

ON THE REALIZATION OF CONTRASTIVE LABIAL PLACE

Daniel Currie Hall
Meertens Instituut & University of Toronto

1. Introduction: The dubious ubiquity of labial consonants

1.1 A typological claim

Labial consonants are extremely common in the phonological inventories of the world's languages, and the presence of contrastive labial place is nearly universal. Indeed, Jakobson ([1941] 1968: 47–48) claimed that the contrast between labial and coronal consonants *is* universal, at least in the absence of interference from extralinguistic physiological factors:

The first consonantal opposition is that of nasal and oral stop (e.g., *mama–papa*), which is followed by the opposition of labials and dentals (e.g., *papa–tata* and *mama–nana*).

These two oppositions form the minimal consonantal system of the languages of the world. These are the only oppositions that cannot be lacking anywhere, provided that there is no deformity of the speech apparatus (dyslalia labialis).

Even Hawaiian, which has a particularly small consonant inventory, has both of Jakobson's basic oppositions, as shown in (1): oral /p/ contrasts with nasal /m/, and labial /m/ contrasts with coronal /n/.

(1) Consonant inventory of Hawaiian (Herd 2005: 80)

p	k	ʔ
		h
m	n	
w	l	

Hawaiian is typologically unusual in that it is generally described as lacking phonemic /t/, and so it would seem to lack Jakobson's "*papa–tata*" distinction (though it contrasts "*mama–papa*" and "*mama–nana*") On the other hand, [t] does occur as a variant of /k/ (Schütz 1995), and in that capacity it contrasts with /p/.

1.2 A challenge: Mohawk

The native phonemic inventory of Mohawk, like those of other Iroquoian languages, presents an apparent counterexample to Jakobson's ([1941] 1968) generalization. The inventory shown in (2) is based on Bonvillain's (1973: 27, 41) inventory for the Akwesasne variety of Mohawk and Michelson's (1981b: 312) inventory for the Caughnawaga variety; all symbols have been converted to IPA.

(2) Native phonemic inventory of Mohawk¹

a. Consonants:

	alveolar	palatal	velar	glottal
stops	t		k	ʔ
affricate		(tʃ)		
fricatives	s			h
nasal	n			
liquid	l/r			
semivowels		j	w	

b. Vowels:

	front	central	back
	unrounded	unrounded	rounded
high	i		ũ
mid	e	ã	o
low		a	

The labial–coronal contrast is not necessarily entirely lacking in Mohawk, depending on what one might have to say about the /w/–/j/ and /ũ/–/i/ oppositions. Bonvillain categorizes /w/ as a dorsovelar, but this should not be taken to mean that it does not involve labial articulation; in particular, she shows /wh/ coalescing to [f]:

(3) /oʔwhahsa/ [oʔfahsa] ‘skirt’ (Bonvillain 1973: 34)

Setting the vowels and semivowels aside, however, it seems clear that there are no labial consonantal phonemes in the native inventory of Mohawk, and that the inventory thus contradicts Jakobson’s ([1941] 1968) generalization.

1.3 Theoretical motivations for the typological claim

1.3.1 Acquisition and markedness

While Jakobson ([1941] 1968) simply asserts that the labial–dental opposition is universal, similar predictions follow from theories in which typological generalizations are derived from other theoretical mechanisms. Many theories of markedness follow Jakobson in predicting a correlation between acquisition and typology, which is stated in a stylized and approximate form in (4):

(4) EARLY ↔ COMMON

In other words, segments that are typologically most frequent are predicted to be among the earliest acquired by children, and vice versa. This correlation can be made to follow from a variety of different formal mechanisms, such as:

¹ Bonvillain (1973) transcribes the affricate as /j/ (i.e., /tʃ/), but indicates that it, like the stops, has voiced and voiceless variants in non-contrastive distribution. Michelson (1981b) does not include an affricate in her inventory. There is one liquid, whose realization varies from one dialect to another. Akwesasne has /l/; Caughnawaga has /r/.

- a universal hierarchical organization of features, such that features lower in the hierarchy entail the presence of features that are above them (Jakobson, Fant, and Halle 1952; Beers 1995);
- filters or feature co-occurrence constraints (Calabrese 1995; Levelt and van Oostendorp 2007);
- universal markedness constraints that must be demoted in order for marked segments to appear (Gnanadesikan 2004);
- universal natural processes that must be suppressed or restricted in order for marked segments to appear (Stampe 1979).

Labial consonants tend to be acquired very early by learners of languages that have them at all (e.g., Beers 1995: 228), so to the extent that our theories of markedness predict the correlation in (4), we expect them to be very common, perhaps even ubiquitous.

Formal representations of markedness are motivated not only by (4), but also by phenomena such as assimilation and neutralization. (See Rice (2007) for an overview of the uses of markedness.) They typically assign an intermediate value to labials, ranking them as more marked than placeless glottals and (default) coronals, but less marked than most other places of articulation (or perhaps on an equal footing with dorsovelars). For example, de Lacy (2002) posits the place-of-articulation markedness scale shown in (5a), which is implemented in the constraints and representations in (5b), where *x* represents one degree of markedness and *o* explicitly marks the absence of an *x*:²

- (5) a. The Major Place of Articulation (PoA) Scale (de Lacy 2002: 37):
dorsal > labial > coronal > glottal

- b. Harmonic bounding for PoA constraints (de Lacy 2002: 41):

	*[Place]	*[xPlace]	*[xxPlace]	*[xxxPlace]
ʔ: [oooPlace]	*			
t: [xooPlace]	*	*		
p: [xxoPlace]	*	*	*	
k: [xxxPlace]	*	*	*	*

Given the representations and constraints in (5b), we might expect any system that tolerates /k/ to admit /p/ as well (although free ranking of de Lacy's (2002) family of IDENT constraints weakens this prediction).

² Thus /p/, which has the feature [xxoPlace], has *exactly* two degrees of markedness on the place hierarchy, while the constraint *[xxPlace] penalizes any segment with *at least* two degrees of markedness on the place hierarchy.

1.3.2 Dispersion Theory

Under the functionalist view of inventories embodied in Dispersion Theory (Liljencrants and Lindblom 1972; Kirchner 1997; Ní Chiosáin and Padgett 2001; Padgett 2003; Sanders 2003; Flemming 2002, 2004), the Mohawk consonant inventory is also unexpected. In its current formulations within Optimality Theory, Dispersion Theory involves two conflicting types of constraints—ones that mandate the presence of multiple contrasting segments, and ones that require the auditory distinctions among these segments to be robust.

The tableau in (6), which is a comparative tableau in the style of Prince (2002), schematizes the evaluation of the Mohawk stop inventory /t k ʔ/ by these two types of constraints. The first type of constraint, represented here as HAVE MANY PHONES, would prefer an inventory that includes /p/ in addition to the three native Mohawk stops. Depending on how the second type of constraint, represented here as SPACE PHONES WIDELY, is formulated, it might favour /t k ʔ/ over /p t k ʔ/—not because the stops in the Mohawk inventory are any more widely spaced, but simply because there are fewer pairs of phones to incur violations. However, the Mohawk inventory does not fare as well on this constraint as an alternative that contains /p/ instead of /t/, and which thus has more phonetic distance between /k/ and the maximally anterior stop.

(6) Comparative tableau: Mohawk stops vs. two alternative systems³

	HAVE MANY PHONES	SPACE PHONES WIDELY
/ t k ʔ/ ~ /p t k ʔ/	L	(W)
/ t k ʔ/ ~ /p k ʔ/		L

Given the harmonic bounding of the Mohawk stop inventory on the constraints shown in (6), the only way for it to emerge as optimal is through the intervention of some high-ranking constraint that specifically penalizes labials. The problem thus reverts to one of markedness.

2. The mystery of the borrowed labials

The Mohawk situation is further complicated by the fact that present-day Mohawk does have labial consonants in words borrowed from French and English. Many languages with small inventories adapt loanwords to their native phonologies, sometimes with quite drastic effects. For example, in borrowings from English into Hawaiian, all obstruents that are neither labial nor glottal are normally mapped onto /k/, as in the examples in (7).

³ HAVE MANY PHONES is a stand-in for any constraint along the lines of Flemming's (1995) MAXIMISE CONTRASTS, Ní Chiosáin and Padgett's (2001) NWORDS, or Padgett's (2003) *MERGE; SPACE PHONES WIDELY represents constraints such as Flemming's (1995) MINDIST, Kirchner's (1997) DISP, and Padgett's (2003) SPACE.

- (7) English /t, d, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ, k, g/ → Hawaiian /k/ (Herd 2005: 80, 83)
- a. /keaka/ 'theatre'
 - b. /paikeneka/ 'percent'
 - c. /kaakini/ 'dozen'
 - d. /kalana/ 'gallon'
 - e. /kanuwika/ 'sandwich'

Early in the history of its contact with French, Mohawk similarly altered the words that it borrowed. In the proper names in (8), French /m/, /b/, and /v/ are realized as Mohawk /w/, and French /p/ and /f/ as Mohawk /k/.

- (8) Early adaptation of French names into Mohawk (Bonvillain 1978: 33)
- a. /wanik/ *Monique*
 - b. /atū:wa/ *Thomas*
 - c. /walija:nĩ/ *Marianne*
 - d. /sawatis/ *Jean-Baptiste*
 - e. /ta:wit/ *David*
 - f. /kol/ *Paul*
 - g. /kel/ *Pierre*
 - h. /kelisite/ *Félicité*

French /m, b, v/ → Mohawk /w/;

French /p, f/ → Mohawk /k/

Later borrowings, however, contain imported labial consonants. In the examples in (9), French /m/ is borrowed faithfully, and /b/ and /p/ are mapped onto a bilabial stop /p/ (with predictable allophonic distribution of voiced and voiceless variants following the same pattern as the native stops).

- (9) Later adaptation of French words into Mohawk (Bonvillain 1978: 33; 1973: 37; 1984: 320)
- a. /aplam/ *Abram*
 - b. /majis/ *Moïse*
 - c. /papaʔ/ *Papa*
 - d. /lapahpot/ *la barbote* 'catfish'
 - e. /raparoet/ *la brouette* 'wheelbarrow'

French /m/ → /m/;

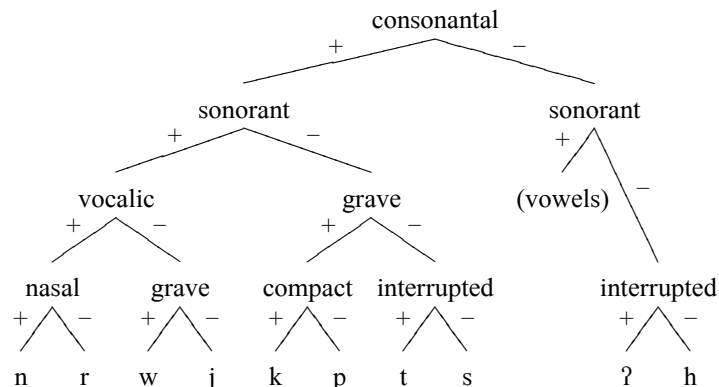
French /b, p/ → /p/

The presence of these labial consonants in modern Mohawk does not eliminate the typological anomaly, as the pre-contact inventory must still be contended with. If anything, the mystery is compounded: it is unusual that Mohawk lacked labials, but it is also somewhat surprising that it later adopted them, rather than continuing to replace labials in borrowings with native phones. Was there some property of Mohawk before contact with French, or is there some property of labial consonants, that made Mohawk more receptive to /m/ and /p/ than Hawaiian is to /s/?

3. /p/ as in Postal

Postal (1964, 1968) offers a striking perspective on the typological problem. The tree in (10) shows Postal's (1964: 277) contrastive hierarchy for the native consonants of Mohawk:

(10) Partial contrastive hierarchy of Mohawk phonemes (Postal 1964: 277)



Unlike the standard Mohawk inventory presented in (2), the hierarchy in (10) includes a segment that is transcribed as /p/, and which can also be identified as labial from the fact that it is assigned the features [+grave, –compact]. Postal (1964: 277 fn. 36) acknowledges that “p has never been recognized in treatments of Iroquoian phonology on the ground that no [p], [b], [m] etc. occur in the language,” but claims that “[i]t is easy to show, however, that such a fourth true consonant must be recognized on the systematic phonemic level.” This claim is elaborated by Postal (1968), who argues that there is an underlying segment /p/ that is realized as [kw]. The primary evidence for this claim comes from the existence of surface [kw] sequences that behave as though they were single segments.

3.1 Open syllable lengthening

One relevant phonological process is the lengthening of stressed vowels that occurs, according to Postal (1968: 147), “before a single consonant.” As Michelson (1981b: 316) points out, the environment for lengthening can be elegantly restated in terms of syllable structure: stressed vowels lengthen in open syllables.

In (11a), the surface [kw] sequence comes from an underlying /ko/ that is immediately followed by another vowel. This [kw] sequence behaves like two separate consonants (with a syllable boundary between them, if Michelson’s analysis is correct), and the stressed vowel in the initial syllable remains short. In (11b) and (11c), however, the surface [kw] sequences come from what Postal analyzes as an underlying /p/, and they act like single (onset) consonants; the stressed vowels before them lengthen.

- (11) Stressed vowels before /koV/ or /pV/ (Postal 1968: 247)
- | | | | |
|----|-----------------|----------------------|-----------------------|
| a. | /hra + ko + as/ | [<u>1</u> rakwas] | ‘he picks it’ |
| b. | /hra + upeh/ | [<u>1</u> ru:kweh] | ‘man’ |
| c. | /opirʔ/ | [<u>1</u> o:kwireʔ] | ‘branch’ ⁴ |

3.2 Morpheme structure

A somewhat more abstract piece of Postal’s case for /p/ comes from morpheme structure constraints. Postal (1968: 210–213) argues that Mohawk does not allow tautomorphemic /Cw/ sequences at all. This generality of this statement depends on the possibility of analyzing surface tautomorphemic [kw] as deriving from a single segment (Postal’s /p/) in cases where it does not come from prevocalic /ko/.⁵

3.3 Word-final (non-)realization

The behaviour of [kw] sequences in word-final position also contributes evidence that such sequences arise from single underlying consonant.

3.3.1 Deletion

Postal (1968: 248 fn. 3) writes that Mohawk “has a rule which deletes word-final [+ Abrupt Onset] segments in *nouns* only” (emphasis in the original); this rule treats /p/ [kw] as a single segment. In (12a–c), a single [t] that appears as part of a cluster in the verb forms on the right is deleted word-finally in the noun forms on the left. In (12d), the same process applies to [kw]. If the [kw] were a cluster at the relevant level of analysis, then it would presumably be immune to the effects of the rule, as the [k] is non-final and the [w] is not [+ Abrupt Onset].

- | | | | | | |
|------|----|-------------|-----------|----------------------|-------------------|
| (12) | | Nouns | | Verbs | |
| | a. | [kâ:sereh_] | ‘vehicle’ | [keʔserehtanû:weʔs] | ‘I like vehicles’ |
| | b. | [oshes_] | ‘honey’ | [keshestanû:weʔs] | ‘I like honey’ |
| | c. | [katsheʔ_] | ‘can’ | [ketsheʔtanû:weʔs] | ‘I like cans’ |
| | d. | [odzistoh_] | ‘star’ | [kdzistohkwânû:weʔs] | ‘I like stars’ |

3.3.2 Realization

When the segment Postal analyzes as /p/ is retained word-finally (i.e., in words other than nouns), its realization differs from what one would expect of an underlying /kw/ sequence. Postal (1968: 251–252) reports that while word-final /w/ is normally realized as [f], word-final /p/ is realized not as *[kf], but as [k], or, for “a handful of related speakers,” [kw].

⁴ ‘Branch’ is Postal’s (1968: 247) gloss; this word is translated elsewhere as ‘bush’ or ‘tree’ (e.g., Baker 1996: 422).

⁵ Both Bonvillain (1973) and Michelson (1981a: 94) indicate that tautomorphemic [sw] is possible; however, this may be analyzable as /so/.

3.4 Epenthesis

Postal identifies Mohawk /p/ with the Proto-Siouan-Iroquoian *p reconstructed by Chafe (1964). While the stop-sonorant clusters in (13a–c) were subject to historical (and in some cases still synchronically active) epenthesis in Mohawk (but not in Oneida), monosegmental *p in (13d) gave rise to modern surface [kw] with no epenthesis (in both languages).

- (13) Proto-Siouan-Iroquoian consonants in Mohawk and Oneida (Postal 1968: 246–247)

	Mohawk	Oneida	
a. *kw	[<u>kew</u> istos]	[<u>kw</u> istos]	‘I am cold’
b. *kr	[onutakeriʔ]	[onutakliʔ]	‘beer’ / ‘sugar’
c. *tw	[<u>tew</u> anû:weʔs]	[<u>tw</u> anû:wehseʔ]	‘we several like it’
d. *p	[ru:k <u>we</u> h]	[luk <u>we</u>]	‘man’

Postal’s (1968) analysis of Mohawk [kw] as /p/, then, effectively says that the Proto-Siouan-Iroquoian segment still exists at the phonemic level, and is treated as a single segment by the phonological rule system, even though it is realized as a sequence phonetically.

4. /k/ as in Kiparsky

Kiparsky (1973: 16–18) argues that there is an alternative explanation for the epenthesis pattern, namely that it is a derived-environment effect. The difference between [kewistos] and [ru:kweh], under this interpretation, is not /kw/ vs. /p/, but rather /k + w/ vs. /kw/, [kewistos] being derived from /k + wisto + s/. In this analysis, epenthesis breaks up /kw/ sequences that are created by the concatenation of morphemes, but underlying /kw/ sequences are left alone.

This analysis of the epenthesis facts does not entirely eliminate the grounds for treating Postal’s /p/ as a single segment, however. For one thing, as Michelson (1981b: 344–345) points out, epenthesis in Mohawk is capable of applying in non-derived environments, as in (14). The examples in (14a) and (14b) show epenthesis breaking up tautomorphic /wj/ and /nr/ clusters, while /kw/ (/p/ in Postal’s analysis) surfaces without epenthesis in (14b). In (14c), underlying tautomorphic /nkw/ (or /np/) surfaces as [nekw], with epenthesis breaking up the potential [nk] cluster but not the [kw]. (The epenthetic status of the relevant vowels is diagnosed by their invisibility to stress, which in Mohawk normally appears on the penultimate non-epenthetic vowel.)

- (14) Epenthesis within morphemes (Michelson 1981b: 323; 1989: 47)
- | | | | |
|----|------------------------|----------------------|----------------------------|
| a. | /t + k + atawjaʔt + s/ | [tkaʔtawejjaʔts] | ‘I enter’ |
| b. | /k + nohkwanr̥k + s/ | [kenohʔkwaner̥k + s] | ‘I’m tying it in a bundle’ |
| c. | /jo + tsiʔnkwar/ | [otʔsiʔnekwar] | ‘yellow’ |

Michelson (1989) also gives an example of an epenthesis process that, even though it does specifically apply in derived environments, lends further evidence for the special status of [kw]. An epenthetic [e] is inserted between the first two consonants of a C + CC cluster, provided that the first consonant is not a glottal and the second is not a fricative (Michelson 1989: 41–43). This process applies normally in the examples in (15a–d); however, it does not apply to the /k + kw/ (or /k + p/) sequence in (15e).

- (15) Epenthesis in C + CC clusters (Michelson 1981b: 315, 320, 327; 1989: 42)
- | | | | |
|----|--------------------|--------------|--------------------|
| a. | /wak + njak + s/ | [wakenjaks] | ‘I get married’ |
| b. | /hs + theʔt + haʔ/ | [sethê:thaʔ] | ‘you are pounding’ |
| c. | /ak + tshe + ʔ/ | [aketsheʔ] | ‘my jar’ |
| d. | /k + ʔnikhu + s/ | [keʔnikhus] | ‘I sew’ |
| e. | /k + kwit + haʔ/ | [kkwithaʔ] | ‘I move it’ |

Finally, Postal’s (1968) other evidence for /p/ is unaffected by Kiparsky’s (1973) reinterpretation of the epenthesis facts; for example, the asymmetry in open-syllable lengthening illustrated in (16) has no obvious explanation in terms of derived-environment effects.

- (16) Repeated from (11)
- | | | | |
|----|-----------------|------------------------|---------------|
| a. | /hra + ko + as/ | [^l rakwas] | ‘he picks it’ |
| b. | /hra + upeh/ | [^l rukweh] | ‘man’ |

Michelson (1981b, 1989) attributes the behaviour of /kw/ to syllable structure: unlike most other clusters, but in common with /ts/, /kw/ can be parsed into a complex onset. However, it is not clear why /kw/ should differ from other clusters, and in particular from other stop–glide clusters, in this way.

5. Another interpretation

Postal’s (1968) evidence that /p/ is a single segment is compelling. There is, however, rather less reason to believe that this segment is specifically /p/. Postal’s primary reason for characterizing it thus is that this makes it easier, in his feature system, to state the generalization that /p/ and /w/ cannot immediately precede a tautomorphemic round vowel, while /k/ and /j/ cannot immediately precede a tautomorphemic /i/ (Postal 1968: 176, 251). This pattern, however, would follow just as naturally from the assumption that surface [kw] corresponds to underlying /kw/.

The analysis of [kw] as /p/ also raises a question about how Mohawk responded to contact with French. If the native consonant inventory already included a phoneme /p/ that surfaces as [kw], then how was it possible for Mohawk to acquire from French another /p/ that surfaces faithfully?

Finally, it is worth bearing in mind that it is somewhat imprecise—or rather, misleadingly overprecise—to say that Postal’s underlying segment is /p/.

Postal does not assume full specification underlyingly; rather, features are assigned to phonemes on the basis of a contrastive hierarchy, as in (10).⁶ The symbol /p/ is ultimately only a convenient abbreviation for the feature matrix in (17). It is a labial obstruent, but beyond that, its properties are unspecified.

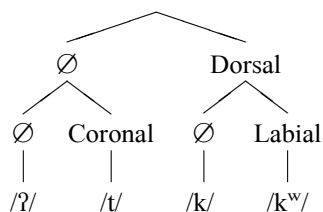
(17) Features of /p/ according to Postal (1964: 277)

$$\begin{bmatrix} +\text{consonantal} \\ -\text{sonorant} \\ +\text{grave} \\ -\text{compact} \end{bmatrix}$$

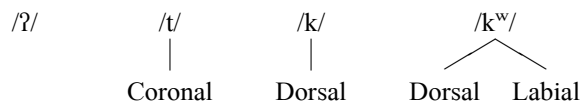
5.1 [kw] qua /k^w/

Suppose instead that we maintain contrastive specification, but say that the segment is something like /k^w/ underlyingly—monosegmental and labial, but also velar. This is entirely consistent with the idea that it splits into a [kw] sequence.⁷ An appropriate set of representations can be generated if the Mohawk stop inventory is divided by monovalent place features as in (18).⁸

(18) a. Dividing the Mohawk stop inventory



b. The resulting feature specifications



Given these native representations, it would be fairly easy for Mohawk to create new segments specified with only Labial place (a subset of the specifications of /k^w/). Thus Mohawk could import /p/ from French without needing to

⁶ This method of contrastive feature specification follows Cherry, Halle, and Jakobson (1953) and Halle (1959), and anticipates Dresher, Piggott, and Rice (1994), Dresher (2009), and Hall (2007).

⁷ If indeed it does split; Hopkins (1987) actually shows /k^w/ in some transcriptions, though without addressing the question of Postal's /p/; for example, she transcribes 'man' as /rú:k^weʔ/ (Hopkins 1987: 446; cf. (16b)).

⁸ The representations in (18b) do not necessarily identify /k^w/ in a way that would distinguish it from a labial-velar double articulation /k^ɸ/ or a velarized labial /p^ɸ/. In the absence of evidence that such a distinction needs to be made in Mohawk, I make no assumptions about the organization of features within segments, but transcribe the segment as /k^w/ for the sake of transparency, /k^w/ being the monosegmental representation that most closely approximates its surface form.

use any new features, but the imported /p/ could still be featurally distinct from the segment that surfaces as [kw].

Some questions remain about the patterns of loanword adaptation in (8) and (9). In (8), the French consonants /p/ and /f/ appear to have been adopted as /k/ rather than as /k^w/; why was the native [Dorsal, Labial] obstruent not preferred over the plain [Dorsal] one as a correspondent for these foreign labials? A definitive answer to this question depends on a more complete understanding of the mechanisms of loanword adaptation in general.⁹ One possible explanation is formal: the mismatch in featural complexity involved in mapping a [Labial] segment to a [Dorsal, Labial] one may somehow have been a greater impediment than the mismatch in featural identity involved in mapping [Labial] to [Dorsal]. Another possible explanation is phonetic: the surface realization of /k^w/ as [kw] may have made it a worse phonetic match for /p/ and /f/ than the single obstruent /k/.

It is also interesting that French /b/ was initially mapped to Mohawk /w/, but later to the new phoneme /p/. This suggests that the contrastive voicing of /b/ was salient enough to cause it to be realized as a sonorant, but that once Mohawk had adopted a /p/ (which included an allophone [b]), this new segment became the better match for French /b/.

5.2 Implications

The system in (18) conforms to the Jakobsonian generalization that all consonant inventories have contrastively labial segments. It is still typologically unusual, though, in that the contrast between labial and non-labial is restricted in scope to the velar consonants. It is perhaps also surprising, from the point of view of formal markedness, that the inventory includes a complex [Dorsal, Labial] segment without also having a simple [Labial] segment. This situation has an analogue in vowel place systems, however; D'Arcy (2004), using the feature system of Rice (1995, 2002), describes several cases in which front rounded vowels are specified as [Coronal, Peripheral], back rounded vowels are specified as [Peripheral], and front unrounded vowels are unmarked for place. The absence in such systems of a vowel specified only as [Coronal] is analogous to the absence of a consonant specified only as [Labial] in the native Mohawk inventory.

The presence of a secondary articulation with such a narrow contrastive scope is also unexpected from the point of view of Feature Economy (Clements 2003, *inter alia*). Feature Economy predicts that in general, languages prefer to cross-classify contrasts as much as possible; thus an inventory that includes /k/, /k^w/, and /t/ might be expected to have /t^w/ as well, and perhaps also other labialized consonants.

⁹ It is also worth noting that of the three relevant examples in (8), two have potential confounds. In (8f), *Paul* /kol/ would presumably be subject to the Mohawk phonotactic restriction prohibiting /w/ or /k^w/ before rounded vowels. In (8g), the /k/ of /kel/ may be taken to correspond to the /pj/ of French *Pierre* rather than to the /p/ alone.



a. Tlingit woman with labret (Jakobson [1941] 1968: 48) b. Labret in a mask (Emmons 1991: 246)

Figure 1: Extralinguistic reasons for the replacement of labials in Tlingit

On the other hand, there are several other languages in which secondary labialization appears to be contrastive only on dorsal consonants; one prominent example is Cantonese (Zee 1999). The Mohawk consonant system as analyzed in (18) is also strikingly similar to that of the Caddoan language Wichita, which also has /k^w/ and lacks /p/, /b/, and /m/:

- (19) Consonant inventory of Wichita (Rood 1975: 316)
- | | | | |
|----|---|----------------|---|
| t | k | k ^w | ʔ |
| ts | | | |
| s | | h | |
| r | | | |
| | j | w | |

The Mohawk and Wichita consonant systems are also reminiscent of Jakobson's remarks about what happens to distinctive labial place when some external factor intervenes to prevent bilabial occlusion. Jakobson ([1941] 1968: 48) writes of Tlingit, whose speakers traditionally wore "a large and heavy labret" like the ones in Figure 1, that

[e]ven in these cases the labial series finds a characteristic substitute in velar consonants with an accompanying *u*-sound: in this way, e.g., *yāk* ('shell fish') and *yāk^w* ('canoe') are distinguished.

The analysis of Mohawk presented in (18) conforms to Jakobson's typological prediction, but only if that prediction is stated in a purely formal way. That is, it is consistent with the hypothesis that all consonant systems use the feature [Labial] contrastively, but it would not be consistent with the more concretely phonetic prediction that all languages have consonants whose primary place of articulation is either bilabial or labiodental. It also does nothing to satisfy the expectations of Dispersion Theory, which predicts the existence of labials because

such major place contrasts are phonetically robust; from this perspective, it is still quite mysterious why Mohawk contrasts /k/ with /k^w/ rather than with the more distant /p/.

If the representations proposed here are on the right track, then Mohawk does indeed use labial place contrastively in its consonant system, but it is typologically unusual in that the scope of the contrast is unusually narrow. The analysis thus captures the intuition that Mohawk is in some sense an unlikely language but by no means an impossible one, and it also offers some insight into why the language was receptive to labial consonants adopted from French.

References

- Baker, Mark C. 1996. *The Polysynthesis Parameter*. Oxford: Oxford University Press.
- Beers, Mieke. 1995. The phonology of normally developing and language-impaired children. Doctoral dissertation, Universiteit van Amsterdam.
- Bonvillain, Nancy. 1973. *A Grammar of Akwesasne Mohawk*, vol. 8 of *Mercury Series, Ethnology Division*. Ottawa: National Museum of Man.
- Bonvillain, Nancy. 1978. Linguistic change in Akwesasne Mohawk: French and English influences. *International Journal of American Linguistics* 44:31–39.
- Bonvillain, Nancy. 1984. Mohawk dialects: Akwesasne, Caughnawaga, Oka. In *Extending the Rafters: Interdisciplinary Approaches to Iroquoian Studies*, eds. Michael K. Foster, Jack Campisi, and Marianne Mithun, chap. 18, 313–324. Albany: SUNY Press.
- Calabrese, Andrea. 1995. A constraint-based theory of phonological markedness and simplification procedures. *Linguistic Inquiry* 26:373–463.
- Chafe, Wallace L. 1964. Another look at Siouan and Iroquoian. *American Anthropologist* 66:852–862.
- Cherry, E. Colin, Morris Halle, and Roman Jakobson. 1953. Toward the logical description of languages in their phonemic aspect. *Language* 29:34–46.
- Clements, G. N. 2003. Feature economy in sound systems. *Phonology* 20:287–333.
- D’Arcy, Alex. 2004. Unconditional neutrality: Vowel harmony in a two-place model. *Toronto Working Papers in Linguistics* 23:1–46.
- Dresher, B. Elan. 2009. *The Contrastive Hierarchy in Phonology*, vol. 121 of *Cambridge Studies in Linguistics*. Cambridge: Cambridge University Press.
- Dresher, B. Elan, Glyne L. Piggott, and Keren D. Rice. 1994. Contrast in phonology: Overview. *Toronto Working Papers in Linguistics* 13:iii–xvii.
- Emmons, George Thornton. 1991. *The Tlingit Indians*. Seattle: University of Washington Press.
- Flemming, Edward. 1995. Auditory features in phonology. Doctoral dissertation, University of California, Los Angeles.
- Flemming, Edward. 2002. *Auditory Representations in Phonology*. London: Routledge. Revised version of Flemming (1995).
- Flemming, Edward. 2004. Contrast and perceptual distinctiveness. In *Phonetically-Based Phonology*, eds. Bruce Hayes, Robert Kirchner, and Donca Steriade, chap. 8, 232–276. Cambridge: Cambridge University Press.

- Gnanadesikan, Amalia. 2004. Markedness and faithfulness constraints in child phonology. In *Constraints in Phonological Acquisition*, eds. René Kager, Joe Pater, and Wim Zonneveld, chap. 3. Cambridge: Cambridge University Press.
- Hall, Daniel Currie. 2007. The role and representation of contrast in phonological theory. Doctoral dissertation, University of Toronto.
- Halle, Morris. 1959. *The Sound Pattern of Russian: A Linguistic and Acoustical Investigation*. The Hague: Mouton.
- Herd, Jonathon. 2005. Loanword adaptation and the evaluation of similarity. *Toronto Working Papers in Linguistics* 24:65–116.
- Hopkins, Alice W. 1987. Vowel dominance in Mohawk. *International Journal of American Linguistics* 53:445–459.
- Jakobson, Roman. 1941. *Kindersprache, Aphasie und allgemeine Lautgesetze*. Språkvetenskapliga Sällskapet i Uppsala Förhandlingar. Uppsala: Uppsala Universitetet.
- Jakobson, Roman. [1941] 1968. *Child Language, Aphasia and Phonological Universals*. The Hague: Mouton. Translated by Allan R. Keiler from Jakobson (1941).
- Jakobson, Roman, Gunnar Fant, and Morris Halle. 1952. Preliminaries to speech analysis. Tech. Rep. 13, MIT Acoustics Laboratory.
- Kiparsky, Paul. 1973. Abstractness, opacity, and global rules. Presented at the Indiana University Conference on Rule Ordering, April 1973. Distributed by IULC.
- Kirchner, Robert. 1997. Contrastiveness and faithfulness. *Phonology* 14:83–111.
- de Lacy, Paul V. 2002. The formal expression of markedness. Doctoral dissertation, University of Massachusetts, Amherst.
- Levelt, Claartje, and Marc van Oostendorp. 2007. Feature co-occurrence constraints in L1 acquisition. In *Linguistics in the Netherlands 2007*, eds. Bettelou Los, and Marjo van Koppen, 162–172. Amsterdam: John Benjamins.
- Liljencrants, Johan, and Björn Lindblom. 1972. Numerical simulation of vowel quality systems: The role of perceptual contrast. *Language* 48:839–862.
- Michelson, Karin. 1981a. A philological investigation into seventeenth-century Mohawk. *International Journal of American Linguistics* 47:91–102.
- Michelson, Karin. 1981b. Stress, epenthesis and syllable structure in Mohawk. In *Harvard Studies in Phonology*, ed. G. N. Clements, vol. 2, 311–352. Bloomington: Indiana University Linguistics Club.
- Michelson, Karin. 1989. Invisibility: Vowels without a timing slot in Mohawk. In *Theoretical Perspectives on Native American Languages*, eds. Donna B. Gerdtts, and Karin Michelson, 38–69. Albany: SUNY Press.
- Ní Chiosáin, Máire, and Jaye Padgett. 2001. Markedness, segment realization, and locality in spreading. In *Segmental Phonology in Optimality Theory*, ed. Linda Lombardi, 118–156. Cambridge: Cambridge University Press.
- Padgett, Jaye. 2003. Contrast and post-velar fronting in Russian. *Natural Language & Linguistic Theory* 21:39–87.
- Postal, Paul M. 1964. Boas and the development of phonology: Comments based on Iroquoian. *International Journal of American Linguistics* 30:269–280.
- Postal, Paul M. 1968. *Aspects of Phonological Theory*. New York: Harper and Row.
- Prince, Alan. 2002. Arguing optimality. In *University of Massachusetts Occasional Papers in Linguistics 26: Papers in Optimality Theory II*, eds. Angela C. Carpenter, Andries W. Coetzee, and Paul V. de Lacy, 269–304. Amherst, Mass.: GLSA.

- Rice, Keren D. 1995. On vowel place features. *Toronto Working Papers in Linguistics* 14:73–116.
- Rice, Keren D. 2002. Vowel place contrasts. In *Language Universals and Variation*, eds. Mengistu Amberber, and Peter Collins, chap. 10, 239–270. Westport, CT: Praeger.
- Rice, Keren D. 2007. Markedness in phonology. In *The Cambridge Handbook of Phonology*, ed. Paul V. de Lacy, 79–97. Cambridge: Cambridge University Press.
- Rood, David S. 1975. The implications of Wichita phonology. *Language* 51:315–337.
- Sanders, Robert Nathaniel. 2003. Opacity and sound change in the Polish lexicon. Doctoral dissertation, University of California, Santa Cruz.
- Schütz, Albert J. 1995. *The Voices of Eden: A History of Hawaiian Language Studies*. Honolulu: University of Hawai'i Press.
- Stampe, David. 1979. *A Dissertation on Natural Phonology*. Outstanding Dissertations in Linguistics. New York: Garland.
- Zee, Eric. 1999. Chinese (Hong Kong Cantonese). In *Handbook of the International Phonetic Association: A Guide to the Use of the International Phonetic Alphabet*, 58–60. Cambridge: Cambridge University Press.