

# THOUGHTS ON THE PHONOLOGICAL INTERPRETATION OF {NASAL, ORAL} CONTOUR CONSONANTS IN SOME INDIGENOUS LANGUAGES OF SOUTH-AMERICA

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- *ABSTRACT: An intriguing feature of the Americas as a linguistic area is the frequent occurrence of oral/nasal contour consonants. In this paper we will study a number of languages that have these sounds and discuss the explanations based on the enhancement of phonological contrast that should account for their occurrence. One of these explanations considers the nasal phase of a contour consonant as the enhancement of an underlying voice contrast; the other explanation regards the oral phase realized on an underlying nasal consonant as a strategy to maintain a neat oral/nasal contrast on vowels. In this way the different enhancement-based theories presuppose different underlying segments from which the contour sounds are derived. In some cases, the synchronic source of the contour segments seems undisputed, either because the language is lacking the contrast that is to be enhanced, or because it uses the secondary (enhancement) feature contrastively. The phonological interpretation of contour sounds becomes more difficult in the numerous languages that have both a nasal/oral contrast on vowels and lack a phonemic opposition between voiceless /P/, voiced /B/ and nasal /N/. In these languages the view of enhancement as a feature of phonetic implementation is dubious. Rather, the enhancing feature seems to play a role in the choice of underlyingly contrastive segments.*
- *KEYWORDS: Contour consonants. Enhancement. Amerindian languages.*

## Introduction

Contour consonants involving a nasal and an oral phase are not uncommon in the world's languages. Not only are they common in the indigenous languages of South America, but they also occur in African, Australian languages, and Austronesian languages, among others. Biphasic consonantal sounds may have different phonetic or phonological origins. Commonly they derive from the spreading of the [nasal] feature from a preceding vowel, as in Mebengokre /prõt+ket/ → [prõt̚ket], or in Kaingang /kōkōm/ → [kō̃kōm] 'dig', /ãpri/ → [ʔã̃mpri] 'road'. In some languages, they can arise from the docking of a floating nasal feature, with or without morphemic status, on a non-sonorant consonant, as in Terena [m̃]iho 'I went' (compare with *piho* 'he went') or [ĩw̃õĩ̃³o] from lexical /iwoĩ³o/ 'I ride', where a voiceless host becomes voiced in the process of prenasalization, or in Angas [m̃p̃]o 'in the mouth' (compare *p̃o* 'mouth') where

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postnasal voicing does not occur. Also, in some languages, nasal contours contrast with plain nasal and plain oral obstruents. When this happens, it is important to establish the monosegmental as opposed to cluster nature of the contour sequences.

The present study focuses on a contour type different from those mentioned above. Languages possessing this contour type usually do not contrast nasal stops with (non-sonorant) voiced stops. Instead, they oppose a series of voiceless stops, henceforth referred to as the /P/ class, with a series of phonemes that is represented by a set of allophones (or a subset thereof), which, for the labial place of articulation, is [mb, bm, bmb, m, b], henceforth called the /{M,B}/ class<sup>2</sup>. When the plain voiced allophones ([b,d,ʒ,g]) are attested, they are often in free variation with the nasal-oral contour type [mb, nd, nʒ, ng] word- and/or syllable -initially before an oral vowel, as in Barasana (GOMEZ-IMBERT, 1998) or they occur obligatorily between oral vowels, as in Maxacalí- a language in which they are also in free variation with [mb] etc. word-initially (WETZELS, 2007). Generally, the oral phase of the contour consonant is voiced and appears contiguous to an oral segment in the phonetic sequence. Contour consonants that show these characteristics frequently occur in the indigenous languages of Latin America, but also elsewhere. In this paper we will address the issue of the underlying representation of these sounds from the functional perspective of phonological contrast enhancement<sup>3</sup>. In the literature, one finds two different explanations for the occurrence of contour stops that are based on this concept. One seeks to explain the nasal phase of the contour as an enhancement of an underlying contrast between voiced and voiceless non-sonorant stops. The other one focuses on the oral phase of what are taken to be underlyingly nasal consonants, explaining its emergence as an enhancement strategy to maintain a neat oral/nasal contrast for vowels. We will see that the biphasic sounds may have different lexical sources, depending on the language. To the extent that the underlying phonemes can be established with some degree of certainty, which does not always seem to be the case, it is possible to decide for a given language which of the enhancement strategies is being at the basis of the contour segments.

## **Kaingang, a challenging exemplar**

Probably the best known Amerindian language showing the contour types under discussion is the Brazilian language Kaingang (Jê family), which has all

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<sup>2</sup> Here and in the remainder of this paper we use the symbols /P/, /M/, /B/, /{M,B}/, [m], [b], [mb], etc. to refer to all points of articulation that a language distinguishes, unless otherwise indicated.

<sup>3</sup> Other authors have sought the explanation of the different surface manifestations of the /{M,B}/ class in an underlying representation that is neither [-sonorant, +voice], nor [+sonorant, +nasal]. In this paper, we will not be concerned with these proposals.

the allophones mentioned above systematically represented, except for [b]. In Kaingang, the contour segments occur in the onset ([m̥b]) and in the coda ([b̥m]) of syllables containing an oral nucleus or intervocalically, when the preceding or the following vowel is nasal ([V̥m̥bV] and [V̥b̥m̥V̥], respectively). Between nasal vowels or in monosyllabic words with a nasal nucleus the plain nasal obstruents occur, whereas the triple [b̥m̥b] contour is found between oral vowels. The following set of examples illustrates the different allophones of the /{M,B}/ class.

(1)	# – ̃	[m]	[mã̃n]	to hold
	̃ – #	[m]	[ŋã̃m]	to break
	# – v	[m̥b]	[m̥ba]	carrying
	v – #	[b̥m]	[hi̥b̥m]	frog
	̃ – ̃	[m]	[m̃ð̃m̃æ̃ŋ]	fear
	v – v	[b̥m̥b]	[ke̥b̥m̥ba]	try out
	̃ – v	[m̥b]	[ø̃ũ̃m̥bu]	tobacco
	v – ̃	[b̥m]	[hḁb̥m̥æ̃]	listen

In Kaingang, the phoneme /r/, an alveolar flap, can occur as the second element of a complex onset. Its presence does not block the surfacing of a preceding /{M,B}/ consonant as a post-oralized sound, as the following words show:

(2)	/mro/	[m̥bro]	to float
	/nĩŋru/	[nĩŋru]	claw

Although it is typical that consonants of the /{M,B}/ class surface as contour segments only when they occur adjacent to an oral segment, the contiguity of an oral segment is not a sufficient condition to trigger the surfacing of a contour allophone in Kaingang. In Wetzels (1995, 2008) it was shown that syllable structure is an important clue to understanding the distribution of contour segments in this language: a consonant of the /{M,B}/ class is realized with an oral phase when it belongs to a syllable with an oral nucleus. The oral phase is uninterrupted within a demi-syllable: [.m̥ba] (nasa|oral-oral), not [.b̥ma] (ora|nasal-oral), and [ab̥m.] (oral-ora|nasal), not [amb̥.] (oral-nasa|oral).

In Kaingang morpheme-internal, hetero-organic /Cr/ clusters (/C/ and /r/ have different places of articulation) are tautosyllabic, whereas homorganic /Cr/ clusters (C and /r/ have identical places of articulation), as well as all /Cj/ clusters are hetero-syllabic. Consonants may also be extrasyllabic, when they appear word-finally after a bisegmental rhyme. Furthermore, consonants can be ambisyllabic between vowels, when they function both as coda and as onset of two consecutive syllables. In addition, syllabification is partially conditioned by morphology, such that the same clusters that are tautosyllabic in underived words remain hetero-syllabic when they belong to different morphemes. Significantly,

only when /{M,B}/ consonants can be syllabified as margins of oral syllables they will emerge with an oral phase<sup>4</sup>.

Kaingang is also illustrative for the disagreement that exists among phonologists regarding the phonological interpretation of the allophones of the /{M,B}/ class. As a matter of fact, our suggestion of a single ‘/{M,B}/’ series of phonemes corresponding to the entire range of consonantal sounds illustrated in (1) is the only thing that the different proposals have in common. The disagreement regards the lexical feature definition of the /{M,B}/ series; there is a good deal of debate around its status and whether it is a non-sonorant voiced /B/, sonorant (nasal) /M/, or maybe something else. For example, Wiesemann (1964, 1972) defines the /{M,B}/ series as [lenis] (and redundantly voiced and nasal), as opposed to the /P/ class, which she defines as [fortis] (and redundantly voiceless)<sup>5</sup>, whereas Kindell (1972) and Wetzels (1995) define the /{M,B}/ class as (non-sonorant) [+voice], the /P/ class as [-voice]. Similarly, for the language Yuhup (Maku family), which has the contour sounds [mb̥, b̥m] etc. In complementary distribution with plain voiced and plain nasal consonants, Ospina (2002) proposes an underlying system in which a series of biphasic (oral-nasal) consonants contrasts with plain voiced and voiceless stops (we omit the two glottal phonemes /ʔ, h/):

(3)		labial	coronal		dorsal
			[+ant]	[-ant]	
	voiceless	p	t	c	k
	voiced oral release	b	d	ʃ	g
	voiced nasal release	b̥m	d̥n	ʃ̥ñ	g̥ŋ

On the other hand, to account for the same facts, Lopes and Parker (1999) propose the subsystem in (4):

(4)		labial	coronal		dorsal
			[+ant]	[-ant]	
	voiceless	p	t	c	k
	nasal	m	n		ŋ

<sup>4</sup> See Wetzels (1995, 2008) for detailed discussion of the role of syllable structure for the distribution of the allophones of the /{M,B}/ class in Kaingang. To the best of our knowledge, the relevance of syllable structure for the distribution of the contour allophones of the /{M,B}/ class has never received systematic attention in descriptions of other South-American languages. Very often this is explicable, because, in many languages, the only contour consonant occurring is [mb̥], whose distribution is moreover limited to the word-initial position. For languages that show a more complex distribution of contour allophones, information about the (ir)relevance of syllable structure is possibly important, as will be evident below.

<sup>5</sup> In the same study, however, Wiesemann (1964, p.307, our translation) defines the neutralization of the contrast between /P/ and /{M,B}/ before /P/, as in the word /kamke/ → [kapke] ‘to break’, in terms of the feature [±voice]: “In the non-peak position of the syllable rhyme, the one-dimensional proportional opposition between voiceless and voiced phonemes [...] is neutralized [...] Before voiceless consonants, the archiphonemes “stops” (/p-m/, /t-n/, /ɲ/, /k-ŋ/) are realized by voiceless allophones, in other environments, by voiced allophones.”

Yet another system is proposed by V. Martins (2005), who replaces the series of nasal consonants proposed by Lopes and Parker (1999) by the corresponding set of voiced stops:

(5)		labial		coronal		dorsal
				[+ant]		[-ant]
	voiceless	p		t		c
	voiced	b		d		ɟ
						k
						g

V. Martins also posits two voiceless glottalized stops /cʰ, kʰ/ and three voiced glottalized stops /bʰ, dʰ, ɟʰ/. This difference is the consequence of his segmental analysis of laryngealization, which is, along with nasality, considered a morpheme-level prosody by Lopes and Parker (1999) and Ospina (2002). A bit surprising is the fact that the voiced palatal stop is lacking from the system proposed by Lopes and Parker (1999). More surprising is Ospina's (2002) decision to posit three series of non-continuant phonemes where the other authors only posit two. As we illustrate in (6), Ospina (2002) establishes a contrast in the syllable coda between /b/ and /b̥m/, based on observed phonetic distinctions that are not made mention of by the other scholars.

(6) Yuhup: distribution of non-continuant consonants in the syllable coda, according to Ospina (2002) (tones are indicated with diacritics above the vowel, with the usual interpretation; nasality is marked with a tilde above the vowel, whereas a tilde underneath the vowel indicates laryngealization)

(a) after nasal nucleus

/p/ [hô<sup>ˀ</sup>p̃] fish /b/ [p̃<sup>ˀ</sup>mb̃] mushroom /b̥m/ [ɲã<sup>ˀ</sup>m̃] jaguar

(b) after oral nucleus

/p/ [dê<sup>ˀ</sup>p̃] meat /b/ [hê<sup>ˀ</sup>b̃] wipe! /b̥m/ [p̃<sup>ˀ</sup>b̥m̃] strong

Assuming that the facts as established by Ospina are correct, it is not clear why [b̥m] as in [p̃<sup>ˀ</sup>b̥m̃] 'strong' is not derived from underlying /m/, along with the coda [m] in [ɲã<sup>ˀ</sup>m̃] 'jaguar'. Although this decision would not lead to a more restricted system of underlying consonants, which would become /p,b,m/, it would eliminate the need for phonologizing the contour consonant.

Independently of the question what the underlying system of consonantal contrasts is for Yuhup, the existing analyses of this language as well as of Kaingang clearly show the disagreement among specialists regarding the question of how to interpret biphasic consonants in phonological terms, particularly in languages that oppose a class of /P/ phonemes to a class of /{M,B}/ phonemes<sup>6</sup>. Clearly, if the

<sup>6</sup> If Ospina's interpretation of the phonetic data is correct, Yuhup presents a triple contrast in the coda, whereas in the syllable onset voiceless consonants contrast only with /{m,B}/, which shows the usual allophonic variation:

/[M,B]/ class is characterized as non-sonorant, the nasal and pre-/post-/medio-nasalized variants must be derived, whereas, if it is defined as sonorant, the post-/pre-/circum-oralized and oral variants must be accounted for. In addition, different functional explanations are usually suggested to explain the phonetic realization of a lexical sonorant segment that becomes a (partially) non-sonorant segment and vice versa. In the following sections we will briefly consider these different views.

### Primary and secondary features.

In a recent paper by Keyser and Stevens (2006) features are claimed to function as primary (lexical) features or secondary (enhancement) features for a given segment or segment class. Enhancement features are added to (sets of) distinctive features that are “[...] in danger of losing their perceptual saliency as a consequence of the environment in which they appear.” (KEYSER; STEVENS, 2006, p.38). The enhancement feature is manipulated in combination with the gesture corresponding with the primary, contrastive feature to strengthen the acoustic correlate of the contrastive feature or to introduce new acoustic properties that serve as cues for the contrasting feature. Some features, like [ $\pm$ sonorant], [coronal], [ $\pm$ anterior] are ‘primary’ and do not seem to be used for enhancement. It is not especially clear which features may be used in both roles, though [nasal] is a case in point. This is what we conclude from the fact that Keyser and Stevens (2006) agree to Iverson and Salmons’ (1996) understanding of ‘optional prenasalization’ in the Chalcatongo dialect of Mixtec. In Mixtec, prenasalization occurs optionally before labials in word-initial position and obligatorily before alveolars. Some examples are given in (7)<sup>7</sup>:

(7)	[ $(m)$ bà?à]	good
	[ $(m)$ bá?ù]	coyote
	[ $(m)$ bí?3a]	nopal
	[ $n$ da?a]	hand
	[ $n$ dákl]	stiff

Iverson and Salmons (1996) understand prenasalization to be a low-level phonetic phenomenon, i.e. the phonetic implementation of an underlying [voice] feature, which functions to maintain a distinction between voiceless and voiced stops that is otherwise difficult to produce. As phoneticians have long observed, in order to realize the vibration of the vocal cords in the production of voiced

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[mb] in oral syllables, [b] between oral vowels, and [m] in nasal syllables.

<sup>7</sup> According to Iverson and Salmons (1996, p.167) “[...] voiced velar stops do not occur initially in any form and appear medially only in a few words, where they are prenasalized and contrast with the plain voiceless stops.”

stops, a difference in air pressure (from high to low) is required between the infra - and supra-glottal areas (BERG, 1958), Lisker and Abramson (1971), Ohala (1983), Westbury and Keating (1986). In consonants produced with a complete closure, air pressure quickly builds up in the supraglottal area behind the closure. As soon as the infra - and supraglottal air pressure equal out, the air flow through the glottis is arrested and the vocal folds stop vibrating. As it turns out, without any enhancing gestures being made, vocal fold vibration cannot be maintained during the complete closure duration of stops, which is roughly 80 ms on average. There are several ways in which the pressure drop in the supraglottal area can be postponed. One important way is to enlarge the size of the cavity between the glottis and the place of constriction, through the expansion of the cavity walls. This gesture has the effect of retarding the equalization of infraglottal and supraglottal air pressure. The necessity for secondary gestures to enhance the primary [voice] feature is greatest for dorsal stops, for which the area between the glottis and the point of constriction is smallest, while it is less urgent for alveolar and coronal stops and least urgent for labial stops. Another way in which the cessation of vocal-fold vibration can be deferred during the production of a stop is by lowering the velum during the closure interval. This gesture radically prevents pressure build-up in the vocal tract and allows a continuous voicing, which, obviously, leads simultaneously to the production of a plain nasal consonant<sup>8</sup>, unless the velum is raised again before the consonant is released, in which case the resultant consonant has a nasal and an oral phase, as in the Mixtec examples in (3) above. It is in this sense that, in Stevens and Keyser's view, prenasalization must be understood to be an enhancement feature for voiced stops.

With the enhancement theory in mind, we return to the facts of Kaingang, for which Wetzels (1995) proposes a similar account, in treating the [voice] feature as a primary feature of a /B/ class of consonants, the nasal consonants as derived from the voiced stops by the spreading of nasality from a nasal vowel and the biphasic consonants in oral syllables as the phonetic implementation (or "enhancement" in Keyser and Stevens' approach) of the underlying [voice] feature on stops<sup>9</sup>.

In Kaingang, nasality is contrastive for vowels. The limited distribution of the nasal consonants, which exclusively occur in syllables with a nasal nucleus, suggests that the nasality of the former is due to their tautosyllabicity with the

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<sup>8</sup> There is at least a theoretical possibility for nasal leakage during the production of non-sonorant voiced stops that is insufficient to be noticed by speakers and yet enough to diminish the pressure in the supralaryngeal cavity allowing for a more sustained vocal cord vibration. We know of no experiments that bear witness to such fact.

<sup>9</sup> Iverson and Salmons (1996) as well as Keyser and Stevens (2006) do not consider the process of postnasalization as a strategy to enhance a primary voice feature. Iverson and Salmons (1996, p. 172) state: "[...] since pressure release is central to perceiving the segments in question as stops - postnasalization would effectively eliminate the needed salient burst and, thus, mask their stop quality". However, quite a few languages show pre- and postnasalization simultaneously, also those, like Mextec, that do not oppose voiced and nasal consonants. Here we will not exclude the possibility that both types of contour sounds can be explained by a single motive.

nuclear vowel, which spreads its nasal feature bidirectionally to the voiced consonants that occur in the syllable margins. Independent evidence for nasal spreading is obtained from the behaviour of the flap and the glides, which are always nasalized when tautosyllabic with a nasal vowel, as in the following examples:

(8)	māreru	yellow	kuĩã	day	ĩã	sun
	ĩã	tooth	ĩãre	root	ũãñ	woods
	mĩãjã	ashes				

The words *māreru* 'yellow' and *kuĩã* 'day' show that nasality does not spread outside of the syllable in which it originates, whereas *mĩãjã* 'ashes' shows that nasal spreading reaches all the segments inside the syllable that belong to the class of target segments, which is defined as [+voice]. Since intervocalic voiced stops belong to two syllables, only the part that belongs to the nasal syllable will surface as nasal, which explains the biphasic contour segments that appear between nasal and oral syllables, as in [fũmbu] 'tobacco' and [habmã] 'listen'. Finally, in oral syllables, the prenasal phase in onset segments as well as the postnasal phase of coda segments is explained as enhancement of the primary [voice] feature. To conclude, if the underlying feature value that distinguishes the /P/ class from the /{M,B}/ class is defined as [+voice], i.e. /{M,B}/ is /B/, the complete set of allophones of the /B/ class can be explained by an independently motivated process of nasal harmony and the distinction between primary features and enhancement features.

However, there is another way of deriving the allophones of the /{M,B}/ class, which is also based on the concept of enhancement. In this view, the /{M,B}/ class is defined as sonorant (and nasal) /M/ at the lexical level, and the pre- and post-oralization of the nasal consonant is understood to be an enhancement of the oral/nasal contrast on vowels. At least, this is our interpretation of, for example, Steriade's (1993, p.448, original emphasis) suggestion according to which:

[...] the delay [in the onset of nasalization of the consonant] is obviously motivated by the fact that the preceding vowel is distinctively oral: had nasalization started on 'time,' at the beginning of the stop closure, the possibility of anticipatory nasalization affecting the preceding vowel would have muddled the contrast between oral and nasal vowels.

Steriade's (1993) explanation of the partial oralization of the nasal phonemes, although presented in the context of her discussion of the medio-nasalized ([b̥mb]) sounds of Kaingang, could easily be extended to the whole set of contour allophones derived from an underlying /M/ class: as a consequence of the anticipatory raising ([m̥ba]) of the velum or its delayed lowering ([ab̥m]) during the



closure phase of the nasal consonant, the overall duration of (contrastive) orality present in the signal increases, thereby enhancing that property.

Both explanations for the existence of the complex consonantal sounds in Kaingang are based on the concept of the enhancement of a phonological contrast that is otherwise difficult to produce (and, when not clearly produced, difficult to perceive), the first focusing on the voiced/voiceless opposition on consonants, the other on the oral/nasal contrast on vowels before and after nasal consonants. Both explanations have some intuitive plausibility and one wonders if arguments can be found for either explanation. The following is an attempt to formulate the predictions made by both hypotheses.

1. Since it would be in contradiction with the function of enhancement features for them to obfuscate a distinction between primary contrastive categories, one would not expect (partial) nasalization to be used as an enhancement feature for voiced obstruents in a system that already uses the nasal feature as a primary feature to distinguish nasal consonants from non-nasal consonants. As was observed above, languages possessing contour stops of the kind under discussion very often lack a triple contrast between /P/, /B/, and /M/, where /B/ represents the class of non-sonorant voiced obstruents and /M/ the class of sonorant nasal consonants. Consequently, the emergence of contour consonants in a system that has no /M/ ↔ /B/ opposition could be indicative of the enhancement function of the nasal feature for a primary [+voice] feature. On the other hand, when biphasic consonants appear in a system that does oppose /P/, /B/, and /M/, a different reason for their presence must be sought. In such a case, a possible explanation is that the system enhances the oral/nasal contrast on vowels through partial oralization of the consonants of the /M/ class.

2. If, in a given language, the biphasic realization of the underlying obstruent varies in function of the different places of articulation, where prenasalization is most frequent for the dorsal place of articulation and least frequent for the labial place of articulation, this variation may be indicative of the enhancement function of the nasal feature for voiced stops.

3. When biphasic consonants emerge in languages without an oral/nasal contrast on vowels, or, in languages that do oppose oral to nasal vowels in contexts in which the oral/nasal contrast on vowels is not in jeopardy, their emergence cannot be motivated by the willingness to enhance the oral/nasal contrast on vowels, and, consequently is likely to be indicative of the enhancement function of the nasal feature for voiced stops.

4. Since it appears to be less easy for languages to maintain an oral/nasal contrast in vowels before a (tautosyllabic) nasal consonant than after a nasal consonant, one would expect that in languages with an oral/nasal contrast on vowels, contour

segments are more commonly found in the syllable coda after oral vowels than in the onset before oral syllables: [ab̥m] > [m̥ba]. In such languages, the specific distribution of contour consonants could be interpreted as being motivated by the enhancement of the oral/nasal contrast on vowels. Inversely, in languages that show the opposite hierarchy [m̥ba] > [ab̥m], or in which the syllable-final allophone [b̥ma] is entirely lacking, this could be interpreted as an argument in favour of the enhancement function of the nasal feature for lexically voiced stops.

5. In languages without a phonological /B/↔/M/ contrast and in which the biphasic segments are in free variation and/or in complementary distribution with non-sonorant voiced stops ([m̥b]~[b]), the nasal phase must be interpreted as the enhancement of an underlying voice feature. Inversely, when the contour segments are in free variation with nasal consonants ([m̥]~[m]), the nasal consonants are lexical and the oral phase of the contour segments might be explained as the enhancement of an underlying oral/nasal contrast on vowels. As will be shown below, the relevance of this criterion is relative, since it depends upon one's assumptions about the permissible degree of abstractness of underlying representations. For example, it is one of the principles of Natural Generative Phonology that one of the surface alternants of a given class of allophones function as the lexical representation of that class. This would mean that in a situation where plain voiced stops are not part of the class of allophones of the /{M,B}/ class, the lexical representation of this class cannot be /B/.

In the remainder of this paper, we will use these parameters to evaluate the plausibility of one or the other explanation based on enhancement in the following way (henceforth we refer to the explanation of the contour stops based on the enhancement of the voicing feature as V(oiced) S(top) E(nhancement), to the explanation based on the enhancement of an underlying nasal/oral contrast on vowels as O(ral) V(owel) E(nhancement):

- a. V↔V̇: if set to 'yes', both explanations are possible, if set to 'no', OVE is excluded.
- b. /P,B,M/: if set to 'yes', i.e. the language has a primary opposition between voiceless, voiced, and nasal consonants, VSE is excluded.
- c. g > ɟ > d > b (place of articulation hierarchy, relativized for the places of articulation a language distinguishes): if set to 'yes', this parameter will be interpreted as an argument in favour of VSE and against OVE.
- d. [ab̥m]>[m̥ba] (margin hierarchy): contour stops are more frequent in the syllable coda than in the syllable onset, or are allowed only in the syllable coda. If set to 'yes' this will be interpreted in favour of OVE and against VSE.
- e. [m̥b]~[b]: The relevance of this parameter is based on the possible assumption

that the complete absence of the [b] allophone as a representative of the /{M,B}/ class excludes /b/ as the underlying phoneme (but see discussion on Wari below). The biphasic sound [mb̥] can be in free variation with [b], in complementary distribution with it, or both. If set to 'yes', this parameter could be interpreted consequently as an argument in favour of an underlying /B/ class and therefore allow for an explanation of [mb̥] in terms of VSO. If set to 'no', it will be considered an argument in favour of an underlying /M/ class, and therefore [mb̥] will be explained by OVE.

- f. [mb̥]~[m]: as e. *mutatis mutandi*.
- g. Nasal Harmony: Not a discriminating parameter by itself, but, when active, explains the structural absence of voiced and contour stops in the margins of nasal syllables. This parameter is relevant with regard to the interpretation of criterion **f**. If, in a given language, the occurrence of nasal consonants is restricted to syllables containing a nasal vowel, the complementary distribution between [mb̥]~[m] is independently explained by the spreading of the nasal feature to the alleged underlying voiced stops and can therefore not be taken as evidence for underlying /M/.

### **Kaingang, an undecided case**

Since Kaingang uses the nasal feature contrastively for vowels, both explanations for the presence of contour stops are in principle possible. Kaingang is of the /P/↔/{M,B}/ type, which would also be compatible with the view that the lexical contrast is /P/↔/B/ with nasal enhancement of /B/. There is no recorded preference for biphasic consonants in the syllable coda over the syllable onset [ab̥m]>[mb̥a]. Furthermore, although contour stops are in complementary distribution with plain nasal consonants, the latter are independently explained by a process of nasal harmony within the syllable. In addition, there is no mention of the relevance of the place hierarchy dorsal > palatal > alveolar > labial. So far, then, none of the criteria considered clearly discriminates between VSE and OVE. One selective criterion may be the following. Complex onsets in Kaingang may consist of a nasal obstruent followed by the flap [r]. Given that nasality is not contrastive for [r], one would not expect contour stops to occur in complex /Nr/ onsets if their presence is due to the enhancement of the oral/nasal contrast on vowels. Since the flap functions as a buffer between the nasal consonant and the oral vowel, even a sustained delay in the raising of the velum after the articulation of the consonant would not jeopardize the orality of the following vowel. If the foregoing could be used to defend an underlying /B/ series, the fact that the plain voiced stops never surface as such in Kaingang could be advanced to argue for underlying /M/. We conclude that the situation in Kaingang is somewhat ambiguous and that the established criteria

do not allow a clear decision with regard to the question of how the allophones of the /{M,B}/ class should be interpreted in phonological terms. The values for the different parameters are summarized below:

(9) Kaingang

V↔Ṽ	/P,B,M/	g > d > b	[a <sub>h</sub> m]>[m <sub>b</sub> a]	[m <sub>b</sub> ]-[b]	[m <sub>b</sub> ]-[m]	nasal harmony
Yes	no	no	no	no	yes	yes

**Wari: a clear case**

Wari is the language of a community of some 1,800 individuals, living along the shores of various tributaries of the Pacaas Novos River in Western Rondônia, Brazil, described by Everett and Kern (1998). Wari is a member of the Chapakuran family, which also includes the languages Oro Win and Moré. In Wari nasalization is not distinctive for vowels, and nasal assimilation from consonants to vowels does not occur. Interestingly, nasalization is predictable for diphthongs. Everett and Kern (1998, p.407) claim that

[...] nasalization of vowels only occurs on surface diphthongs. In fact, there are only a few diphthongs which are not nasalized. The exceptions to nasalization of diphthongs are a few examples of plain diphthongs ending with /i/ [ɪ]. They occur in seemingly open stressed syllables ..., and the voiced non-syllabic /i/ becomes the voiceless [ɪ]. Alternatively, it is possible that the non-syllabic [ɪ] is actually an allophone of /tʃ/.

Whether or not the authors' suggestion regarding the underlying consonantal source of voiceless [ɪ] is correct, it is clear that the small class of oral diphthongs of Wari does not contrast with nasal diphthongs for the feature [nasal] alone, and therefore the conclusion that there is no contrastive nasality in Wari is justified.

Wari is like many other indigenous languages of the Americas in its lack of a contrast between non-sonorant voiced and sonorant nasal consonants, as is shown in the following table, based on Everett and Kern (1998) <sup>10</sup>.

<sup>10</sup> The sound we have represented as /tw/ in table (1) is symbolized by Everett and Kern (1998, p.396) as /tʃ̥/, defined as a "[...] voiceless apico-dental plosive and voiceless bilabial trilled plosive [,which] occurs as a single sound word-initially and word-medially."

(10) Wari consonantal phonemes

Labial	Coronal		Dorsal	Laryngeal
	[+anterior]	[-anterior]		
p	t, t <sup>w</sup>	tʃ	k, k <sup>w</sup>	ʔ, h, h <sup>w</sup>
{M,B}	{N,D}			
m <sup>ʔ</sup>	n <sup>ʔ</sup>			
	r			

In Wari, the contrast between plain and glottalized nasal consonants is neutralized word-initially in favour of the plain series<sup>11</sup>. Except for /m<sup>ʔ</sup>, n<sup>ʔ</sup>/, all consonants may occur in word-initial position. Word-finally only /p, t, k, ʔ, m, n, m<sup>ʔ</sup>, n<sup>ʔ</sup>/ and, possibly, /tʃ/ are found. The only contour sounds encountered in Wari are [mb, nd]. According to Everett and Kern (1998, p.400-401) [mb, nd] fluctuate with [m, n] syllable-initially “[...] more frequently before [a] and less frequently before the other vowels. [There is] a greater tendency toward this fluctuation in stressed syllables.” Some examples are given in (11):

- (11) [‘mõn<sup>ʔ</sup>na] or [‘mbõn<sup>ʔ</sup>na] it is full  
 [tõ<sup>ʔ</sup> na me] or [tõ<sup>ʔ</sup> na mbe] the birds flew  
 [no<sup>ʔ</sup>wi] or [ndo<sup>ʔ</sup>wi] electric eel  
 [wi<sup>ʔ</sup>na] or [wi<sup>ʔ</sup>nda] my head

Testing our criteria for Wari, we obtain the results in (12).

(12) Wari

V↔Ṽ/	/P,B,M/	g > d > b	[abm]>[mba]	[mb]~[b]	[mb]~[m]	nasal harmony
no	no	no	no	no	yes	no

Again the results are somewhat contradictory, although in a way different from Kaingang. The absence of a contrast on vowels rules out in principle an explanation based on the enhancement of such a contrast. This conclusion is corroborated by the fact that the contour stops may occur in front of (surface) nasal diphthongs, as in the first example of (13), a fact which is not problematical from the point of view of VSE, because, as Wari has no rule of nasal assimilation, the oral phase is not affected by the nasality of a contiguous nasal segment. Turning to the place hierarchy, and abstracting away from the influence of the quality of the following vowel on the frequency of occurrence of the contour consonants<sup>12</sup>, we observe that no preference for a biphasic realization is mentioned for the alveolar place of articulation over the labial place of articulation, which would

<sup>11</sup> Otherwise, we would have expected these sounds to present post-oralized phases also.

<sup>12</sup> For which fact we do not have an explanation.

have provided independent evidence for the VSE hypothesis<sup>13</sup>. On the other hand, one of the parameters seems to argue against an underlying /B/ class, namely the fact that the existing contour segments alternate with plain nasal segments and that otherwise plain non-sonorant voiced stops are not part of the allophones of the /{M,B}/ class in this language. At the same time, the facts of Wari makes us wonder about the extent to which the non-existence of [b, d] at the surface can be considered decisive with regard to the plausibility of a VSE-based explanation, since it is beyond doubt that OVE is not applicable in this language, thereby leaving VSE as the only plausible alternative. However, once it is admitted that some language may use nasality as an enhancement feature for voiced stops, nothing excludes that, in some (or even all) contexts, these stops surface as plain nasal consonants. If one accepts that the systematic absence of plain non-sonorant stops at the surface need not be an impediment for positing an underlying /B/ series, the existence of the biphasic stops word-initially as well as all plain nasal consonants can be explained as VSE<sup>14</sup>. In turn, this takes us to reconsider the case of Kaingang for which an explanation based on VSE now gains in plausibility.

### Dãw: another clear case

Dãw is classified as a member of the Eastern Maku languages by Valteir Martins (2005), together with the languages Nadëb, Kuyawi, Hupda, and Yuhup. The 94 members of the Dãw people are located on the left shore of the upper Rio Negro, across from the town of São Gabriel da Cachoeira. Silvana Martins (2004) establishes the following system of consonantal phonemes for this language:

#### (13) Dãw consonantal phonemes

Labial	Coronal		Dorsal	Laryngeal
	[+anterior]	[-anterior]		
p	t	c	k	ʔ, h
b	d	ɟ	g	
m	n	ɲ	ŋ	
mʔ	nʔ	ɲʔ		
	l			
	lʔ			
		ʃ	x	

Dãw possesses a relatively rich system of consonantal phonemes, which contains a series of non-sonorant voiced and voiceless stops, as well as a series of

<sup>13</sup> Note that Wari has no palatal or velar consonants in the /{M,B}/ class.

<sup>14</sup> This would allow one to go as far as positing for Wari an underlying consonant system /p,b,bʔ/, with neutralization of /b,bʔ/ word-initially.

plain and glottalized nasal consonants. Nasality is contrastive for vowels. Glides and liquids are nasalized when they occur in the margin of a syllable containing a nasal nucleus. Nasal spreading never targets other consonantal sounds, including voiced ones. The following example sets demonstrate the distribution of the consonantal phonemes in syllables with an oral and a nasal nucleus.

(14) Onset of syllable with oral nucleus

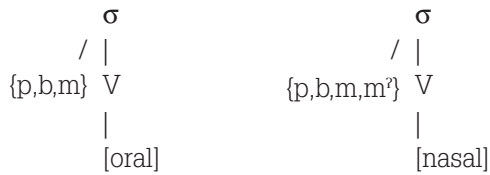
/p/	/paʔ/	agouti	/t/	/tɔ̃g/	pith
/b/	/baʔ/	cold	/d/	/de/	to fish
/m/	/ma/	to encircle game	/n/	/nɛt/	flat
<b>/mʔ/</b>	<b>absent</b>		<b>/nʔ/</b>	<b>absent</b>	
/c/	/cɔ̃g/	arrow	/k/	/kàw/	clearing
/ʃ/	/ʃél/	ice	/g/	/gid/	when
<b>/ɲ/</b>	<b>absent</b>		<b>/ŋ/</b>	<b>absent</b>	
<b>/ɲʔ/</b>	<b>absent</b>		<b>/ŋʔ/</b>	<b>absent</b>	
/ʃ/	/ʃi/	to smell	/x/	/xàw/	to boil
/ʔ/	/ʔèw/	to walk crippled	/l/	/lax/	to fall
/h/	/hèw/	a lot	/ʔ/	/ʔax/	to bark

(15) Onset of syllable with nasal nucleus

/p/	/pɛ̃m/	trumpet	/t/	/tān/	vine
/b/	/bɔ̃jʔ/	banana (spec.)	/d/	/dũʔ/	also
/m/	/mɛ̃d/	downstream	/n/	/nũʔ/	other
<b>/mʔ/</b>	<b>/mʔɔ̃/</b>	otter	<b>/nʔ/</b>	<b>/nʔák/</b>	cross-eyed
/c/	/cɔ̃ɲ/	beetle sp.	/k/	/kic/	grass
/ʃ/	/ʃũɲ/	junior	/g/	<b>absent<sup>15</sup></b>	
/ɲ/	/ɲè/	snake sp.	<b>/ŋ/</b>	<b>absent</b>	
<b>/ɲʔ/</b>	<b>absent</b>		<b>/ŋʔ/</b>	<b>absent</b>	
/ʃ/	/ʃɛ̃ʃ/	grass area	/x/	/xɔ̃k/	snore
/ʔ/	/ʔáx/	to ask for	/l/	/lɲp/	lizard
/h/	/hɛ̃n/	cold food	/ʔ/	/ʔɛ̃ʃ/	wild dog

<sup>15</sup> The voiced dorsal stop is lacking syllable-initially, except in a single loan /g-kɔʔ/ (< Gregório), in which it alternates with /k/ and some grammatical formatives most of which represent reduced forms (MARTINS, S., 2004, p.31).

(16) Co-occurrence restrictions between nucleus and onset



Onset restrictions in syllables with an oral nucleus \*/Nʔ/, \*/ɲ, ɳ/

Onset restrictions in syllables with an nasal nucleus \*/ɲʔ/, \*/ɳ, g/

The phoneme /ɳʔ/ is absent altogether from the Dãw phonemic system. The opposition between plain and glottalized nasal consonants is neutralized to the plain nasal series in the onset of oral syllables. Moreover, for the plain nasal consonants, only the labial and alveolar places of articulation are attested. In the onset of nasal syllables, the dorsal place of articulation is only realized in the voiceless stop series. In addition, the glottalized palatal nasal /ɲʔ/ is not attested in this position. The important fact from the point of view of this study is that Dãw maintains in the onset of both oral and nasal syllables an opposition between /p,b,m/.

Turning to the distribution of the consonants in the syllable coda, we observe that no restrictions exist, except for /l/, which only occurs in loans, and the above-mentioned systematic absence of the glottalized dorsal nasal.



## (17) Syllable coda with oral nucleus

/p/	/pɾp/	to kick	/t/	/tɾt/	salamander
/b/	/nab/	flat	/d/	/lad/	street
/m/	/xɔm/	root	/n/	/con/	be hungry
/m²/	/lũm²/	fish esp.	/n²/	/lon²/	to enrol
/c/	/jac/	big	/k/	/tuk/	to want
/ʃ/	/jaʃ/	travel	/g/	/cɾg/	arrow
/ɲ/	/ʃeɲ/	stumble	/ŋ/	/coŋ/	elbow
/ɲ²/	/wap²/	be delirious	/ŋ²/		<b>absent</b>
/ʃ/	/baʃ/	fruit sp.	/x/	/búx/	honey
/ʔ/	/púʔ/	to bury	/l/	/béł/	candle <sup>16</sup>
/h/	/peh/	snake sp.	/ʔ/	/jélʔ/	banana

## (18) Syllable coda with nasal nucleus

/p/	/háp/	fish	/t/	/mɛt/	agouti
/b/	/mɪb/	sound of tapir	/d/	/mɛd/	downstream
/m/	/xũm/	armpit	/n/	/ʃũn/	wart
/m²/	/xũm²/	to close the hand	/n²/	/mãn²/	bean
/c/	/xɛc/	parakeet	/k/	/xɔk/	to snore
/ʃ/	/wɔʃ/	whirl	/g/	/nág/	in this
/ɲ/	/pɛɲ/	to kick	/ŋ/	/pɔŋ/	short
/ɲ²/	/n²ɛɲ²/	to stick	/ŋ²/		<b>absent</b>
/ʃ/	/ʃɛʃ/	grass area	/x/	/ʔáx/	to ask for
/h/	/ʔãh/	I	/ʔ/	/jɛłʔ/	money
/ʔ/	/mãʔ/	bee sp.	/l/		absent

<sup>16</sup> The non-glottalized lateral /l/ is very rare in the syllable coda in native words. The word *bél* 'candle' is from Portuguese *vela*. No example was found of /l/ in the coda after a nasal vowel, which is understandable, since it could only come from Portuguese VNIV, with deletion of the final vowel. However, such a sequence does not exist in Portuguese.

(19) Co-occurrence restrictions between nucleus and coda



Although Dâw shows a contrast between /p,b,m/ syllable-initially and syllable-finally, in the coda of oral syllables biphasic consonants occur systematically, which, according to Silvana Martins (2004), are the surface manifestation of underlying nasal consonants<sup>17</sup>:

- |      |       |         |              |        |          |                            |
|------|-------|---------|--------------|--------|----------|----------------------------|
| (20) | /pam/ | [pab̥m] | to smash     | /lumʔ/ | [lùb̥mʔ] | fish sp.                   |
|      | /cón/ | [cód̥n] | to be hungry | /ɣnʔ/  | [jɣd̥nʔ] | to move body like a lizard |
|      | /jep/ | [jɛ̥p]  | to stumble   | /waɲʔ/ | [wḁɲʔ]  | to be delirious            |
|      | /jóŋ/ | [jó̥ŋ]  | elbow        |        |          |                            |

Since in Dâw nasal consonants contrast with voiced stops, and given that underlying voiced stops always surface as plain non-sonorant voiced stops, the occurrence of the biphasic consonants cannot be explained as VSE. Consequently, Silvana Martins' hypothesis regarding the underlying sonorant origin of these sounds must be correct. Interestingly, although biphasic consonants do not occur syllable-initially, the contour property of the root-final consonants remains intact when words like the ones in (20) are followed by a vowel-initial suffix, as in /hòmʔ-oʔ/ 'fruit sp.-focalizer', realized as [hòb̥mʔoʔ], or /dom-ĩh/ 'fish sp.-modal', pronounced as [dòb̥m-ĩh]. The contour sounds in these sequences contrasts with plain nasal consonants in non-derived words: /lemù/ [le'mù:] 'pumpkin'. It is unclear how exactly this surface contrast must be explained. One possibility is that consonants that are syllabified across a morpheme boundary are ambisyllabic (and maybe also longer), whereas underlyingly intervocalic consonants are only syllabified as onsets of the following nucleus. Another way of explaining this contrast would be to refer to paradigmatic factors. Until further evidence becomes available, this question must remain unanswered.

We have already concluded that in Dâw, contour consonants cannot be explained as VSE. As a matter of fact, Dâw appears to be a language for which all the relevant parameters point to an underlying /M/ series as the source of the biphasic consonants:

<sup>17</sup> Silvana Martins (2004, p.47); cites Valteir Martins (1994), who measured that the nasal phase is about 30% to 50% longer than the oral phase.

(21) Dâw

V↔Ṽ/	/P,B,M/	(g >)	ɸ > d > b	[abm]>[mba]	[mb]~[b]	[mb]~[m]	nasal harmony
yes	yes	no	yes	no	yes, complementary distribution	yes: glides and /l/ only	

The opposition between oral and nasal vowels is a prerequisite for an explanation of the contour consonants based on OVE. The triple contrast between /P,B,M/ strongly argues against a VSE-based analysis. In light of two facts, (1) biphasic consonants do not occur in the syllable onset and (2) their complementary distribution with nasal consonants in a language that has no nasal assimilation targeting voiced consonants, the OVE-based explanation of the contour stops appears to be the most appropriate.

**Wansöjöt: an interesting case**

The Wansöjöt, more generally known as Puinave<sup>18</sup>, represent a relatively well-populated indigenous group, with about 3500 speakers located in two areas. The larger group lives in Colombia, in the region of the Inírida River. The smaller group lives on the shores of the Venezuelan Orinoco. Girón Higuita (2008) proposes the following system of underlying consonantal phonemes for this language:

(22)	Labial	Coronal	Dorsal	Laryngeal
	p	t	k	ʔ, h
	m	n		
		<b>s</b>		

In Wansöjöt, nasality is a distinctive feature for vowels. The following examples illustrate the contrastive use of non-continuant consonants in the onset and coda of syllables with oral and nasal nuclei.

(23) Onset of syllable with oral nucleus

/p/	[póʔ]	tree sp.	/m/	[(m)bóp]	arrow
/t/	[tʔ]	banana	/n/	[(n)deb̀ɪm]	pig
/k/	[kʔt]	star			

<sup>18</sup> The genetic classification of this language is controversial. For some discussion, see Valteir Martins (2004) and Girón Higuita (2008).

(24) Onset of syllable with nasal nucleus

/p/	[pát]	axe handle	/m/	[mát]	rat
/t/	[hátáp]	he has a fever	/n/	[nõmã]	downriver
/k/	[akãĩ]	I'm getting bored			

(25) Coda of syllable with oral nucleus

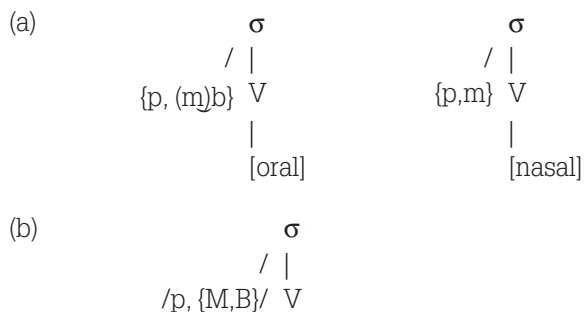
/p/	[(m)bóp]	arrow	/m/	[(n)debòm]	pig
/t/	[hót]	those	/n/	[kitkín]	parrot sp.
/k/	[kók]	pepper			

(26) Coda of syllable with nasal nucleus

/p/	[atáp]	I have a fever	/m/	[atãm]	my name
/t/	[ʔát]	wasp sp.	/n/	[ʔãn]	casabe
/k/	[hápók]	(s)he lies in hammock			

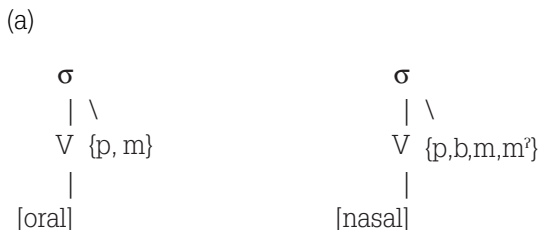
In the syllable onset we find the typical allophones of underlying /{M,B}/, as illustrated in (29a), and generalized over oral and nasal syllables, in (29b).

(27) Onset

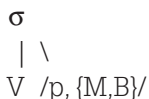


For the syllable coda, the distribution of the relevant consonants is as in (28a) and (28b), although, instead of the expected [bm], we find a plain nasal consonant after oral vowels.

(28) Coda



(b)



As shown in (22) above, Girón Higueta (2008) interprets /{M,B}/ as /M/. He proposes a generalized (lexical) rule of oralization that applies to underlying nasal consonants in the onset of oral syllables. An optional (postlexical) rule of prenasalization accounts for the fact that in word-initial position, non-sonorant voiced stops is usually realized as biphasic consonants. The following examples illustrate this process:

(29)	/móp/	→	/bóp/	→	[m <sub>h</sub> óp]	arrow
	/nuít-ot/	→	/duíd-ot/	→	[nduírət]	rope-pl
	/nemám/	→	/debám/	→	[ndebám]	pig

Wansöjöt has no nasal (or voiced) counterpart of /k/. The only possible input for the oralization rule are underlying /m,n/ in the onset of oral syllables. In the process of resyllabification, morpheme-final consonants are voiced, as can be seen in the second example. When voicing affects the coronal stop, it is realized as a flap. The process of sandhi voicing does not interfere with prenasalization, which does not happen word-internally, as is clear from the last example in (29).

Although the derivation of prenasalized consonants via an intermediate process of oralization seems somewhat complicated, the stable realization of /m/ in the syllable coda looks like a strong argument in favour of Girón Higueta's (2008) analysis. On the other hand, if we consider the facts of Wansöjöt from the perspective of the existing hypotheses about the emergence of contour stops, the exclusive appearance of biphasic consonants word-initially points to a VSE-based explication. Indeed, if the underlying class of consonants is /M/, the word-initial biphasic consonants could only be explained by OVE, in which case we would expect to find also (or only) biphasic variants in the coda of oral syllables, which are not attested. Let us therefore consider the plausibility of an underlying /B/ class for Wansöjöt. This hypothesis would in itself account for the distribution of voiced stops between oral vowels. We must furthermore posit a process of voice enhancement by way of nasal venting that creates biphasic consonants word-initially and plain nasal consonants in the syllable coda. Finally, there must be a rule that derives plain nasal consonants in the onset of nasal syllables. Together these processes derive the attested surface patterns, as in /debám/ → [ndebám] 'pig' and /dōbā/ → [nōmā] 'downriver'.

If, in fact, voiced oral stops in the syllable onset are nasalized by a following nasal vowel, we would expect that the same rule nasalizes segments that are less

sonorous than voiced stops. This is indeed the case, as is shown by the following examples provided by Girón Higueta (2008):

(30)	/iãt/	[ɲãt̚]	quarts
	/a-iðk/	[ã.ɲðk̚]	my elbow
	/a-kãĩ/	[a'kã̃]	I'm getting bored
	/uáp/	[wãp̚]	fish sp.
	/sʃũ/	[çũũ]	squirrel monkey sp.

The examples in (30) provide evidence for a syllable-based rule of nasal harmony in Wansöjöt, which could be generalized to include underlying voiced consonants. On the other hand, the realization of voiced stops as nasal consonants in the syllable coda is not dependent on the oral/nasal quality of the nuclear vowel. The process by which an underlying /B/ is changed to [m] is prosodically conditioned, although we may assume that the nasal spreading rule, which, as we have seen, applies both to onsets and codas, does not need to be restricted for this reason to the class of approximant segments. The rule that spells out voiced stops as nasal consonants is given below:

(31)	σ
	coda
	[+voice] → [nasal]

If a VSE-based explanation for the contour consonants of Wansöjöt is correct, it must again be admitted that nasal enhancement of voiced stops may produce plain nasal consonants, at least in some contexts.

Given that two alternative analyses are again possible, one would require some supplementary evidence that could tip the scales in favour of one explanation or another. Evidence for a VSE-based explanation comes from a synchronic process of fortition that affects syllable-initial coronal glides. Consider the examples in (34):

(32)	/náã iot/	[náãʃot]	this dog
	/iãñ/	[(ɲ)ʃãñ]	kingfisher sp.
	/iãt/	[ɲãt <sup>1</sup> ]	quarts
	/a-iõk/	[ã.ɲõk <sup>1</sup> ]	my elbow
	/hʃi-ʃ/	[hʃɲʃ]	to whistle-agentive

The words above illustrate the process of fortition, which turns syllable-initial glides into oral or nasal consonants, depending on whether the following vowel is oral or nasal. The optionality of the fortition process as well as the fact that resyllabified glides are equally affected –see the last example of (32) - convincingly shows that [ʃ,ɲ] are derived rather than underlying. Interestingly, in oral syllables, the derived voiced palatal stop [ʃ] is optionally prenasalized, as is the case with all voiced stops in this position, thus providing independent evidence for the claim that contour stops may have a synchronic lexical source that is not a nasal consonant.

Consider next the words in (33):

(33)	/a-nóm/	[aróm]	my grandfather
	/uãw-nʀk/	[wãurðk]	rain-to fall (to rain)
	/sãi-nei/	[sãi <sup>1</sup> rɛj]	at night
	/hʀnúk/	[hʀ <sup>1</sup> rúg <sup>1</sup> ]	animal
	/tonóʔ/	[tõ <sup>1</sup> róʔ]	frog sp.
	/iõt-ot/	[jórot <sup>1</sup> ]	dogs

For expository purposes we have posited underlying nasal consonants in the examples in (33), as assumed by Girón Higueta (2008). The words illustrate the process of intervocalic flapping, which affects /n/ between oral vowels in derived and underived contexts. As the last example of (33)<sup>19</sup> shows, flapping also applies to [d] derived from morpheme-final /t/ that is resyllabified with a following vowel-initial syllable. What this shows is that, if the oralization rule exists, it must be ordered before flapping. Obviously no ordering statements are necessary if the underlying /n/ in the words in (33) is replaced by /d/.

Fortition as well as flapping suggest an underlying series of voiced stops in Wansöhöt morphemes, at least in syllable-initial position. However, if we turn to the behaviour of the morpheme-final /{M,B}/ consonants, the picture becomes less clear. Morpheme-final consonants have the effect of nasalizing the vowel of a following vowel-initial suffixes, as illustrated with the words given in (34):

<sup>19</sup> It would be interesting to see what happens when morpheme-final /t/ is resyllabified with a nasal vowel. We would expect /t/ to become [n], via intermediate [d]. Unfortunately, we have not found any suffixes with an initial nasal vowel in Girón Higueta (2008). Girón (personal communication) confirms that such suffixes do not exist in Wansöhöt.

(34)	/mi-hǎm-at/	[bihǎmãt']
	1p-cultivate-terminative	we already cultivate
	/mõ-túm-at/	[mõtúmãt']
	house-back-ablative	behind the house
	/hǎ ha-hõn-i nem/	['hǎ hãhũnĩ dẽm]
	3sg 3sg-climb-interr yesterday	he climbed yesterday?
	/épin-ot/	[épĩnõt']
	person-pl	persons
	/nán-ot/	[dãrõt']
	jigger flea-pl	jigger fleas

With the exception of the last example, the words above illustrate a general pattern of progressive nasalization in Wansöjöt. Clearly, if the morpheme-final nasal consonants are derived from a /B/ class of phonemes, it is not possible to account for the fact that they act as triggers for the nasalization of the following suffixes. This was likely Girón Higuita's motive for attributing a phonemic status to nasal consonants. Equally, in Wansöjöt the nasal consonants in the coda cannot be explained entirely by nasal harmony. Inversely, if we wish to maintain the hypothesis of an underlying /B/ class also in the syllable coda, we must abandon the view of nasalization as being exclusively a low level phonetic phenomenon in the sense of Iverson and Salmons (1996). It would mean that the enhancement of the stop voicing by the nasal feature happens, at least in some languages with a /P/ ↔ /{M,B}/ opposition, at a deeper level of the grammar, even before the morphology takes place. Again, this early presence of the nasal feature does not discriminate between the alternative proposals, since, as we have seen, the oralization rule for onset consonants in Girón Higuita's proposal must also be deeply embedded in the grammar of Wansöjöt, a fact corroborated by the last word in (34). In the formation of plural nouns some exceptions to the progressive nasalization of suffixes are found. In these words, the morpheme-final nasal consonants of the base morpheme appear as their oral correspondents before the oral vowel of the plural suffix. The exceptional morphemes must either be lexicalized as irregular plurals or be marked lexically for undergoing oralization (recall that the subsequent flapping of derived [d] is automatic). Consequently, voiced onset stops already exist at the level of lexical representation, or are created in the morphology triggered by a lexical diacritic, depending on how one wishes to deal with exceptions. What the facts of Wansöjöt really seem to show is that non-sonorant voiced stops are underlying syllable-initially, and nasal consonants syllable-finally. The willingness to reduce both consonant classes to a single class of underlying segments is based on their complementary distribution, which, ever since the advent of structuralism, has been considered an important argument in favour of a single underlying representation. If one wishes to maintain this



argument in face of the facts of Wansöjöt, the choice between an early oralization rule for onset consonants and an early nasalization rule for coda consonants seems arbitrary<sup>20</sup>. From a cross-linguistic point of view, it could still be maintained that in systems of the /P/ ↔ /{M,B}/ type, the usual way of implementing this contrast is via nasal enhancement, which may take place already at the moment of selection of the phoneme inventory in which /P/ contrasts with /M/ (in some or all positions), or in which nasality is implemented as a low-level enhancement feature in the sense of Iverson and Salmons (1996). Consonant systems that oppose /P/ ↔ /B/ without any contrastive or allophonic use of nasality indeed appear to be rare.

## Conclusion

In this study we have addressed the issue of how contour segments must be interpreted in phonological terms. More specifically, we have tried to find criteria that decide for a given language which of the proposed theories of contrast enhancement would explain the existence of contour stops. We have seen that the only clear cases are those in which one or the other explanation is ruled out by principle. An analysis based on VSE is implausible in a language that uses the feature [nasal] contrastively, like Dâw, whereas a language like Wari, which has no vocalic contrast, could not be claimed to enhance an oral/nasal contrast on vowels through post-oralization. The study of Wansöjöt has shown that the phonological facts can be contradictory and point to different underlying segment sets in different positions, even in the case of segments classes that are in complementary distribution. The situation in Wansöjöt could be similar to the one in Wari. Kaingang turns out to be particularly difficult to interpret. The plain nasal consonants can be explained by nasal harmony at the syllable level, while all other allophones of the /{M,B}/ class are biphasic, allowing an argument in favour of underlying /M/ as well as underlying /B/. The only argument found which posited an underlying /B/ instead of an underlying OVE was that of the systematic appearance of contour segments in complex onsets, i.e. in a context in which nasality is not contrastive in Kaingang. Given the disagreement among specialists about the phonetic facts of Yuhup, an evaluation of this language must be suspended until the facts are solidly established.

None of the other criteria that we have proposed, such as the place and margin hierarchies, has been crucial in discriminating between possible explanations, probably due to the limited amount of languages that were discussed. One wonders, for example, whether languages exist that, like Dâw, have contour

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<sup>20</sup> This, of course, posits the question of the 'psychological reality' of underlying representations. The facts of Wansöjöt seem to suggest that, from a synchronic point of view, the [+nasal] feature is lexicalized for syllable coda consonants and that, consequently, the complementary distribution between /B/ and /M/ is better expressed by way of a well-formedness constraint rather than by a derivational rule.

consonants restricted to the syllable coda, but which, unlike Dâw, are of the /P/ ↔ /{M,B}/ type, or languages that show the place hierarchy in the syllable coda only, or that possess other kinds of restrictions in the distribution of biphasic consonants that were not discussed here. One also wonders whether there exist languages which lack a nasal contrast and present an asymmetry (/P/ ↔ /B/ ↔ /M/ vs. /P/ ↔ /{M,B}/) in the set of contrasting consonants in the onset and coda, but still maintains contour segments in both positions. Such a language would in all respects be like Yuhup, in Ospina's (2002) description of this language, without a nasal contrast on vowels. In order to gain a deeper understanding of the problem of the phonological interpretation of non-contrastive contour consonants, and given the pervasive occurrence of contour segments in the consonant systems of indigenous languages of South-America and elsewhere, it is both worthwhile and necessary to widen the class of languages for which this phenomenon is studied.

WETZELS, W. L. Considerações a respeito da interpretação fonológica das consoantes de contorno {nasal,oral} em algumas línguas indígenas da América do Sul. *Alfa*, São Paulo, v.52, n.2, p.251-278, 2008.

- RESUMO: Um traço intrigante da América como uma área lingüística é a ocorrência de consoantes de contorno oral/nasal. Neste artigo, estuda-se um certo número de línguas que têm esses sons e discutem-se as explicações baseadas no melhoramento do contraste fonológico que deveria dar conta dessas ocorrências. Uma dessas explicações considera a fase nasal do contorno consonantal como um melhoramento de um contraste subjacente de vozeamento; a outra explicação considera a fase oral de uma consoante nasal subjacente como uma estratégia para manter um contraste claro oral/nasal em vogais. Desse modo, as diferentes teorias de melhoramento propõem segmentos subjacentes diferentes, a partir dos quais os sons de contorno são derivados. Em alguns casos, os dados sincrônicos dos segmentos de contorno parecem inquestionáveis, seja porque a língua não tem o contraste para ser melhorado, seja porque usa contrastivamente a propriedade secundária (de melhoramento). A interpretação fonológica dos sons de contorno torna-se mais difícil nas numerosas línguas que têm ambos os contrastes nasal/oral em vogais e a falta de oposição fonêmica entre /P/ surdo, /B/ sonoro e /N/ nasal. Nessas línguas, o melhoramento como uma propriedade de implementação fonética é duvidoso. Antes, a propriedade de melhoramento parece ter preferencialmente um papel na escolha de segmentos contrastivos subjacentes.
- PALAVRAS-CHAVE: Consoantes de contorno. Melhoramento. Línguas ameríndias.

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