Southern Bantu vs. the world: The case of palatalization of labials

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Introduction.

Applying typological data to the analysis of particular languages is not new nor is the general principle behind it: the inductive method. Having observed a particular pattern in many languages, positing it in yet another language (given appropriate circumstances) is not wholly unjustified. The purpose of this paper is to demonstrate that one can do a much better job of linguistic analysis if one uses a combination of the inductive and deductive methods, i.e., if one's expectation of a pattern is determined not only by the fact that it has been encountered previously but also because one knows the underlying principles which give rise to it. To illustrate this, I will examine the so-called palatalization of labials, i.e., the shift in place of articulation of palatalized labials or labials followed by a palatal (off-) glide to dentals, alveolars, or palatals (henceforth, for ease of reference, simply 'dentals').

The inductive approach.

A survey of the phonologies of many languages around the world turns up quite a few independent cases of the type of sound pattern exemplified in (1).

(1) [pj, pʲ] → [t, ts, tʃ]
[bj, bʲ] → [d, dz, dʒ]
[mj, mʲ] → [n, ɲ]
etc.

(Occasionally, but not necessarily, intermediate stages may be found, e.g., [ptʃ], [bdʒ], [mn].) Some examples of this pattern are listed in (2) through (10).[1]

(2) Czech (data from Bělič 1966 and Andersen 1973).

Standard Czech	East Bohemian	English gloss
[mʲɛstɔ]	[nɛstɔ]	'town'
[pʲɛt]	[tɛt]	'five'
[pʲi:vɔ]	[ti:vɔ]	'beer'
[pʲɛknʲɛ]	[tɛknʲɛ]	'nicely'

(3) Tai (data from Li 1977).

Siamese	Lungchow	T'ien-chow	English gloss
plaa	pjaa	čaa	'fish'
plau (plaaw)+	pjau	čuu	'empty'
phaai (phaj)+	phjaai	čaai	'to walk'

(+ Accepted current phonemic transcription in Thai.)

Evidently the post-consonantal /l/ changed to /j/ first, then /p (h) j/ changed to the palatal affricate. This same pattern of development is also attested in the Romance languages; see (5), (6) below.

(4) Tibetan (data from Thomas 1948, Benedict 1972, and Chang and Chang 1975).

Old Tibetan	Tzu-ta	Wassu	Mi-li		English gloss
mig~myig	temma	temniak	nie +		'eye'
byi-ru	ptsyeru				'coral'
	Gyarong	Lha-sa	Lolopho	Ahi	
bya	pyē-pyē	ca [tʃa]	byo	do	'bird'
byi-ba		ci-wa [tʃiwa]			'rat'

(+ If Thomas' 'Mi-li' refers to the Tibetan language known as 'Muli', then this word should rather be given as /nöö/ (Nagano 1957).)

(5) Spanish and Portuguese (data from Malkiel 1963).

Latin	Spanish	English gloss
amplu	ancho	'large, spacious'
	Old Spanish	
implēre	(f)enchir	'to fill'
	Portuguese	
plōrāre	chorar	'to weep'
flamma	chama	'flame'
plānu	chão	'floor; level'
plumbu	chumbo	'lead (metal)'

Other data provide evidence for the following separate stages of development of the Latin pl- cluster in these languages: pl-> pj-> tʃ- >ʃ-.

(6) Italian (data from Jaberg and Jud 1928-1940; transcription simplified).

Roman dialect	Genoese and neighboring dialects	English gloss
[pjeno]	[tʃena]	'full'
[pjanta]	[tʃanta]	'to plant'
[er fjato]	[uʃa]	'breath'
[bjanko]	[dʒanku]	'white'

(7) French

Latin	French	English gloss
sapius	sage [saʒ]	'wise'
rubeus	rouge [ʁuʒ]	'red'
rabies	rage [ʁaʒ]	'rabid'
cavea	cage [kaʒ]	'cave'
Proto-Germanic		
laubja	loge [loʒ]+	'arbor'; 'small house'

(+ Cf. English 'lobby' and 'lodge', the first having a Germanic origin, the second French.)

(8) Bantu (data from Guthrie 1967-1970).

Proto-Bantu	Tonga	Xhosa, Zulu		English gloss
*pia	phya	-tʃha		'new'
	Kaonde	**Sena**	**S. Sotho**	
*biad	-βyal-	-bzaɽ	dʒal	'plant'
	Venda			
*piu	tswhu			'knife'

(9) Classical Greek (data from Meillet and Vendryes 1924).

Pre-Classical Greek	Classical Greek	English gloss
*g^wam-yo	βαίνω (cf. Latin venio)	'I come'
*kom-yo- (cf. Latin cum)	κοινός	'common'
*χαλεπ-yω	χαλέπτω	'provoke'
*θαφ-yω	θάπτω	'bury'

(10) Gwari (No. Nigeria) (data from Hyman and Magaji 1970).

Kuta	Ganagana	Nupe	English gloss
byè	dywè	dzò	'sow'
byì	dywī	dzū	'bury'
ōpyá	ēpʃā	ētswā	'moon'

The deductive approach.

To understand why such changes occur, it is instructive to examine the spectrographic pattern of palatalized labials and compare this with the patterns of plain labials and dentals. Figure 1 shows tracings of spectrograms (the originals published by Fant 1960) of the Russian CV syllables [ba], [bʲa], and [da]. In examining this figure it is necessary to keep in mind the fact that place of articulation cues reside in the second formant (F2) transitions and in the noise bursts. That being the case, it is of interest to see in the figure that the F2 transition for the palatalized labial is more similar to that for the dental than it is to that for the plain labial.[2] Undoubtedly in this instance the noise burst from the release of the stop is a sufficient cue to the labiality of the palatalized labial in spite of the dental-like F2 transition. If a listener were to miss the noise burst cue, however, the consonant would very likely be taken for a dental. Moreover, the impression that such stops were dentals or palatals would be reinforced by any fricative noise generated from the rush of air through the narrow palatal constriction. A sound mistaken for a dental or palatal is likely to be repeated as such. Thus a sound change could occur.

But why should the palatal constriction, a secondary articulation, have a greater influence on the consonantal F2, than the labial constriction, the primary articulation? The beginnings of an answer to this question can be seen in the nomogram in Figure 2 (again, from Fant 1960). The nomogram shows the formant frequencies that would be produced as one varies both the position of the constrictions in the vocal tract and the accompanying lip opening. As can be seen, although the F2 frequency is generally susceptible to change due to both variations in place of constriction and variations in lip opening, its frequency due to a constriction in the palatal region (see arrow) is largely independent of the lip opening. A palatal constriction, even though a secondary articulation, will be the primary determinant of the F2 frequency and will produce a frequency much like that of a dental consonant.

In the case of nasal consonants, there are related but slightly different reasons why the nasal murmur of a palatalized [m] or an [m] coarticulated with the palatal vowel [i], would be acoustically similar to an [n] or [ɲ] (Ohala 1975).

The acoustic similarity of palatalized labials (or labials followed by or coarticulated with palatal vowels) and dentals is

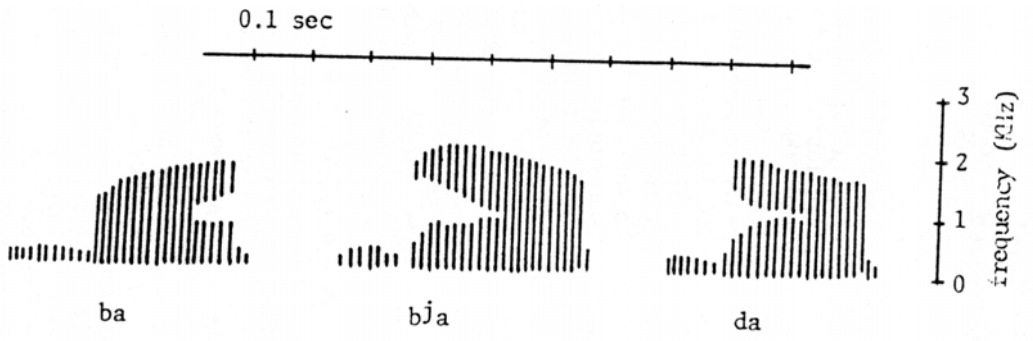


Figure 1. Tracings of spectrographic patterns for the Russian syllables [ba], [bʲa], and [da] (from Fant 1960).

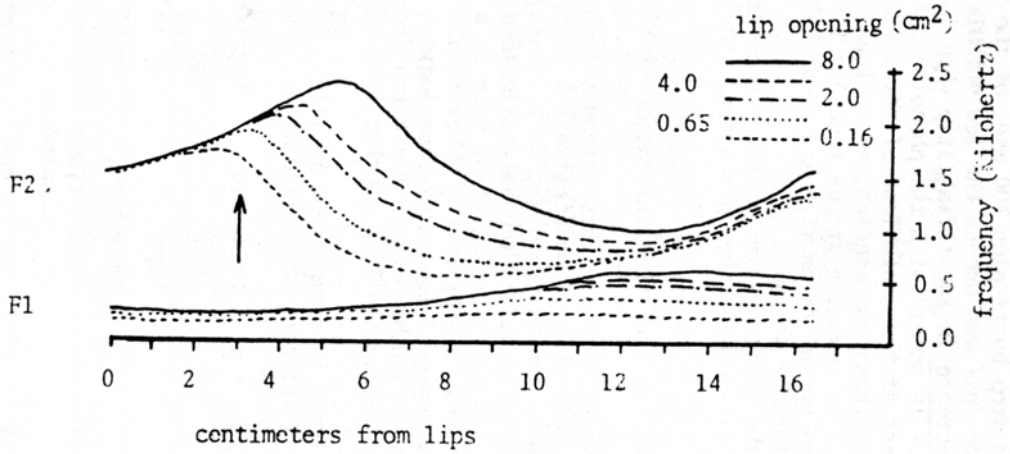


Figure 2. A nomogram (from Fant 1960) showing the frequencies of the first two formants (F1 and F2) that would result from constrictions in various places in the vocal tract (horizontal axis) and from variations in the lip aperture (the parameter). The arrow marks the approximate position of a palatal constriction.

also suggested by the results of various speech perception studies. Lyublinskaya (1966) in studying the confusability of VC transitions (i.e., where there were no bursts to aid identification of the consonant) found palatalized labials were up to 30% more likely to be confused with dentals than were plain labials. Winitz, Scheib, and Reeds (1972) published confusion matrices of CV sequences (where C = p, t, k, and V = i, a, u,) obtained under two conditions: stop burst only and stop burst plus 100 msec of the following vowel. The sequence /pi/ was one of the few stimuli that showed a relatively large decrease in identifiability when 100 msec of vowel was included. In accord with the phonological evidence presented above, most of the confusions of this syllable were with the syllable /ti/. (These two studies, as well as that of Wang and Fillmore 1961, also reveal a strong tendency for labials preceded or followed by /u/ to be misheard as dentals. This effect will be discussed further below.)

In addition, the auditory similarity of the syllables [mi] and [ni] has been revealed in other perceptual studies by House (1957), and Gay (1970).

Analysis of the Southern Bantu Palatalization of labials.

We can now attempt to apply this information to an analysis of some rather unusual cases of palatalization of labials in several Southern Bantu languages, e.g., Zulu, Xhosa, Tswana, Sotho, Venda, Pedi. In these languages the palatalization of labials (and some non-labials) plays an important role in a number of morphological processes, all of which, however, are manifested in about three or four types of (surface) phonological environments. (The data to follow on Southern Bantu are taken from Doke 1926, Meinhof and Warmelo 1932, Cole 1955, Tucker 1929, Jacottet 1927, Guthrie 1967-1970).

One of these types is exemplified in (11). Addition of the causative suffix -ya triggers palatalization. Although we might

(11)

Sotho	verb stem + a	causative	English gloss of stem
	ɛta	etsa	'go'
	kɛna	keɲa	'go in'
but:	ɬapa	ɬatswa	'wash'
Tswana	-tlhaleɸa	-tlhaletʃhwa or -tlhaletsha	'become wise'
	-nat'eɸa	-nat'etʃhwa or -nat'etsha	'become pleasant'

wonder a bit as to where the w came from in the derived forms of the last three verb stems (a point that will be addressed later)[3], this seems to be a normal development; it parallels the kind of change we have seen before in many other languages.

Another environment for palatalization is that exemplified in (12) viz., addition of the diminutive suffix -ana. This is a

(12) Diminutive formation of nouns by suffixation of -ana.

Sotho	Noun stem	Diminutive	English gloss of noun stem
	lebese	lebesana	'milk'
but:	moriɸi	morits^{h}wana	'saucer'
Zulu	u:pha:phɛ	u:phaʃa:na	'feather'
	u:ʃu:bu	u:ʃudʒa:na	'meal-water'
	iŋk'a:bi	iŋk'atʃ'a:na	'ox'
Tswana	tl^{h}ap'i	tl^{h}atʃ'wana (dial. tl^{h}ap'ʃana)	'fish'

very unnatural and unexpected environment for this process--given what we have reviewed above. There is no apparent reason why the vowel /a/ or any other phonetic property of the suffix /ana/ should lead to palatalization.

Finally,[4] the most unexpected case of palatalization of labials is that triggered by the addition of the passive suffix -wa to verb stems. Examples are given in (13). Not only should a

(13) Passive formation by suffixation of -wa.

Sotho	Verb stem + a	Passive	English gloss of verb stem
	lesa	leswa	'leave'
	rɛka	rɛkwa	'bury'
but:	bɔɸa	boʃwa	'tie on back'
	tseba	tseɣwa	'know'
	thopa	thotʃwa	'capture'
	ɬɔpha	ɬotʃwha	'heap up'

following /w/ not cause palatalization of labials, it is the one segment most likely to reinforce the labiality of labials.

A digression on [w].

It might be asked how I can justify that last statement given the evidence mentioned above that in at least 3 perceptual studies labials in the environment of the vowel /u/ were often misheard as dentals. The justification is that /u/, although phonetically close to /w/, differs in the important respect that, unlike /w/, in the environment of a labial it need not have a rapid change in formant frequency. Lyublinskaya presents evidence that one of the cues

for place of articulation of a consonant is direction of F2 transition; presumably a negative (downward) transition for labials and a lack of transition for dentals. Thus the lack of strong F2 transitions between /u/ and a labial could lead to the consonant being taken for dental. Since /w/ necessarily has rapid formant transitions this factor should not apply. There is, moreover, phonological evidence that /w/ should enhance the labiality of labials.[5]

A labial (velar) glide (sometimes < u + V) adjacent to non-labial obstruents generally precipitates a shift to the labial place of articulation (if it leads to any change at all). Examples of this are not uncommon; (14) and (15) provide a few of many cases that could be cited.

(14) Classical Greek (data from Meillet and Vendryes 1924, Meillet 1964).[6]

PIE root	Latin	Greek	English gloss
*yḗkʷr̥	iecur	ἧπαρ	'liver'
*ekwos	equus	ἵππος	'horse'
	Sanskrit		
*gʷiwos	gayaḥ	βίος	'life'

(Cf. also, βαίνω in (9) above.)

(15) Gujarati (data from Turner 1921).

Middle Indic	Gujarati	English gloss
dvāra	bār	'door'
dvē	bɛ̄	'two'
-tvana	-pan	(suffix)

References to further such data can be found in Ohala and Lorentz (1977) and Ohala (forthcoming). These same sources as well as Durand (1956) discuss some of the auditory-acoustic reasons for these sound patterns.

Such data would lead us to expect [w] to reinforce the labiality of labials since it has the power to cause non-labials to become labials.

Previous analyses.

There is a fairly extensive literature on these Southern Bantu languages and I have not had access to most of it. Nevertheless, if there has been any analysis which succeeds in pulling all instances of palatalization together under one rule, it has not found its way into the standard reference works on Bantu. Meinhof and Warmelo (1932) and even Guthrie (1967-1970), for

example, two major contributors to the reconstruction of Proto-Bantu, simply list for these Southern Bantu languages (what amounts to) sound changes of the type *p → t / _ j, w; they apparently saw nothing unusual in the presence of the w in the environment. Meinhof does offer an explanation for the w or labialization that often remains after the palatalization of labials occurs:

> A very peculiar process is that by which sounds to some extent exchange their quality, each giving up some of its own and assuming those of the other. Thus in Sotho ʃya becomes swa. The first sound, ʃ, is a voiceless labial fricative, the second y is a lingual (or more accurately palatal) semi-vowel. The first sound becomes s, i.e. a lingual (strictly an alveolar) voiceless fricative, the second becomes w, i.e. a labial semivowel [16].

However, he seems not to have applied this analysis to cases such as, e.g., Sotho bɔΦa + wa > boʃwa, where there is no surface y to account for the ʃ.

Doke (1926:139ff) attributed palatalization in the passive to the process of dissimilation since, as it happens, most of these Southern Bantu languages do not have (or permit?) sequences of labial + w. In order to avoid this supposedly forbidden sequence (which would result upon addition of the passive suffix -wa to a stem ending in a labial) speakers, he reasoned, must have shifted the labials to dentals.

In 1970 Talmy Givon and Erhard Voeltz recognized the need to unify all the various instances of palatalization in Southern Bantu under one process triggered by a palatal glide. They found evidence for the 'missing' palatal glides in all the relevant cases of palatalization. They incorporated their views and evidence in various lectures (T. Givon, personal communication).

Stahlke (1976) in arguing for the notion of 'segmental fusion' (essentially that expressed by Meinhof in the above quote[7]), cited Tswana data such as that in (11) and (12) and presented evidence that the causative, passive, and diminutive formations could all be accounted for by one basic rule which involved exchange of features between the labial consonant and a following (sometimes reconstructed) palatal segment.

Herbert (1977) took issue with Stahlke's analysis and rather argued that these cases were morphologically not phonologically conditioned (that is, not phonetically based). His arguments were based primarily on three points: a) that the alternations observed are phonetically unnatural, b) that they applied only in certain morphologically, not phonologically-defined environments, and c) that they show many exceptions and much free variation.

In what follows I propose to provide additional evidence for the Givon-Voeltz-Stahlke analysis. I do not dispute Herbert's claim that these alternations are now activated by specific

morphological environments (e.g., diminutive, passive formations) not by phonetic environments. But this is in no way contradictory to the claim that they all had a common phonetically natural origin.

I have already presented evidence for the phonetic naturalness of labials shifting to dentals when followed by palatal glides. What is necessary, then, is to assemble the evidence that palatal glides can be found in earlier stages of the passive and diminutive suffixes.

The history of the passive.

As was pointed out by Stahlke the passive suffix in Tswana has two forms: -wa and -iwa. One can make the case that there was once only one, -iwa. Prosodic factors presumably contributed to the creation of two forms. Zulu, Tswana and Venda for example, use the -iwa form primarily with monosyllabic verb stems but -wa with most polysyllabic stems. We can guess that the -iw coalesced in the latter case, perhaps to [j], perhaps to [ɥ]. Indeed, with simultaneous labialization there is not much difference between these two. As Tucker points out, the labialization of consonants, although indicated in conventional phonetic transcriptions as a w after the sound, is in fact more a prosody of labialization that persists through the segment. If we indicate this prosody as a superscripted line above the consonant, as is done in the Firthian Prosodic tradition, it is easier to see why [j͡ʷ] is equivalent to [ɥ]. Pedi probably still shows some remnants of this early development; see (16).

(16) -rɛka + wa > -rɛkwa 'buy'
-ripa + wa > -ripɥa 'cut'

Assuming that all labial consonants are intrinsically labialized in these languages (which explains why labials cannot support distinctive, i.e., extrinsic, labialization[8]), we may speculate that the two passive forms originated more or less in the sequence indicated in (17).

(17) [rɛkiwa] [ripi͡ʷwa] ≡ [ripywa]
↓ [ripyɥa] via glide assimilation
[rɛkwa] [ripɥa] via vowel deletion

(On this point one wonders what use to make of the comment by Jacottet (1927:110) that an older, rarer form of the Sotho passive suffix exists: -uwa, and that it is used mainly after labials? It could validate the claim that labials tend to round the following vowel--especially when it is assisted in this by the -w- --but unfortunately it does not prove that the resulting rounded vowel would be [y].)

Another possible route for the development of a palatal glide after labials is suggested by the passive forms in Venda given in (18) (from Ziervogel and Dau 1961:37).

(18) -bɛba + wa > -bɛbɣwa ≡ [bɛbɣ͡ʷa] ~ -bɛbja 'bear'

The [ɣw] is described as having very little frication.

Since the listeners would expect inherent labialization after the labial b, they may have ignored (i.e., treated as redundant or non-distinctive) the labial part of the following labial velar glide w. What would remain to be considered distinctive in this glide, then, would be the velar component, [ɣ]. This is quite speculative, of course, and, in any case, does not reveal how [ɣ] could change to [j] in the environment given or, indeed, whether the [j] is from the [ɣ].

The history of the diminutive.

In the case of the diminutive formation, as Stahlke pointed out, there is another common form of the suffix which has a palatal initial, -ɲana, and it is possible to trace this and the -ana form to -ɟana. This morpheme exists in many Bantu languages and means 'child'.

Further evidence for the elided ɟ comes from traces of its influence on non-labials, e.g., in Tswana logoŋ 'piece of wood' + dim. suffix > logoɲana. The change of [ŋ] to [ɲ] is plausible only if we assume a palatal glide in the suffix.

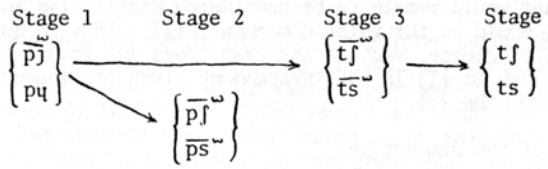
Possible additional evidence for this point comes from the participation of the diminutive suffix in the pattern of vowel harmony in Sotho. In that language it seems that the lower mid vowels shift to higher mid vowels when followed in the next syllable by a high vowel (either i or u) or--and this is the curious part--by labialized consonants formed by passivization or diminutivization, e.g., selɛpɛ 'axe' + dim. > seletswana (transcription simplified). If we can be sure that simple labialization itself doesn't effect vowel harmony (the evidence isn't very clear on this point, but it seems not to) and if we can trust Tucker's transcription of the Sotho vowels (Cole 1955:xxvii, warns us not to) it would seem that the shift of [ɛ] to [e] in the above example could be attributed to the once-present palatal segment.

The source of the w.

Returning to the question raised earlier, 'where did the w or labialization come from after the palatalization had shifted the labial to a dental?', we can agree with Meinhof and Stahlke that it came from the original labial consonant.[9] From this it follows that the w in the phonetic transcription of passive forms such as tseɣwa has a different source from the w in forms such as rɛkwa. In the former case it comes from the labial in the stem tseba; in the latter

it comes from the passive suffix itself -(i)wa. It is not necessary, though to view the process as entirely one of featural exchange as Meinhof and Stahlke do, at least as far as preservation of the labialization is concerned. It is simpler to assume that labialization spanned the stem-final consonant originally (since, as was mentioned, these labials were probably intrinsically labialized) and it spanned the stem-final consonants after the shift in place of articulation as well. Using the prosodic transcription of labialization, (19) presents a probable scenario for the change, taking up where (17) and (18) left off.

(19)

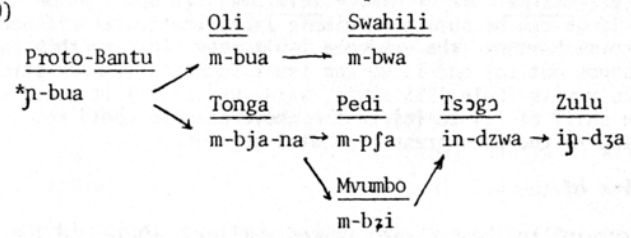


Evidence for Stage 2 comes from, among other things, the passive forms in 'old fashioned' Sotho, e.g., bɔɸa + wa > bɔɸʃwa, as well as some of the variants given above in (12). It should be emphasized that Stage 2 is a possible but not a necessary intermediate stage between Stages 1 and 2. In the perceptual tests reviewed above, subjects' misperceptions, which may be regarded as the stuff sound changes are made from, were abrupt--hearing a p as a t--and did not involve any intermediate stages.

Evidence for the development from Stage 3 to 4, i.e., loss of labialization, was presented earlier (see 11); Cole (1955:43) testifies that among forms showing this variation, those with labialization are older.

Some support for the scheme in (19) comes from the variant reflexes of the Bantu word for 'dog' as given in (20). Here it

(20)



was a palatal nasal noun class prefix ɲ which sometimes exerted a palatalizing influence on the following consonant. The arrows here do not imply direct genetic development but rather that the form near the head of the arrow represents in some sense a further development than the one near the tail.

Conclusion.

Why is it better to combine the inductive and deductive approaches in linguistic analysis? Because they complement each other. In the present case, the inductive approach could tell us that j is a catalyst in the shift of labials to dentals and w helps to shift dentals and velars to labials but it could not tell that in principle it is unlikely that w could also help shift labials to dentals. The deductive approach, in this case reference to the underlying phonetic factors which cause perceptual ambiguity, can tell us which kinds of misperceptions (which might lead to sound changes) are more likely than others. Nevertheless, the deductive approach works perfectly only if our knowledge of the underlying principles of speech production and perception is also perfect. Since this undoubtedly will never be the case, our deductions based on current knowledge may sometimes be erroneous. Only when we find a match between our deductions and inductions can we have some increased confidence that we are on the right track.

Acknowledgements.

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Footnotes.

1 In general, I retain the transcription used by the source of the data. This creates potential problems only when palatal glides are sometimes represented as y and sometimes as j. Given the emphasis of this paper and the context of a particular symbol, no ambiguity should arise. When square brackets surround a word IPA transcriptional conventions are followed, i.e., [j] for a palatal glide, [y] for a high front rounded vowel, [ɥ] for a labial palatal glide.

2 The same high F2 is characteristic of labials adjacent to the palatal vowel [i] (Lehiste and Peterson 1961, Fant 1973, Öhman 1966).

3 Leaving aside, for the moment, where the w came from in these forms, the presence or absence of the labialization in the latter two (the Tswana) cases provides a ready explanation for the alternation between the phonetic quality of the resulting affricates [tʃ hw] and [tsh]. As is well known, the presence of lip rounding effectively lowers the resonant frequencies of

the vocal tract. Thus the sibilant noise generated will have a higher or lower center frequency depending on whether or not there is labialization. From such an initial allophonic difference it is quite plausible to find the development of distinctive [ʃ]-type vs. [s]-type fricative releases to the affricates since the primary difference between these fricatives is in their low vs. high center frequencies. In this regard we can note that the lip rounding accompanying English [ʃ] and [tʃ] may not be entirely coincidental: it helps to keep these sounds as distinct as possible from [s].

4 I pass over three other morphological processes that involve palatalization of labials: the formation of the perfect tense of verbs, the formation of the locative of nouns, and the action of the singular prefix of the 5th noun class li> le (and occasionally some other similar prefixes). In general, the analysis of these cases is less controversial than that of the passive and diminutive and, in some cases, was well understood by Bantuists early on (cf. Tucker 1929:85ff).

5 [m] in the environment of [w] or [u] is liable to shift to [ŋ] but not [n] or [ɲ]. The reasons for this, which are relevant only to nasals, are given by Ohala and Lorentz 1977a, b. In view of this it is interesting to note the varying fate of stem-final [m] when it is subject to the same derivations that palatalize the obstruents. The result seems to hinge in part on whether labialization is retained or not. If it is not, we find only [ɲ]; if it is retained we can find either [ɲ] or [ŋ]. Thus, e.g., Zulu int'a:mɔ 'neck' + dim. > int'aɲa:na, but Sotho lelene 'tongue' + dim. > leleŋwana. One could venture the prediction that [ɲw] sequences are unstable and will shift either to [ɲ] or [ŋw].

6 Before front vowels, however, PIE labial velars generaly become Greek dentals, e.g., cf. Latin que 'and', but Greek τε. See Allen (1957) for an interesting discussion of this exception and of exceptions to the exception.

7 See also Henderson 1975 for similar views.

8 The Southern Bantu languages are in no way unusual in not having distinctively labialized labials or labials followed by w. Even in English, clusters of labial + w exist only by virtue of some rather uncommon loanwords, e.g., bwana. Many other examples could be cited (see Ohala, forthcoming).

9 Muddying the issue somewhat is the fact that some non-labial consonants also show labialization in these derivations. Such cases,however, can be attributed to a stem-final rounded vowel, e.g., Tswana lekoto 'leg' + dim. > lekotwana.

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