Labial Place in Phonology: Universal and Variable

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1. Introduction: Universal Labial Place?

Jakobson (1968: 48) posited that the most basic place contrast in consonants is between dentals and labials, and that this contrast "cannot be lacking anywhere, provided that there is no mechanical deformity of the speech apparatus." Indeed, even in cases where there is a physical impediment to labial constriction, the phonological contrast may still exist, and find an alternative phonetic implementation. Jakobson mentions the case of Tlingit, whose speakers traditionally wore large labrets in their lower lips, remarking that "the labial series finds a characteristic substitute in velar consonants with an accompanying *u*-sound: in this way, e.g., *yāk* ('shell fish') and *yākᵘ* ('canoe') are distinguished." (Cf. Maddieson et al. (2001) for a fuller discussion of the Tlingit consonant inventory.)

A challenge to Jakobson's generalization is posed by Mohawk, which has no native consonantal segments with labial place. While labials do occur in loanwords (e.g., *raparot* 'wheelbarrow' < Fr. *la brouette*; Bonvillain 1984: 320), the language as it was before contact with French remains an evident counterexample. Hall (2010), building on evidence from Postal (1968) that some surface [kw] sequences are underlyingly monosgmental, argues that Mohawk has an underlying /kʷ/, which must be specified as having labial place in order to distinguish it from plain /k/. As this is the only labial(ized) consonantal segment in the inventory, there is no need for the phonological representation to mark explicitly the fact that the labial place is secondary; effectively, 'labialized dorsal' functions as a contrastive primary place of articulation in Mohawk.

If the feature Labial was already contrastive in Mohawk, its presence in the system might account for the fact that Mohawk has been receptive to adopting /p/ and /m/ in borrowings from French: as shown in (1), adding /p/ to the Mohawk stop inventory does not require the introduction of any new features, or even any additional complexity in the way in which features are combined.

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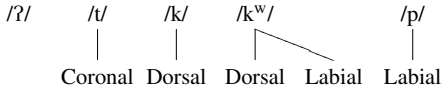
(1) Place specifications for four native stops and non-native /p/ in Mohawk



Under this analysis, the Mohawk consonant system begins to look a bit more like that of Tlingit, and is strikingly similar to that of Wichita, whose stop series likewise contrasts /k/ and /kʷ/ but lacks /p/ (Rood 1975).

Mohawk (Iroquoian)				*Wichita (Caddoan)*			
t	k	kʷ	ʔ	t	k	kʷ	ʔ
(ʧ)				ʦ			
s			h	s			h
n							
l/r				r			
j		w		j		w	

Figure 1. *Consonant inventories of Mohawk and Wichita*

In this paper, I argue that this representational possibility offers an explanation for the otherwise odd typological patterning of labialized dorsal consonants more generally. In particular, if labialized dorsals have the possibility of being represented more simply than other combinations of primary and secondary articulations, then the formal system of representations sheds some light on why these consonants are typologically more common than we might otherwise expect, and why their presence in an inventory is not as strong a predictor of the presence of other labialized consonants as we might otherwise expect. Section 2 discusses the typological predictions about labialized dorsals that follow from proposals about the structure of inventories by Clements (2003, 2009) in combination with standard assumptions about featural representations. Section 3 discusses the extent to which these expectations are defied by the range of inventories attested in Mielke's (2008) P-base database. Section 4 explains the proposed system of representations and discusses how it corresponds to the attested inventories. Section 5 concludes the paper with a discussion of the possible consequences of the proposed representations for the phonological behaviour of the segments involved.

2. Typological Expectations

Clements (2003, 2009) posits a number of principles responsible for patterns in the typology of phonological inventories, of which Feature Economy and Marked Feature Avoidance are the most relevant to the question addressed in this paper.

2.1 Feature Economy

Clements's principle of Feature Economy predicts that if a feature is used contrastively in a language at all, it will be used to something approaching maximal advantage, at least to

the extent that this is compatible with other desiderata. This principle prefers inventories in which contrasts cross-classify as fully as possible, or, in mathematical terms, inventories that optimize the ratio of segments to distinctive features. (See Hall (2007: §4.3.3) and Mackie and Mielke (2011) for discussion of how best to calculate Feature Economy.)

For example, Feature Economy would disfavour the first of the three stop inventories in Figure 2, because the laryngeal and place contrasts in this inventory do not fully cross-classify. Either the second inventory, in which the same number of contrasting segments are distinguished using fewer features, or the third, in which the same number of features distinguish a larger number of segments, would be preferable.

Less economical	*More economical*	*More economical*
k^h		p^h t^h k^h
p t	p t k	p t k
d g	b d g	b d g
b^h		b^h d^h g^h

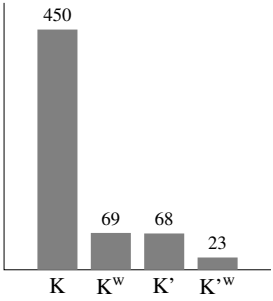
Figure 2. *Three possible stop inventories as evaluated by Feature Economy*

2.2 Marked Feature Avoidance

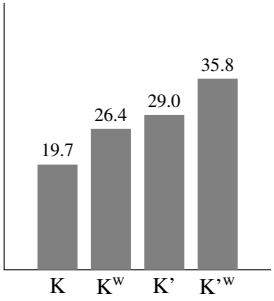
Clements (2009: 42) describes the effects of Marked Feature Avoidance by saying that "inventories show a tendency to avoid marked feature values," where "marked feature values can be defined as those that are not present in all languages." Stated in these terms, the principle looks perilously close to a tautology: features that are less frequent are less frequent. However, as Clements shows, Marked Feature Avoidance does have empirical content.

Clements predicts that patterns of markedness that are observable *across* languages should correspond to patterns of markedness observable *within* languages. Marked sounds are, in general, a last resort (or at least a latter resort) in the construction of any inventory; all other things being equal, the more marked a sound is, the larger an inventory should need to grow in order to include it. There should be no sounds that occur only in small inventories and not also in larger ones. We expect the relative markedness of a segment to correlate negatively with the number of inventories in which it occurs (marked segments occur in fewer languages), and positively with the mean size of the inventories in which it occurs (marked segments occur in larger inventories rather than in smaller ones).

Figure 3, based on data from Clements (2009: 42), gives an example of how these predictions are borne out in the UCLA Phonological Segment Inventory Database (UPSID; Maddieson and Precoda 1989). The figure compares the number and size of consonant inventories containing plain dorsal stops (K), labialized dorsal stops (K^w), dorsal ejectives (K'), and labialized dorsal ejectives (K'^w). On the assumption that labialization and glottalic airstream are both formally marked options (Clements assumes that they are represented by marked features [+round] and [constricted glottis], respectively), the pattern in Figure 3 is exactly what Marked Feature Avoidance predicts. The least marked segment (K) occurs in



Number of inventories in UPSID containing segments of the indicated type



Mean number of consonants in UPSID inventories containing segments of the indicated type

Figure 3. *Marked Feature Avoidance in UPSID, based on Clements (2009: 42)*

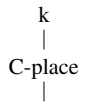
the largest number of inventories (450 of the 451 languages represented in UPSID[1]), and the languages in which it occurs have the lowest mean number of consonants (19.7); the most marked segment (K'^{w}) occurs in the fewest inventories (23), and these inventories have an average of 35.8 consonants each.

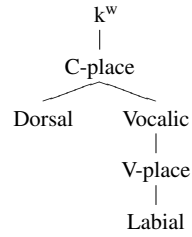
2.3 Representations

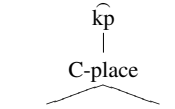
The predictions made by these principles, and particularly those of Marked Feature Avoidance, depend in part on the system of representations that is assumed. In the particular case of labialized dorsal consonants, which are the focus of this paper, standard feature theories imply that labialization is a marked property, but do not generally predict any special interaction between labialization and primary place. For example, Clements (2009), in discussing the data in Figure 3, assumes that labialized K^{w} and K'^{w} are distinguished from their plain counterparts by a marked feature [+round]; the same feature could presumably be added to any other consonant just as easily.

In the Unified Feature Theory of Clements and Hume (1995), secondary articulations on consonants are represented by features under the V-place node, while primary consonantal place is represented on the C-place node. A plain velar /k/, a labialized velar /k^{w}/, and a labial-velar double articulation /k͡p/ would thus be distinguished by the place specifications shown in (2):

[1] The lone exception seems to be the Papuan language Vanimo.

(2) a. 

b. 

c. 

If primary and secondary articulations are encoded on two different nodes, then we should expect them to vary independently of each other, within the range of combinations that the human vocal anatomy is capable of producing. The presence of labialization (or any other secondary articulation) is marked, but there is no reason to expect any specific combination of primary and secondary place to be any more or less marked than any other, except to the extent that some place features are inherently more or less marked than others.

3. Typological Surprises

These expectations are confounded by the results of a typological investigation of secondary labialization in the phoneme inventories collected in Mielke's (2008) P-base database, which includes 628 varieties of 548 spoken languages.[2]

In a few of the languages in P-base, the distribution of labialized consonants conforms to the predictions of Feature Economy. One such language is Tangale (Figure 4).

Tangale (Chadic)

p		t		k	ʔ
		tʷ		kʷ	
b	ɗ	d	ƈ	g	
bʷ		dʷ		gʷ	
ᵐb		ⁿd	ⁿƈ	ᵑg	
ɓ		ɗ			
ɓʷ		ɗʷ			
		s	ʃ		h
		sʷ	ʃʷ		
		z	ʒ		
		zʷ	ʒʷ		
m		n		ŋ	
w	l	r	j		
		rʷ	jʷ		

Figure 4. *The consonant inventory of Tangale*

In Tangale, the marked property of labialization distinguishes thirteen segments from their unrounded counterparts, out of a total inventory of 40 consonants. Contrastive round-

[2] I am very grateful to Jeff Mielke for making a copy of this database available to me.

ing cross-classifies with distinctions in primary place, manner of articulation (apart from nasality), and airstream mechanism.

Also unsurprising, although in a somewhat different way, are inventories like that of English. English has no phonemic labialization contrasts on consonants at all; rather, lip-rounding on consonants occurs allophonically before rounded vowels, and as a phonetic enhancement on postalveolars and retroflexes (Keyser and Stevens 2001: 271–272; Hall 2011: 17–18). Labialization contributes nothing to the number of phonemes in the inventory, but it also does not add to the number of distinctive features (at least in the strict sense of 'distinctive'); its purely predictable role in the phonology and phonetics of English consonants makes it economically neutral.

However, many of the inventories in P-base show a more surprising pattern. There are 117 inventories in the database that include at least one labialized consonant; of these, 26 have *only* one labialized consonant. (Four of these are shown in Figure 5.) In these inventories, the lone labialized consonant is almost always velar (/k^w/ in 15 instances, /$ŋ^w$/ in six, /g^w/ in two, and /$ɣ^w$/ in one). The two (apparent) exceptions are Sonora Yaqui (Uto-Aztecan), in which the only labialized consonant is /b^w/, and Woleaian (Austronesian), which has what is transcribed in P-base as /m^w/. Interestingly, Dedrick and Casad (1999) argue that Sonora Yaqui /b^w/ is a reflex of earlier /*k^w/. As for Woleaian, the description of the segment inventory in Sohn (1975), the source cited in P-base, suggests that the consonant transcribed as /m^w/ is in fact a velarized labial /$m^ɣ$/, a point which will be discussed further in section 4.

Comanche (Uto-Aztecan)

p	t	k	ʔ
		k^w	
	s		h
m	n		
w		j	

Passamaquoddy (Algonquian)

p	t	k	
		k^w	
	s		h
m	n		
	l		
w		j	

Dani (Austronesian)

p	t	k	ʔ
		k^w	
	s		h
m	n		
	l		
w		j	

Degema (Edoid)

p	t		k	k͡p	
b	d	ɗ̪	g	g͡b	
ɓ	ɗ				
f	s				h
v					
m	n	ɲ	ŋ	$ŋ^w$	
w	r l	j			

Figure 5. *Some inventories containing only one contrastively rounded consonant*

In these inventories, labialization is used in what seems a strikingly uneconomical way; a marked feature that could in principle be used contrastively with several other combinations of features, producing a significantly larger inventory, serves to distinguish only a single consonant.

Many other inventories employ contrastive rounding on a larger, but still closely circumscribed, set of consonants. In these inventories, rounding cross-classifies at least to some extent with manner features, but not with primary place of articulation. Rather than freely combining primary and secondary articulations, languages such as the ones in Figure 6 have a series of labialized velar consonants that contrast with plain velars, but not with labialized consonants at any other primary place of articulation.

Kombai (Trans-New Guinea)

^{m}b	^{n}d	ɟ	^{ŋ}g	^{ŋ}g^{w}
ɸ			x	x^{w}
	l			
	r			
w		j ɻ		

Nisga'a (Penutian)

p	t̪	ts			k	k^{w}	q	ʔ
p'	t̪'	ts'	tɬ'		k'	k'^{w}	q'	
		s	ɬ		x	x^{w}	χ	h
m		n	l					
m'		n'	l'					
w				j				
w'				j'				

Sinaugoro (Austronesian)

	t	k	k^{w}
b	d	g	g^{w}
f	s		
v	r	ɣ	ɣ^{w}
m	n		
	l		

Tigrinya (Semitic)

p	t	ʧ	k	k^{w}		ʔ
b	d	ʤ	g	g^{w}		
p'	t'	ʧ'	k'	k'^{w}		
f	s	ʃ			ħ	h
	z	ʒ			ʕ	
	s'					
m	n	ɲ				
	r					
w	l	j				

Figure 6. *Some inventories with a labialized velar series only*

Even in languages in which contrastive labialization is not confined solely to velars, it often does not cross-classify fully with primary place. For example, the inventories in Figure 7 use lip-rounding distinctively on both velars and uvulars (and in the case of Kabardian, also on the glottal stop), but not on any consonants whose primary place of articulation is farther forward. In the inventories in Figure 8, rounding is contrastive on velar and labial consonants, but not on coronals. In general, coronal consonants seem to be the least likely to have contrastively labialized versions: among the inventories in P-base, no language has contrastive rounding on coronals unless it also has contrastive rounding on velars. The uneconomical deployment of contrastive labialization, then, seems to involve a particular affinity between rounding and primary dorsal (or sometimes labial) place, or perhaps an antagonism between rounding and primary coronal place.

The same interaction between primary and secondary place can be seen when we consider the typological data from the perspective of Marked Feature Avoidance. Figure 9 applies Clements's (2009) tests for markedness to plain /k/ and /t/ and labialized /k^{w}/ and /t^{w}/. Neither /k/ nor /t/ appears to be particularly marked, either in comparison to the other or in a more general sense: each of them occurs in a large majority of the inventories in

Halkomelem (Salishan)

p		t		k	k^w	q	q^w	ʔ
p’		t’		k’	$k’^w$	q’	$q’^w$	
			ʧ					
	tθ’	tɬ’	ʧ’					
	θ	ɬ	ʃ	ç	x	x^w	χ	$χ^w$	h
m	l	j	w					

Yavapai (Hokan)

p^h	$t̪^h$	ʧ^h		k^h	k^{wh}		
p	t̪	ʧ	k^j	k	k^w	q	q^w	
ʍ	θ	s	ʃ					h
β	l̪	r	ʎ					
m		n	ɲ					
w			j					

Tashlhiyt (Berber)

	t	$t^ʕ$		k	k^w	q	q^w
b	d	$d^ʕ$		g	g^w		
f	s	$s^ʕ$	ʃ	$ʃ^ʕ$	x	x^w	
	z	$z^ʕ$	ʒ	$ʒ^ʕ$	ɣ	$ɣ^w$	
m	n	$n^ʕ$					
	l	$l^ʕ$					
	r	$r^ʕ$					

Kabardian (North Caucasian)

p	t	ʦ	c		k^w	q	q^w	ʔ ʔ^w
b	d	ʣ	ɟ		g^w			
p’	t’	ʦ’	c’		$k’^w$	q’	$q’^w$	
f	s	ɬ	ʃ	ɕ	x	x^w	χ	$χ^w$	ħ h
v	z	ɮ	ʒ	ʑ	ɣ		ʁ	$ʁ^w$
f’		ɬ’	ʃ’					
m	n							
w	r							

Figure 7. *Some inventories with contrastive labialization on velars and uvulars*

Kilivila (Austronesian)

p	p^w	t	k	k^w
b	b^w	d	g	g^w
β		s		
m	m^w	n	ŋ	
		r l		
w			j	

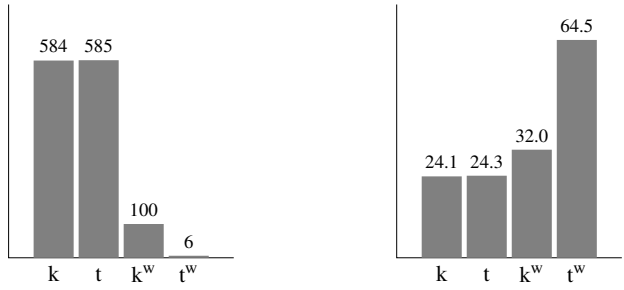
Argobba (Semitic)

		t̪	ʧ	k	k^w	ʔ
b	b^w	d̪	ʤ	g	g^w	
p’		t̪’	ʧ’	k’	$k’^w$	
f		s̪	ʃ			h
		z̪	ʒ			
		s̪’				
m		n̪	ɲ			
		l̪ ɾ̪				
w			j			

Figure 8. *Two inventories with contrastive labialization on velars and labials*

P-base, and the inventories in which they appear have, not surprisingly, mean total numbers of consonants that are very close to the average for P-base as a whole (24.2). The labialized consonants are, also as expected, more marked than their plain counterparts by both of these tests. Labialized /k^w/ occurs in 100 inventories, which have on average 32 consonants each. For labialized /t^w/, however, the difference is much more drastic: /t^w/ occurs in only six inventories, and the mean number of consonants in these inventories is 64.5.

While it is not surprising that labialized /k^w/ and /t^w/ are marked relative to plain /k/ and /t/, the apparent difference in markedness between /k^w/ and /t^w/ is much more startling. Since /t/ does not appear to be any more marked than /k/, there is no reason to expect that adding the same marked feature to each of these consonants would have such different results. It seems that the markedness of a complex segment such as /k^w/ or /t^w/ cannot be



Number of inventories in P-base containing the indicated segments

Mean number of consonants in inventories in P-base containing the indicated segments

Figure 9. *Comparing /k/, /t/, /k^{w}/, and /t^{w}/*

calculated simply by adding up the markedness of each of its components; rather, these components interact with one another in more complicated ways.

The typological pattern thus presents two puzzles. First, why is contrastive rounding on consonants so often deployed in an apparently uneconomical way? And second, why is contrastive rounding most likely to occur on dorsal and labial consonants, and so unlikely to occur on coronals?

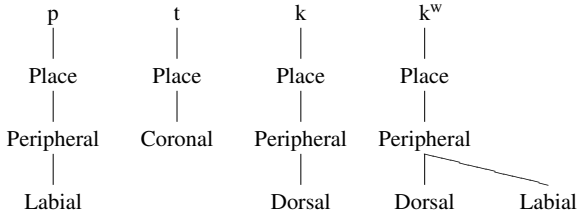
4. Proposal

I propose that there are two distinct phonological roles that labialization can perform in an inventory. In systems like that of Tangale (Figure 4), where lip-rounding is contrastive across all or nearly all primary places of articulation, the standard view holds, and rounding is represented as a vocalic articulation independent of the primary consonantal place node. In systems like the ones in Figures 1, 5, and 6, however, secondary labialization is treated as part of consonants' primary place specifications—in other words, its secondariness is underspecified in the representations.

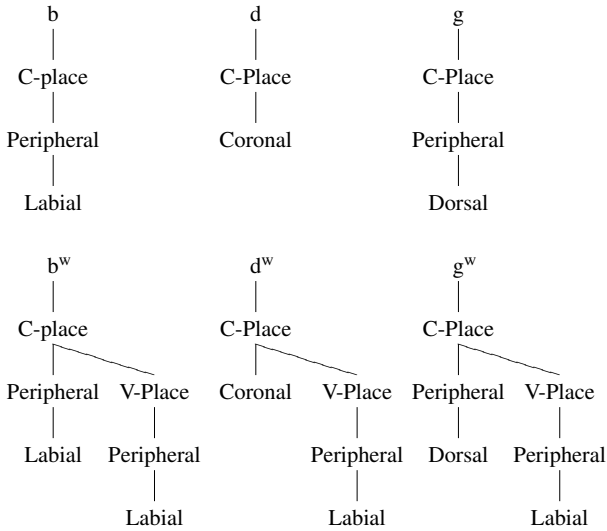
Specifically, I assume, following Rice and Avery (1993) and Rice (1995, 2002), that the dorsal and labial places of articulation are grouped together under a more general Peripheral node, in opposition to Coronal. In (at least some) languages with systems like those in Figures 1, 5, and 6, no distinction is made between V-Place and C-Place, and rounded velars have Dorsal and Labial as dependents of a single Peripheral node, as in (3a). In such a language, rounded velars function—and are expected to behave phonologically in all respects—as a distinct primary place of articulation, as though they were labial-velar double articulations rather than velars with secondary rounding. Indeed, in Degema (Figure 5), the lone labialized consonant /ŋ^{w}/ may in fact be the nasal counterpart of the doubly articulated stops /k͡p/ and /g͡b/; under the current proposal, these three segments would constitute a single Dorsal+Labial series, in which the realization of the Labial feature as either rounding

or complete closure is a matter of phonetic implementation, not explicitly encoded in the phonological representations. In languages like Tangale, on the other hand, where rounding cross-classifies more fully with primary place, C-Place and V-Place are distinguished, as in (3b).[3]

(3) a. Comanche-type:



b. Tangale-type:



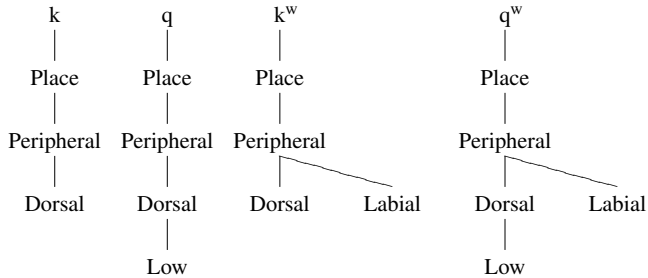
The possibility of representations like those in (3a) accounts for the large number of languages in which rounding is contrastive on dorsals, but not at other places of articulation. While the presence of both Dorsal and Labial under Peripheral is more marked than the presence of only one such dependent, it is still less marked than the additional structure needed to represent labialization that can combine freely with any primary place features.

Further dependent features of Labial and Dorsal can account for intermediate typological possibilities, in which rounding is contrastive on more than just velars, but still does not

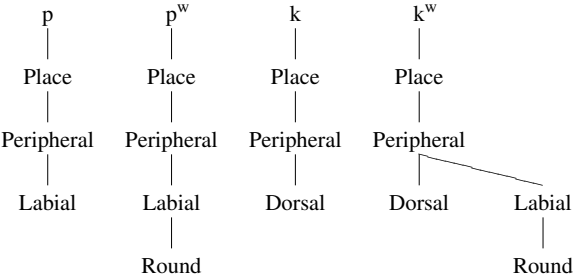
[3] In all of these representations, I abstract away from further forms of contrast-based underspecification.

fully cross-classify with primary place, and in particular does not combine with coronals. In languages like Halkomelem (Figure 7), for example, contrastive rounding appears on velars and uvulars only; this can be accommodated by augmenting the representations in (3a) with a height feature dependent on Dorsal. And the existence of languages such as Kilivila (Figure 8), where rounding is contrastive on dorsals and labials, but not coronals, suggests a third possibility, in which rounding on consonants is encoded neither by the Labial feature itself nor under the V-Place node, but by a Round feature dependent on Labial. (4) illustrates the representation of the relevant contrasts in each of these languages.

(4) a. Halkomelem-type:



b. Kilivila-type:



Since there is nothing in the representations of labialized velars in (3a) to indicate that Labial is a secondary place, we might expect that such representations could just as easily correspond not only to labial-velar double articulations (as in Degema) but also to velarized labials. In fact, the Austronesian languages Woleaian (Sohn 1975) and Pulu Annian, whose inventories are shown in Figure 10, exemplify this alternative phonetic realization of the system of phonological contrasts in (3a): secondary velarization is contrastive on labial consonants, but not on any other primary place of articulation.

5. Phonological Consequences

This approach predicts that in languages with the system in (3a), secondary labialization should be able to interact directly with primary place. An example of this can be seen in

Woleaian (Austronesian)					*Pulu Annian (Austronesian)*				
p		t	ʧ	k	p	pˠ		t	k
f	ɸˠ		ʂ	ç			ð	s	
m	mˠ	n		ŋ	m	mˠ		n	ŋ
		ɾ	ɻ		w			l	j

Figure 10. *Two inventories with velarized labials*

Tashlhiyt Berber (whose inventory is shown in Figure 7), in which labialized velars undergo dissimilatory unrounding after labials (Ní Chiosáin and Padgett 1993):

(5)

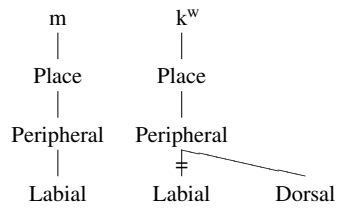
	PRETERITE	AGENT SG.	GLOSS
a.	kʷra	amkray	'rent'
b.	gʷra	amgru	'glean'

Ní Chiosáin and Padgett (1993: 16) note that this dissimilation is unexpected in the usual V-Place model, because it seems to involve an interaction between instances of Labial that belong to two different tiers: the primary labial place of the /m/ triggers delinking of the secondary labial articulation from the velars.

Ní Chiosáin and Padgett (1993) account for this by proposing that the labial consonants in Tashlhiyt have 'inherent' labial V-Place. In the absence of a contrast between plain and rounded labial consonants, the labiality of the (plain) labials is represented not only by the feature Labial under the primary Place node, but also by a Round feature under V-Place. It is this feature, rather than the primary Labial place feature, that motivates delinking of Round from the velars to satisfy the Obligatory Contour Principle. This proposal could be seen as the diametric opposite of contrastive underspecification: because the absence of rounding is not contrastive on labials, rounding is not omitted from their phonological representations.

Under the proposal set out above in section 4, the interaction between labials and labialized velars in Tashlhiyt is indeed related to the contrasts present in the system, though not in the way Ní Chiosáin and Padgett suggest. In Tashlhiyt, rounding is contrastive only on dorsals, and the rounded dorsals do not contrast with labial-dorsal double articulations; accordingly, /kʷ/ and /gʷ/ are represented with Labial as a sister to Dorsal, so that it occupies the same tier as the primary place of /m/. Dissimilation thus takes place entirely on the primary Place tier, as in (6).

(6)



In this account, the secondary status of the Labial feature on /kʷ/ is not encoded in the representations, because its secondariness is not contrastive. If the representational

possibility proposed in (3a) is on the right track, then we should expect to find similar kinds of interactions between secondary and primary articulations in other languages in which the two do not fully cross-classify.

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