL]. So, suffix independence in this prosodic analysis is simply predicted by restricting the domain of IDENT-R[NASAL] to the prosodic word.

An alternative prosodic analysis is also possible under the assumption that Guarani prosodic structure is recursive (Ito and Mester 2009, 2012, 2021). The schematic structure necessary to predict the nasality and nasalization facts is in (73) below. Here, suffixes do not form their own prosodic words as they did in (72). Instead, they recursively adjoin to the prosodic word constituent, forming parts of increasingly larger prosodic words as more suffixes adjoin. Prefixes are still within the domain of roots as they are clear targets of nasalization from the leftmost root or other prefixes to their right.

(73) $[[[[[\overleftarrow{\text{P} - \text{R}_1}\,]_\omega - \overleftarrow{\text{R}_2}\,]_\omega - \overleftarrow{\text{S}_1}\,]_\omega - \overleftarrow{\text{S}_2}\,]_\omega - \overleftarrow{\text{S}_3}\,]_\omega \ldots$

As with the previous prosodic analysis in (72) above, the IDENT-R[NASAL] constraint also applies within the domain of the prosodic word, such that regressive nasalization proceeds suffix internally. So, IDENT-R[NASAL] protects the right edges of all prosodic ω constituents, including those ω prosodic words that are intermediate. Ultimately, both prosodic structures in (72) and (73) have the same effect as the output-output correspondence analysis: suffixes attach (either recursively or non-recursively) to the phonological phrase in a way that leaves preceding suffixes, roots, and prefixes unaltered in nasality and nasalization.[34,35]

The problem with the prosodic structure in (72) above is that Guarani's lexically unstressed suffixes must also form their own prosodic words. This crucially goes against previous literature that proposes prosodic analyses for other morphophonological phenomena in Guarani. Specifically, Dabkowski (2022a,b); Russell (2023a) and Dabkowski and Russell (2025) argue for a prosodic structure for Guarani where only lexically stressed suffixes form their own prosodic words while lexically unstressed suffixes remain unprosodified, using evidence from Guarani's suffix order restrictions and reduplication patterns. Dabkowski (2022a,b) and Dabkowski and Russell (2025) show that Guarani has variable suffix order, but lexically stressed suffixes are always ordered before lexically unstressed suffixes, as shown in (74) below.[36] And, Russell (2023a) and Dabkowski and Russell (2025) show that reduplication is also sensitive to the lexical specification of stress of suffixes: the reduplicant, which is always composed of two syllables, may optionally contain syllables from lexically stressed suffixes but most not contain syllables from lexically unstressed suffixes. In (74) and (75) below, *-mo'ã* NEG.FUT, *-ve* 'more', *-pa*/*-mba* TOT and *-ite* INT are lexically stressed suffixes (underlined), while *-ma* CMPL and *-pa* Q are lexically unstressed suffixes.

(74) (adapted from Dabkowski and Russell (2025), Examples 8 and 12)

a. *a-guata-mo'ã-ve*
1SG-walk-NEG.FUT-more
'I planned to continue walking'

b. *a-guata-ve-mo'ã*
1SG-walk-more-NEG.FUT

[34] The fact that prosodic categories may be recursively self-embedded is not universally accepted (Vogel 2009a,b). And, prosodic analyses to prefix-suffix asymmetries are often proposed when alternative morphophonological analyses encounter the "missing base" problem, in which the base of correspondence is not a legal output in the language (Mascaró 2016; Bennett 2018). However, in Guarani, all morphological bases are legal outputs in the language under the assumption that prefixes are ordered first in the derivation before suffixes, as discussed in Section 4.1.

[35] Interestingly, the fact that the mechanism regulating allomorphy selection (PROGHARM) references the left edges of suffixes might support the non-recursive prosodic structure in (72) over the recursive one in (73): the left-edge of the prosodic word is more clearly demarcated in the prosodic structure in (72), and PROGHARM can be defined in such a way that requires agreement between the rightmost syllable of the root and the left edges of other prosodic words to their right. Notably, the domain of this mechanism if the phonoloical phrase and not the prosodic word, since the nasality or orality of the rightmost segment of the root does affect suffixes.

[36] Dabkowski (2022a,b) note that the flexible order of suffixes does not change scope. See these works for details on how scopal relations were evaluated with the language consultants.

c. *a-guata-pa-ma*
1SG-walk-TOT-CMPL
'I finished walking'

d. **a-guata-ma-pa*
1SG-walk-CMPL-TOT

(75) (adapted from Russell (2023a), Examples 13 and 14)

a. *o-myaña-**myaña**-mba-ite*
3-push-RED-TOT-INT
'she keeps pushing'

b. *o-myaña-mba-**ñamba**-ite*
3-push-TOT-RED-INT

c. *o-myaña-mba-ite-**mbaitei***
3-push-TOT-INT-RED

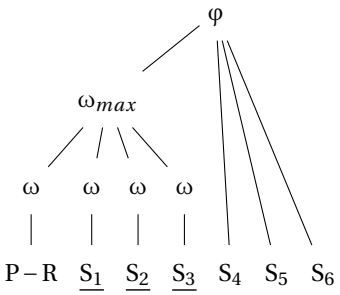
d. *re-karu-**karu**-ma-pa*
2SG-eat-RED-CMPL-Q
'have you eaten a little something already?'

e. **re-karu-ma-**ruma**-pa*
2SG-eat-CMPL-RED-Q

f. **re-karu-ma-pa-**mapa***
2SG-eat-CMPL-Q-RED

To account for these ordering restrictions, these works propose a prosodic structure for Guarani in which lexically stressed suffixes form their own prosodic words while lexically unstressed suffixes are non-prosodified and attach to the phonological phrase directly, as show in (76) below.

(76) Schematic Guarani prosodic structure proposed in Dabkowski (2022a,b); Russell (2023a); Dabkowski and Russell (2025). Underlined suffixes are lexically stressed.



Dabkowski (2022a,b), and Dabkowski and Russell (2025) account for the variation in ordering of suffixes by having suffixes subcategorize for prosodic words to their left, therefore suffixes attach to the right edges of prosodic words. For verbs with prosodified (lexically stressed) suffixes, the suffixes can attach in any order since the root's right edge as well as all of the suffixes' right edges are prosodic word boundaries. For forms with prosodified and unprosodified (lexically unstressed) suffixes, the analysis adds a restriction that the rescursive prosodic word (ω_{max} in (76) above) must immediately dominate only prosodified suffixes. Therefore, structures wherein a non-prosodified suffix precedes a prosodified suffix are ruled out. Russell (2023a) and Dabkowski and Russell (2025) use the same mechanism to account for the pattern of reduplication in (75) above. The reduplicant, a prosodic template consisting of two syllables, may attach to the right of any prosodic word within the verb, similar to the flexible attachment of prosodified suffixes. So, the reduplicant template never attached to the right of non-prosodified suffixes and so it never copies segmental material from unprosodified suffixes.

Under the prosodic structure in (76), the domain of IDENT-R[NASAL] must still be the prosodic word to account for the lack of nasalization across adjacent lexically stressed suffixes. But, this would leave the unprosodified suffixes outside the domain of right-edge faithfulness, therefore predicting their neutralization of the oral/nasal contrast and their lack of suffix-internal nasalization. Ultimately, the failure of this prosodic analysis at predicting the full system of Guarani oral/nasal contrast and leftward nasalization reinforces the fact that neither are tied to stress: it must be the case that, regardless of stress, all suffixes

either form their own prosodic words (as in (72)) or are recursively adjoined to prosodic word constituents (as in (73)) to full facts on Guarani nasalization.

However, the prosodic structures proposed in (72) and (73) fail to provide a prosodic account for the suffix ordering and reduplication patterns described in Dabkowski (2022a,b); Russell (2023a), and Dabkowski and Russell (2025). This is simply because their account involves not prosodifying lexically unstressed suffixes, which is incompatible with what is required for the suffix independence observed in regressive nasalization. This complete mismatch between Guarani nasality and stress potentially suggests that Guarani nasalization warrants an explanation based on output-output correspondence and cyclic morphological structure, while other morphophonological phenomena that are tied to stress (such as Guarani suffix order and reduplication) warrant a prosodic explanation.

Ultimately, the current data on Guarani nasalization does not disentagle between a morphological vs. prosodic analysis. And, both analyses make theoretical assumptions and stipulations, some of which are typologically supported and others of which are contested in the literature. The same applies to the two possible prosodic structures proposed here: in one you have to assume that lexically unstressed suffixes can form their own prosodic words, which goes against previous proposals, and in the other you have to assume that prosodic structure is recursive, which is also contested. So, both the morphophonological analysis proposed in this paper as well as a prosodic analysis are possible, but a better understanding of the broader array of morphophonological phenomena in Guarani may help disentangle these analyses. Still, regardless if Guarani's suffix independence is formalized using morphophonological or prosodic mechanisms, it is still clear that Guarani nasality must be positionally faithful at the right edges of words as opposed to at stressed syllables. The prosodic analysis to suffix independence would only substitute the proposed output-output correspondence constraint and not right-edge faithfulness.

6.3 Dialectal variation in progressive nasal harmony

The final point of discussion in this paper is that, although the language consultants whose data is featured in this paper show general agreement in the phonological patterns of Guarani, there is some dialectal variation in progressive harmony among the language consultants. Such variation potentially suggests that suffixes are becoming increasingly independent from the nasalization patterns of roots and prefixes. The speakers of Guarani dialects spoken in more urban areas (Asunción and Concepción) show robust progressive harmony alternations in roots, such as in compounds and causative constructions, but they only occasionally show progressive harmony in suffixes. But, the consultants from Coronel Oviedo show more productive and consistent progressive harmony in both roots and suffixes (therefore consistent with the data and generalizations of Section 5). Specifically, both speaker groups have the progressive harmony alternations seen in causative constructions and in compounds (consistent with the data in (66), (67), (68), and (69) above). However, when it comes to forms with suffixes (as in (57) to (60), and (63) to (64)) the speakers from Asunción and Concepción have oral-initial suffix allomorphs even when preceded by fully nasal roots, as shown in (77) below.[37] This is also the case for forms where the otherwise alternating suffixes immediately follow the phonemic nasal vowel of the root.

(77) a. ***Coronel Oviedo speakers:***
o-ñe'ẽ-se-mba-mbotá-mẽve
[õ-ɲẽʔẽ-se-mᵇa-mᵇoˈta-mẽṽẽ]
3-talk-DES-TOT-INCIP-until
'until he is about to finish wanting to talk'

b. ***Asunción / Concepción speakers:***
o-ñe'ẽ-se-pa-potá-peve
[õ-ɲẽʔẽ-se-pa-poˈta-peve]
3-talk-DES-TOT-INCIP-until
'until he is about to finish wanting to talk'

[37] Both speakers were asked to produce these and other constructions organically, and were also asked to judge forms with consistent or variable progressive harmony alternations.

Additionally, the speakers from Asunción and Concepción may show variation in progressive harmony even within the same form, as in (78) below. Here, they show progressive harmony in the first but not the second suffix.

(78) a. *jagua-kuéra-pe*
[ʤaɣʷa-ˈkʷera-pe]
dog-PL-DOM
'dogs'

b. *mitã-nguéra-pe*
[m̃ĩt̃ã-ˈŋgʷera-pe]
child-PL-DOM
'children'

This dialectal variation potentially serves as further evidence of the incohesiveness of suffixes to the phonology of roots and prefixes, and perhaps that the independence of suffixes is being generalized from regressive nasalization onto progressive harmony. However, the lack of progressive harmony alternations in certain dialects could just reflect that progressive harmony is becoming increasingly unproductive in general, a fact that is supported by diachronic studies of the pattern in Tupi-Guarani (Estigarribia 2021). But, it is still worth noting the asymmetry between roots targets and suffix targets in the dialectal variation, where only suffixes, and not roots, show less progressive harmony alternations.[38] Of course, more comprehensive studies are needed to determine the true extent and distribution of variation in progressive harmony. This is perhaps a starting point to the study of dialectal variation in Guarani nasalization and progressive harmony, the latter of which has only recently started to be rigorously investigated (Russell 2021, to appear; Cabrera 2025).

7 Conclusion

This paper presented a reanalysis of the distribution of nasality and the pattern of leftward nasalization in Paraguayan Guarani, based on newly collected fieldwork data on the language's pattern of nasalization in suffixes. In Guarani, suffixes show asymmetric phonological behavior regarding the distribution of the language's oral/nasal contrast and its system of regressive nasalization. Specifically, while prefixes are never stressed and they are clear targets of regressive nasalization, suffixes are lexically stressed or unstressed, they fail to neutralize the oral/nasal contrast, and they only show suffix-internal nasalization. Crucially, this data on suffixes, and a more detailed study of Guarani roots with non-final stress, reveal that Guarani nasality is instead positionally faithful at the right edges of words as opposed to at stressed syllables, which has long been the prominent analysis for the nasalization pattern of the language (Sportiche 1977; Vergnaud and Halle 1978; Trigo 1993; Flemming 1994; Beckman 1998; Walker 1998, 1999, 2000; Kaiser 2008; Dabkowski and Russell 2025). Right-edge faithfulness, along with the language's cyclic morphological structure, fully predicts the distribution of nasality and leftward nasalization in Guarani. Guarani holds a special place in the typology of prefix-suffix asymmetries since prefix independence, as opposed to suffix independence, is overwhelmingly more common crosslinguistically.

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[38] The fact that suffix nasalization, and not root nasalization, under progressive harmony shows variation for some speakers might serve as further evidence that suffix and root nasalization are different in Guarani. Russell (2021) shows evidence that Guarani causative constructions are lexicalized, and compounding is not entirely productive in Guarani, therefore it might be the case that some Guarani dialects have lexicalized root progressive nasalization while suffix nasalization remains variable.

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