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THE INTERFACE OF STRESS AND NASALITY IN TUPÍ-GUARANÍ LANGUAGES IN A HISTORICAL PERSPECTIVE

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ABSTRACT
We discuss data from a range of Tupí-Guaraní languages seeking for foundations for the hypothesis under which in early stages of the Tupí-Guaraní family stress would have interacted with [+/- nasal] prosodic features yielding, among other things, patterns of nasal and post-oralized nasal consonants in the phonetic output of phonological words. Our hypothesis also states that the present day distribution of fully nasal, post-oralized nasal and voiced oral consonants across languages of different sub-branches is the result of adjustments in the action's scope of such interface, oriented by principles of balanced symmetry between oral and nasal patterns.

KEY WORDS: Nasality, Stress and nasalization interaction, Tupí-Guaraní languages, language changes, phonological patterns.

1. INTRODUCTION

In this paper[3] we retake an issue of relevance in the phonological studies of several Tupí-Guaraní languages, which had been in the focus during the early generative works on the geometry of phonological representations – the interface of stress and nasality. We discuss data from a range of Tupí-Guaraní languages seeking for foundations for the hypothesis under which in early stages of the Tupí-Guaraní family stress would have interacted with [+/- nasal] prosodic features yielding, among other things, patterns of nasal and post-oralized nasal consonants in the phonetic output of phonological words. Our hypothesis also states that the present day distribution of fully nasal, post-oralized nasal and voiced oral consonants across languages of different sub-branches is the result of adjustments in the action's scope of such interface, oriented by principles of balanced symmetry

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between oral and nasal patterns. The languages, as we shall demonstrate, have changed the original configuration of such interface either by increasing the domains of contrast between [+nasal] and [–nasal] spans, as it has happened with the Zo'é language, in which words are either oral or nasal, or by reducing such domains so that nasality has remained only a feature of nasal consonants, such as in Asuriní of Tocantins and in Parakanã.

In section **2** we present a panorama of the distribution of nasal consonant variants across some Tupí-Guaraní languages representative of the six sub-branches of the Tupí-Guaraní family, according to its internal constitution as proposed by Rodrigues (1985). This panorama shows the existence of some languages displaying fully nasal and post-oralized consonants, other languages showing fully nasal, post-oralized, and fully oral variants. This panorama also presents evidence favoring a view, discussed in section **4,** that a contrast of nasal versus oral features in association with stress has been playing an important role in the development of historical changes underwent by languages of the Tupí-Guaraní family, contributing to their phonological differentiation and affecting other phonological domains. As we shall show, the languages have reacted differently in relation to the effects of stress, changing patterns in opposed directions, either to a nasal extreme or to an oral one.

The present work also retakes in section 3 earlier important studies on nasalization in Tupí-Guaraní languages, which have made innovative claims that are still valid nowadays as adequate explanations for the phenomena of nasality in that linguistic family, such as Gregores and Suárez (1967), who have stated for the first time that nasality and stress should be treated as belonging to a high phonological level, such as the prosodic one, as well as Harrison and Taylor's (1971) morpheme approach to the domain nasality, and the work by Goldsmith (1976) on auto-segmental phonology, which is still an explicative model of representing important aspects of the phenomena under discussion here.

In section 5 we make some considerations on the historical changes underwent by languages from different sub-branches in relation to nasality and stress, and we recognize the autosegmental approach to these aspects of the Tupí-Guaraní languages as one of the most faithful to the facts of such languages.

2. THE DISTRIBUTION OF NASAL VERSUS VOICED ORAL CONSONANTS ACROSS TUPÍ-GUARANÍ LANGUAGES

Excluding sub-branches IV and VII of the Tupí-Guaraní family, all other sub-branches have languages displaying some alternation between fully nasal and post-oralized consonants, and there are some of them which also display voiced oral consonants. In branches I, II, III, and VI, all languages display alternation of nasal and post-oralized stops, the former occurring in nasal contexts and the later in oral ones. It is important to note that when a stem has more than one nasal consonant, only the closest one to an oral stressed vowel surfaces as a post-oralized nasal (examples 1c, 3b, 5b and c, 6b, 7b, 8b, and 10b of table 1). The Tupinambá language differs from the others in that post-oralized variants occur systematically only in onset position of syllables with oral stress (examples 7a and b of table 2) as well as in presenting a fluctuation of nasal and post-oralizad variants when the nasal consonant belongs to a syllable to the left (7c, d and e) (Rodrigues 1958:106-107).

Among the languages of sub-branch V, Araweté is the only language which shows some instances of voiced stops, but not all of them derived from PTG nasal consonants. The alternation *bydé ~ mydé*,

4. Cabral, Rodrigues and Solano (2011) present a hypothesis under which the word bydé ~ mydé 'we (all)' derived from PTG *m-pir+er /generic human-skin-retrospectif/ 'human skin', following an analogous direction of the present day word míra 'people' in Língua Geral Amazônica.

for example, seems to be one of the marginal illustrations of the alternation.[4] The instances of *d* found in Araweté are a consequence of a former change of PTG *i* > ɨ,, which motivated the change of a contiguous *r* into *d*, as in [pɨˈdɛ] < PTG **pirá* (see Solano 2004). In Asuriní of Xingu, on the other hand, nasal alternates with post-oralized nasal and with voiced stops respectively in nasal and oral contexts. In languages of sub-branch VIII, such as Urubú-Ka'apór, the alternation is quite marginal, being better characterized as a marginal free variation, where post-oralized nasals occur instead of full nasals in onsets of stressed syllables with oral vowels (Kakumasu 1986, Caldas 2009). Part of the languages of sub-branch IV are like Kamayurá (sub-branch VII), in that there is in them no alternation of full nasal versus post-oralized nasal or versus voiced stops. The Tenetehára languages, Tembé and Guajajára, as well as Asuriní of Tocantins, Parakanã and Suruí, all lack nasal vowels, whereas Avá-Canoeiro (Borges 2007) and Tapirapé (Leite 1977, 1995) do have nasal vowels.

The two following tables present data representative of the Tupí-Guaraní languages which display nasal consonants (table 1) versus post-oralized nasal and/(or) voiced stop consonant (table 2) alternation.

TABLE 1. NASAL CONSONANTS[5]

GA	1a	o[m]a[n]õ	'he dies'	**Gy**	6a	[m]árã	'what?'
	b	[m]araka[n]ã	'a parrot, *Ara* sp.'		b	ai[m]ẽẽ	'I give it'
					c	[m]araká[n]ã	'a parrot, Ara sp.'
GP	2a	[m]okõj	'two'	**Tb**	7a	[m]ytũ	'a bird, *Crax* sp.'
	b	[m]itã	'child'		b	[m]araká	'rattle'
					c	[m]urukujá	'passiflora'
Mb	3a	[m]okõj	'two'	**AsX**	8a	[m]aja	'snake'
	b	o[m]a[n]õ	'he dies'		b	[m]erú	'fly'
					c	[m]a[n]i'áka	'manioc'
					d	e[ma]rakañĩ	'sing!'
					e	ipi[n]i[ŋ]	'he blushes'
Ch	4a	[m]õa	'medicine'	**Pt**	9a	[m]ytũ	'a bird, *Crax* sp.'
	b	o[m]ã[n]õ	'he dies'		b	[m]oytí[ŋ]	'glas beads'
	c	[m]arakãnã	'a parrot, *Ara* sp.'				
Em	5a	[m]ytũ	'a bird, *Crax* sp.'	**Ju**	10a	[m]ahã	'what, which'
			'two'		b	i[n]a[m]ũ	'a bird *Cripturellus* sp.'
	b	[m]ojepehã	'he is white'		c	ikã[ŋ]	'it has bones'
	c	itxi[ŋ]					

TABLE 2. POST-ORALIZED VARIANTS OF NASAL CONSONANTS

5. Abbreviations for languages names in tables 1 and 2:
AsX = Asuriní of Xingu
Ch = Chiriguano
Em = Emérillon
GA = Guaraní Antigo, Old Guaraní
GP = Guaraní Paraguaio, Paraguayan Guaraní
Ju = Júma
Mb = Mbyá
Tb = Tupinambá

GA	1a	ka[mb]í	‘monkey’
	b	[mb]erú	‘fly’
	c	ma[nd]i’oɤ	‘manioc’
	d	[mb]arakajá	‘wild cat’
GP	2a	[mb]ój	‘snake’
	b	[mb]a’é	‘thing’
	c	ka[mb]ý	‘milk’
	d	[mb]urukujá	‘passiflora’
Mb	3a	[mb]ój	‘snake’
	b	mo[nd]é	‘trap’
	c	[mb]arakujá	‘wild cat’
Ch	4a	[mb]ój	‘snake’
	b	ká[mb]y	‘milk’
	c	[mb]éru	‘fly’
	d	[mbarakája	‘passiflora’
Em	5a	[mb]ódʲ	‘snake’
	b	na[mb]í	‘ear’
	c	tama[nd]uá	‘ant eater’
	d	[mb]yrisý	‘palm tree’
Gy	6a	[mb]ój	‘snake’
	b	[mó[nd]e	‘trap’
	c	[mb]á’e	‘thing, food’
	d	[mb]arakája	‘wild cat’
Tb	7a	[mb]ój	‘snake’
	b	mo[nd]é	‘trap’
	c	[mb]a’é ~ ma’é	‘thing’
	d	[mb]erú ~ merú	‘fly’
	e	[mb]uruβixáβa ~ muruβixáβa	‘chief’
As-X	a	[mb]ejú	‘manioc kukies’
	b	je me[mb]ýra	‘my son/ woman speach’
	c	e[nd]é	‘you’
	d	mapuru[ŋg]í ~ mapuru[g]í	‘a person name’
	e	ipyrý[g]	‘it is red’
Pt	9a	[mb]ój	‘snake’
	b	ña[nd]ú	‘spider’
	c	[mb]arakajá	‘wild cat’
Ju	10a	[mb]a’í	‘small girl’
	b	ina[mb]í	‘his ear’
	c	[mb]ietiwáp	‘salt cellar’

From a contrastive analysis of the above data we may summarize the following:

- The alternation of nasal versus post-oralized consonants is motivated by the nasal or oral context following such consonants.
- The affected nasal consonant is the first one from left to right preceding a stressed oral vowel (GP [mb]ój ‘snake’, Mb mo[nd]é ‘trap’; Tb [mb]ój ‘snake’, PT ña[nd]ú ‘spider’).
- Asuriní of Xingu behaves differently from the other languages, since its nasal velar consonants have also oral voiced variants preceding oral vowels as well as in coda position of an unstressed syllable.
- There are languages with final stress and languages with penultimate stress.

These observations are of importance for the discussion that follows on the motivations of sound changes in Tupí-Guaraní languages which have induced the developing of symmetric alternation of oral and nasal morphemes in some languages in contrast to other languages in which orality does not trigger denasalization of nasal consonants.

3. THE EARLIER WORKS ON NASAL AND ORAL VARIANTS OF TUPÍ-GUARANÍ NASAL CONSONANTS

3.1. Gregores and Suárez (1963) account of nasality in Paraguayan Guaraní

Gregores and Suárez (1967) were the first linguists to distinguish two different nasality types in Tupian languages, in observing the linear distribution of oral and nasal spans of utterances in Paraguayan Guaraní. They concluded that every utterance in that language is heard as nasal or oral spans. The evidence found by Gregores and Suárez led them to consider *O* and *N* in the first place as prosodic features, treating them as they have treated stress. They observed that /m, n, ŋ/ as consonants differ from the other consonants with respect to nasality. They noticed that:

The amount of nasalization is not exactly the same everywhere; in the position

> *immediately following any consonant except [m, n, ŋ], the contrast is heard between a complete oral or slightly nasal vowel, and a strong nasalized vowel, sometimes involving a nasal closure at the end; in the position immediately following [m, n, ŋ], the contrast is only between a completely oral vowel, following oral release in the consonant, and a somewhat nasalized vowel when the release of the consonant is nasal; in the latter case, and however weak the nasalization of the vowel may be, it is always present. (Gregores and Suárez 1967:42).*

A very important observation made by Gregores and Suárez is that phonetically there is at least three degrees of nasalization in Guaraní and that native speakers, "who do not hear differences in isolation but in utterances, hear the difference O-N after [m, n, ŋ] both in the consonant and in the vowel." (p.42). They observe that even being purely phonetic, this contributes to give [m, n, ŋ] a place into the system different of the other consonants.

Another fundamental observation made by the authors is that "after pause, every consonant, except [m, n, ŋ], may occur with N only if the following vowel (and normally several more bundles) occur also with N." The nasal consonants, differently, occur after pause whatever the following vowel is a nasal or an oral. Concluding, Gregores and Suárez observe that the nasals are the only sounds that constitute a nasal span by themselves and, most importantly, if we were to extract N from them, we would have [b, d, g] occurring with N after pause and before a nasal span.

In order to explain the conditioning of nasalization by the vowels Gregores and Suárez make use of the notion of "spreading" of nasality from one point, in which it is contrastive, to the preceding sounds, in which it is determined and non-contrastive. The authors arrive to an elegant solution under which nasality is conceivable as predictable, in most of its occurrences, as the domain of nasalization is defined. The authors observe that the phonological domain of nasalization "has its phonetic correlate in the fact that, in it, the velum is increasingly lowered, from its beginning towards the vowel in which N is contrastive, in such a way that the nasal timbre is strongest at the end of the domain."

The authors conclude that there are two kinds of nasality in Paraguayan Guaraní, nasality that occurs in the consonants [m, n, ŋ] which is their defining feature and nasality which is the manifestation of a different phonetic unity n̄.

In their phonemic interpretation of nasalization in Paraguayan Guaraní, Gregores and Suárez consider the occurrence of n̄ as a phoneme of nasalization /˜/ that includes as members all the sequences of linear phonemes that are heard as strongly nasalized, in a contrastive manner, but not those in which n̄ is automatically present and nasalization is weak. For the authors sequences such as [ṽãr̃ã] or [ñãñ ẽr̃ãtãp̃ĩ̃] constitute the domain of /˜/.

3.2. A brief overview of Goldsmith analysis of Guaraní nasal and oral phonological spans

The first theoretical attempt at explaining the nasal versus post-oralizad alternation of nasal consonants present in Tupí-Guaraní languages is due to Goldsmith (1976). Using Guaraní data from Lunt (1973) and Rivas (1974), Goldsmith, argued for an autosegmental phonology, since Guaraní, according to him, favors the visualization of a bidirectional spreading phenomenon of nasalization versus post-oralization, which is due to the geometry of autosegmental representations and its Well-formedness Condition (or WFC). Goldsmith calls the attention for the Guaraní affixes *nV* 'negation', *ro-* 'causative comitative', and *-i* 'negation' which, as shown by Guaraní data, surface as: *ⁿdo ~ nõ, ro- ~ r̃õ- , -i ~ -ĩ*. An illustration given by Goldsmith (1976:50) is the following:

75a. ⁿdo + ro+ haihú +-i (oral stem)

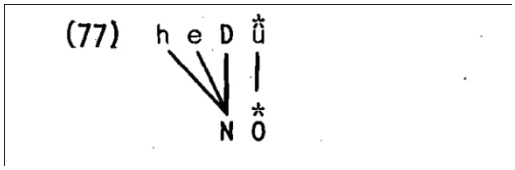
b. nõ + ɾ̃õ + hẽndú + -i (oral stem with nasal in it)
c. nõ + ɾ̃õ + nũpã̄ + -ĩ (nasa1 stem)

According to Goldsmith "Which alternate appears is determined by the stem, the morpheme which contains the accent" and "In general, a vowel with an accent in Guaraní is also one endowed with a nasality melody or specificaton". In saying so, Goldsmith claims for an autosegmentalized view of nasality in Guaraní, where the oral versus nasal melodies "are initially associated with accented vowels". Goldsmith also analyses true nasal consonants "as endowed with an inherent Nasal specification on the autosegmental level (these true nasal consonants are m, n, ŋ, ŋw)." Goldsmith represents a stem like the one in 75a by 76a and a stem as in 75b by 76b.

(76) a. h a i h ũ b. h e D ũ

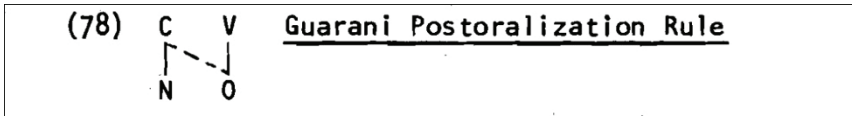
According to Goldsmith, the symbol "D" "represents all the normal feature specifications of an */n/* except for nasality -- raised tongue, and so forth." The symbol "0" corresponds to a [-nasal] element, whereas "N" symbolizes [+nasal]. Accent is indicated by a star. As above, the star * indicates an accent; corresponding autosegments are accented (starred) also. The Well-formedness Condition must apply to the forms in (76) yielding:

(77)



The Well-formedness Condition does not create post-oralized consonants, Goldsmith proposes a rule which creates them, represented by (78):

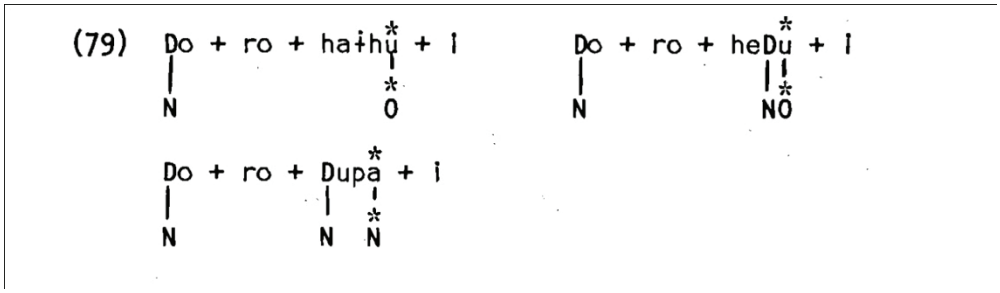
(78)

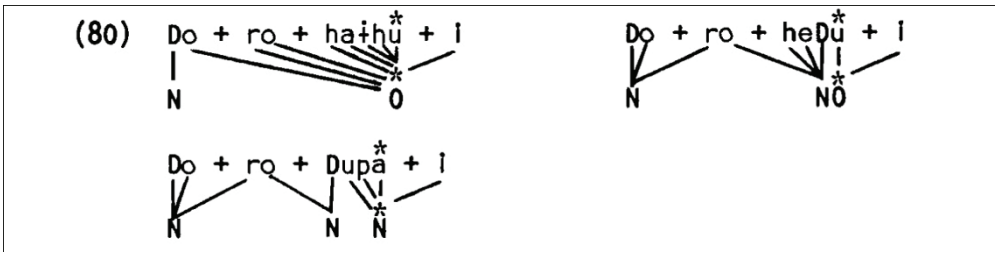


The Well formedness Condition and the post-oralization rule applied to (79) give the following:

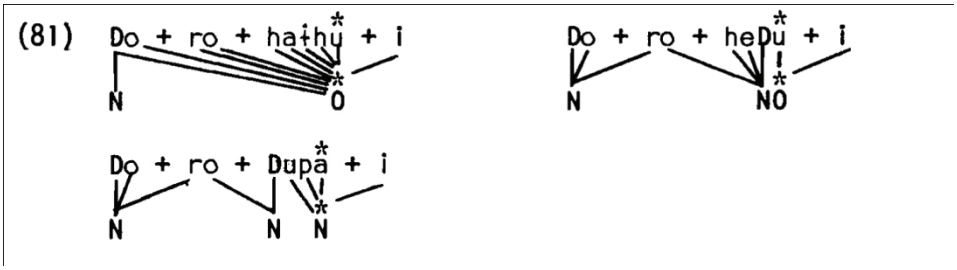
Well formedness condition:

(79)





Post-oralization rule:



Goldsmith observes that bidirectionality of the spreading "is the result, in a sense, of the fact that there are prenasalized stops."(1976:52).

Three points of the autosegmental analysis of Goldsmith to explain the presence of post-oralized nasals in Paraguayan Guaraní are also of great importance for the understanding of how Tupí-Guaraní languages have changed over time: the existence of inherent nasality (nasal consonants), the interface of stress and nasal versus oral features, and the creation of post-oralized nasals. We will consider these points in our working hypothesis on the Tupí-Guaraní internal motivation for the changes underwent by the languages during their historical diversification.

3.3. Harrison and Taylor analysis of nasalization in Kaiwá

Harrison and Taylor (1971) have given one of the main contributions to the understanding of the nasalization phenomena in a Brazilian Tupí-Guaraní language, the Kaiwá language. The Kaiwá data have led them to conclude that:

> *...nasalization needs to be described in terms of something other than the syllable. A hypothesis which attributes intrinsic nasality to certain whole morphemes in the language turns out to be the most fruitful, although certain other qualifications must be added in order to develop a truly comprehensive descriptive system for nasalization in Kaiwá. (1971:16).*

An important fact observed by Harrison and Taylor is the occurrence of full nasal allophones (and not post-oralized ones – postoccluded in their terms) following oral vowels. As stated by the authors in view of the facts they have observed, a hypothesis which attributes intrinsic nasality to certain whole morphemes in the language turns out to be the most fruitful to explain nasalization in that language. In their analysis, Harrison and Taylor make use of two important ideas, the existence of intrinsically nasal morphemes and the existence of stress groups. A stress group, according to Harrison and Taylor, is a "...group of syllables which can occur immediately before and after a syllable which has primary stress." (1971:16). A primary stress is defined as primary intensity with concomitant features of

length of the whole syllable and rising pitch. They also define nucleus to be the syllable with primary stress and all syllables that precede it in a stress group. Nucleus and margin are two concepts of great importance for the explanation the authors give to the nasalization process in Kaiwá.

The authors also make clear that the division between stress groups, which they define as "the point at which the margin leaves off and another nucleus begins", which is determined by a combination of "potential pause and an audible rhythm change in which there is a relative speeding up of the first part of the nucleus in relation to the last part of the preceding margin." (1991:16).
Harrison and Taylor propose four rules which would account for the nasalization phenomena in Kaiwá:

Rule 1

Within the nucleus, if an intrinsically nasal morpheme occurs, *it* will potentially nasalize morphemes that precede it within the limits of the stress group boundary.
šẽ apɨ̃ gwa-rupí ' in my nose cavity', 'in my nostril'(1971:17)

Rule 2

The postoccluded nasals m^b, n^d, $ŋ^g$ (which occur only in nuclei) will nasalize all syllables which precede them in a nucleus in normal speech and often in slow speech as well.
tẽmbiʔu 'food'
õ mõ ñẽ ^{m}bo asɨ 'he makes him sorry for himself'(1971:18)

Rule 3

A nasal margin does not affect an oral nucleus apart from a possible slight nasalization of the final vowel of the nucleus.
õ manõ mbã ma 'they all died' (rules 1 and 3) (1971:18)

Rule 4

Certain margins manifest nasal allomorphs if the last morpheme of the nucleus is nasal.
o ke-pɨ 'in his sleep'
oke-mɨ̃ 'in his doorway' (rule 4) (1971:19)

The importance of Harrison and Taylor's work on nasalization in Kaiwá resides primarily in the fact that they propose two types of nasality, one of them as part of the nasal consonants and the other related to morphemes.

3.4. The treatment of nasality in other Tupí-Guaraní languages

The analysis of Lunt (1973) of nasality in Guaraní also views nasality associated to a class of lexical morphemes as did Harrison and Taylor (1971). Lunt also inspires his analysis in Gregores and Suárez work, as he recognizes different degrees of nasalization according to the distance from the nasal centers. Rodrigues (1980) and Grannier Rodrigues (1990) have analyzed respectively in Tupinambá and in Old Guaraní two kinds of nasality, a nasality conveyed by nasal consonants and a nasality conveyed by suprasegmental phonemes, a nasal /˜/ and an oral /´/. Grannier Rodrigues also postulated the existence of another suprasegmental phoneme /`/ for Old Guaraní, following Gregores and Suarez (1967). She (1990:50-51) recognizes though the relevance of the nasal/non-nasal property in the opposition of the consonantal phonemes and recognizes, as was done by Gregores and Suárez, two

suprasegmental phonemes which are opposed by the nasal/non-nasal properties. These properties constitute, according to Grannier Rodrigues, the only manner of describing properly the conections between a group of stress and nasalization.

Grannier Rodrigues (1990:67), in order to explain the nasalization processes present in Old Guaraní, affecting [+voiced] segments across syllables, defines group of stress (which may be tonic or not) as the minimal phonological unit where sub-phonemic alternations motivated by nasalization are developed.
Cabral (2001) proposes the existence of a series of voiced oral stops in Zo'é, as well as a series of oral vowels, nasality being a feature of morphemes which associates to all sonorant segments by means of stress assignment. Following Rodrigues (1980), she posits the existence of a contrast between nasal and oral suprasegmental phonemes accounting for the phonological form of words as being either oral or nasal. This fact about Zo'é words accounts for the existence of underlying voiced stops as well as vowel unspecified for nasality, and also for the fact that all voiced segments are phonetically associated to the nasal feature of a lexical stem.

Costa (2007) proposes a series of pre-nasalized stops as phonemes for Ñandéva, surfacing as such preceding oral vowels and surfacing as full nasals preceding nasal vowels (p. 91). Costa reconsiders her previous analysis (2002) and proposes that accent and nasality are independent and that "they only coincide as to their place of occurrence." For her, "Among vowels there exists a phonological nasality which is only distinctive in stressed position, generating stressed oral and stressed nasals."

3.5. Summarizing

Although the analyses of nasalization in Tupí-Guaraní languages are divergent in some aspects, they all recognize at least two levels of nasality, one which is part of the nasal phonemes and nasality which associates to Tupí-Guaraní vowels. With the exception of Costas' analysis, all the other consider an interaction between stress and nasality in their association to vowels. All analyses also recognize a domain of spreading of nasality/orality and a group of stress comprising all syllables affected by the spreading of nasality/orality. All this means that the early works carried out on the nasalization phenomena of Tupí-Guaraní nasality, specially Gregores and Suárez (1967), Harrison and Taylor (1971), Rivas (1974), and Goldsmith (1976), have brought a fundamental contribution to the understanding of the puzzle explanation of the Tupí-Guaraní nasality phenomena.

4. A HISTORICAL ACCOUNT

We now explore some aspects of nasality in three Tupí-Guaraní languages which behave differently from the languages mentioned up to now. These languages contribute to the view that no matter how languages have differentiated from each other with respect to nasality during their historical development, they all bring elements supporting the view that their different behaviors all converge to a stage where morphemes were either oral or nasal, proeminent stress position was the last syllable of a morpheme, only nasal consonants were intrinsically nasal, and in the domain of stressed syllables vowels contrasted as to the [+/- nasal] feature. In stressed syllables containing an oral vowel, orality would spread until the next nasal consonant, although affecting it in some grounds. The span of oral realization would be the same of the span of nasal realization. In the face of this, the stage from which

Tupí-Guaraní started diversifying could be represented by a language very similar to Tupinambá with respect to nasality. This hypothesis would explain why some languages that changed the original stress position to the penultimate syllable did not change the nasal value of the new stressed syllable, as shown by the Chiriguano data bellow:

[mb]ój 'cobra'
ká[mb]y 'leite materno'
[mb]éru 'mosca'

Notice that although stress had changed its original position the nasal consonant to its right is still post-oralized as in the word *ká[mb]y*. This means that the final vowel is still in the domain of stress even though stress is now realized in the nasal domain of a nasal consonant, or the rule that changes the position of stress is a later rule, following the primary stress rule aplying to the last syllable of a stem. The Xetá language, although showing analogous patterns of stress and nasality, also shows that a change of stress position would block post-oralization of a nasal consonant, as in the following examples:

hény	'his/her spit'
námi	'ear'
hinámi	'his/her ear'
pána	'butterfly'
pána ko	'it is a butterfly'
pánagádjo	'big butterfly'
pána pépo	'butterfly wings'

The Xetá data also shows that a change in stress may bring with it the oral/nasal value associated to a vowel in its domain:

tũ̃ka	'tucano'
tũ̃ka ĩ̃txi	'the tucan has a bill'
ĩ̃pwápe	'his/her fingernail'
txĩ̃pwápe	'my fingernail'

The above examples show a close relation between stress and nasality in face of the fact that the present day nasality of words like *tũ̃ka* comes from a final nasal consonant in PTG *tukán 'tucano', which was lost in languages from sub-branches II and III. On the other hand, the nasality of words such as *ĩ̃pwápe* 'his/her finger' has as its historical source a nasality associated to the last syllable of *PTG *i-* 'relational prefix marking the non-contiguity of a determiner'+*pwã 'finger of the hand' + pẽ 'nail' pwãpẽ, i-pwã-pẽ. As this kind of nasality spreaded to the left, and as all preceding sonorants were in the domain of stress, the unstressed prefix *i-* was naturally nasalized.

Part of the languages of sub-branch IV (Tapirapé (cf. Leite, 1977, 1995)) and the language of sub-branch VII (Kamayurá) have lost the contrast between oral and nasal spans associated with prominent accent, but not the contrast of nasal versus oral final syllables, as there is still contrast between oral and nasal vowels, illustrated by such pairs as the following:

ãpe 'caminho dele'	ãpẽ 'está pronto'
yo 'espinho'	yõ 'capim'
ãpi 'fruta vermelha'	ãpɤ̃ 'mamãe'
ãtʏ 'esposa'	ãtɤ̃ 'duro'

Costa (2007) proposes a different analysis accounting for nasality in Tapirapé. However, considering that another language of the same sub-branch, the Awá-Canoeiro language (Borges 2007) has maintained a contrast between oral and nasal vowels, and that as Tapirapé has nasalized vowels whose nasalization cannot be explained otherwise, we adopt Leite's analysis which posit a series of nasal consonants for Tapirapé, as well as a set of 10 vowels, five oral and their five nasal counter-parts.

Awá-Canoeiro, as registered by Toral (1984), and as it has been analyzed by Borges (2007), also has nasal consonants and has developed a contrast between oral and nasal vowels.
The other languages of the same sub-branch, Guajajára, Tembé, Asuriní, Parakanã, and Suruí have lost the rule associating stress and morphemic nasality, so that the nasality associated to the last vowel of a stem has definitively disappeared, and nasality has become an intrinsic feature of nasal consonants only. In all of these languages, as morphemic nasalization used to spread across morpheme boundaries, changing the phonological status of sounds, all instances of old *p, t, k* which had changed to *m, n,* ŋ respectively, by the time a left to right spreading of morphemic nasalization was active, have maintained their new phonological status as nasal phonemes (an indication favoring the morphophonemic approach in phonology), as illustrated by the Guajajára following example:

Guajajára [pɛˈŋwɛr] 'a piece of (something)'
[zəˈpəhɛˈŋwɛrə] 'ex-oven'

An evidence favoring this view is the treatment of borrowings in the Guajajára language: when a word from Portuguese having nasality is introduced in the language, it will not combine with the nasal allomorph ŋwɛr of the retrospective suffix:

[manɨˈkwɛr] 'mango juice'

Although the word for mango has a nasal consonant, as nasality does not spread anymore across morpheme boundaries, the retrospective suffix is the simply oral (see also Soares 1979).

Finally we bring to our discussion some data from the Zo'é language, in which, according to Cabral's analysis (1998, 2001), nasality is a prosodic feature associated with morphemes, which comprises roots and stressed suffixes. This nasality must be associated by rule to all voiced segments: vowels, glides, flaps, and voiced stops. Since Zo'é differs from Tupí-Guaraní languages which have oral and nasal spans in the same stem, there is no apparent reason to not consider the existence of underlying voiced stops in that language.

Example such as [bɔdɛ] 'to glow', [ɛrɛbiˈɛ] 'my pet', [bɔˈgwa] 'to sieve', [dɔˈruri] 'don't bring it' don't bring it' are strong indication that nasality is now a feature of morphemes. Notice that even the reflexes of nasal morphemes as the PTG**mo-* 'causative' and **emi,* 'nominalizer of object' do not trigger nasality as in other Tupí languages of the family. Their nasal surface form being conditioned by their [+/-nasal] value, which associates to the last syllable of that stem. What follows illustrates the necessary steps to the Zo'é [+/-nasal] prosodic feature association:

Lexical entry	Stress assignment+nasal assoc.	Nasal spreading	Phonetic output

Lexical entry	Stress assignment	+nasal assoc	Nasal spreading	Phonetic output
		*	*	
{bɔhɛb}	bɔhɛb		bɔhɛb	[mɔ̃ˈhɛ̃m]
[+ nas]			[+nasal]	
	[+nas]			

5. SOME ADDITIONAL REMARKS

A panoramic look at the phonological form of Tupí-Guaraní words allows the identification of indications that stress and nasality have been in a productive interface since earlier stages of the diversification of the family, what means that this interaction must have been active in the Proto-Tupí-Guaraní language. The proto-language had to have intrinsically nasal consonants as well as prosodic [+/- nasal] features associated with the most prominent syllable of stems. The interaction of stress assignment and morphemic nasality would have been so pervasive in earlier stages of the family that the daughter languages are still showing the effects of such an interaction. Languages of sub-branch I, such as Xetá changed the position of stress but leaving behind the effects of spreading of either oral or nasal values, the oral values illustrated by the post-oralized allophones of the nasal consonants. A language like Xetá shows the intricate relation between stress and [+/- nasal] values of the morphemes of the language, to such an extent that the change in stress position causes the displacement of nasality to the new position of stress, as illustrated by words such as [ˈtũka] < *tuˈkan ‘tucan’.

Languages such as Tapirapé, Awá-Canoeiro, Wayampí, and Araweté have developed a contrast of [+/-nasal] vowels independently of stress, stressed oral vowels do not affecting the phonetics of nasal consonants preceding them. Languages such as Asuriní of Tocantins, Parakanã, Tembé and Guajajára behave differently as if they have lost the prosodic contrast between [+nasal] and [-nasal] features. This explains why these languages have lost nasal vowels, and why stressed oral vowels do not trigger the post-oralization rule affecting nasal consonants.

This view also explains why in languages such as Zo’é words are either wholly oral or wholly nasal, leading to the assumption that the [+nasal] and the [-nasal] prosodic features are the source of nasality and orality in this language. This also supports the view that Zo’é has no intrinsically nasal consonants, but voiced stops. This favors the generalization that all voiced sounds are nasalized during the assignment of stress interacting with the [+nasal] prosodic feature, as well as the same sounds are fully oral when stress interacts with the [–nasal] prosodic feature.

A INTERFACE DE ACENTO E NASALIDADE NAS LÍNGUAS TUPY-GUARANI SOB UMA PERSPECTIVA HISTÓRICA

RESUMO
Discutimos dados de várias línguas Tupí-Guaraní reunindo fundamentos para a hipótese segundo a qual, em estágios anteriores da família linguística Tupí-Guaraní, acento teria interagido com traços prosódicos [+/- nasal] criando, entre outras coisas, padrões de consoantes nasais e pós-oralizadas na forma fonética das palavras. Nossa hipótese também mostra que a distribuição atual de nasais plenas, nasais pós-oralizadas e consoantes orais sonoras através das línguas de diferentes sub-ramos é o resultado de ajustes na interface de acento e nasalidade, orientados por princípios de balanceamento simétrico entre padrões orais e nasais.

PALAVRAS-CHAVE: Nasalidade, Interação entre acento e nasalidade, línguas Tupí-Guaraní, Mudanças linguísticas, Padrões fonológicos.

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