OSU Working Papers in Linguistics 53, 71-92

Positional Contrast and Labial-Velars

Michael Cahill
cahill@ling.ohio-state.edu

The labial-velar stops [kp] and [gb] display several distributional patterns cross-linguistically: they almost never occur syllable-, morpheme- or word-finally, and have a strong tendency to occur only morpheme-initially and in roots rather than affixes. They are always released into a sonorant or vowel. In Amele and perhaps other languages, a phonemic labial-velar is manifested as a labial word-finally. Three constraints are proposed, permitting labial-velars to be licensed only before sonorants, morpheme-initially, and in roots. While the first is phonetically-based, the latter two are morphologically-based. Various rankings of these account for the different phenomena of labial-velars in different languages. It is speculated that these constraints may be connected to broader patterns with multiply-articulated consonants.

1. Introduction

Labial-velar consonants, as the term is used in this paper, are those made with approximately simultaneous velar and labial closures. Labial-velar is a more accurate term than the more traditional "labiovelar" (since the term "labio-velar" implies the lip extending to the velum, not an optimal physiological configuration for the normal human vocal tract!), and I will use the term "labial-velar" in this paper. This designation commonly includes the stops /kp/, /gb/, and the nasal /ŋm/. In this paper I also will not discuss [w] or labialized velars [k^w, g^w] under the umbrella of "labial-velar."

Labial-velars are relatively rare in the languages of the world as independent phonemes, occurring in approximately 6% of the 317 languages surveyed in the UCLA Phonetic Segment Inventory Database (UPSID) (Maddieson 1984). Phonemic labial-velars occur exclusively in West/Central Africa and a small region of Papua New Guinea and nearby islands. Labial-velar consonants occur in at least some languages of all of the 10 main subfamilies of Niger-Congo (Bendor-Samuel 1989), and many of the languages of Nilo-Saharan as well. African languages with labial-velars far outnumber the handful of Papuan languages that have them (10 of the Huon Peninsula languages surveyed in

McElhanon 1967 have *kp* and *gb*, and the total number of Papuan languages with labial-velars is probably less than 20, while the number of African languages with labial-velars is in the range of several hundreds.). Since the Papuan languages are relatively rarer, I will note them with (PNG) by the language name.[1]

In this paper, I will examine the distribution of labial-velar stops cross-linguistically. We shall see that phonemic labial-velars never occur as phonetic labial-velars word-finally. They also never seem to occur in affixes. Furthermore, in some languages they are severely restricted to morpheme-initial position. Appropriate positional constraints are proposed to account for these patterns of occurrence, leading to the conclusion that both phonetically-based and morphosyntactically-based constraints are needed to account for this distribution.

2. Cross-linguistic distributional patterns of labial-velars

2.1 Position in word, syllable, and morpheme

In the more than 80 languages for which I have data (see Cahill 1999), phonemic labial-velars always occur word-initially, but never occur word-finally. However, there are two unusual "fringe" cases of *phonetic* labial-velars word-finally that I am aware of. In Vietnamese, [kp] and [ŋm] are allophones of word-final /k/ and /ŋ/ when preceded by back round vowels. (Dick Watson - pc, Liêm 1970:138,141, Smalley 1964:306). Second, Ndyuka, a Creole language of Suriname, has word-final [gb] in ideophones only (Huttar & Huttar 1994). Since the Vietnamese and Ndyuka labial-velars do not contrast with other segments, I will not consider them further in this paper. All languages I am aware of allow labial-velars word-medially, though they are often restricted to morpheme-initial position, as discussed in specific languages below.

Labial-velars are almost never found syllable-finally. Amele (PNG) is the only exception I have found, e.g. [ˈtugb.dɔʔ] 'to butcher' (cf. [ˈtub.dɔʔ] 'to join') (Roberts 1987:346). Even in this language, /gb/ surfaces as [p] word-finally (see Sec. 2.4).

---

[1] A few Caribbean Creole languages also have labial-velars, presumably as a result of an African substratum. In both Saramaccan (Rountree 1972) and Ndyuka (Huttar & Huttar 1994) the labial-velars can be considered allophones of labialized velars (see Cahill 1999 for details).

Amele is also the only language I have found which has a labial-velar in morpheme-final position, with the single segment /gb/ as the first person plural agreement marker on verbs (Roberts 1987).

While there is a clear generalization that languages almost never have labial-velars word- or syllable-, or morpheme-finally, the question of morpheme-internal vs. morpheme-initial position is more involved, and in the next sections we examine specifics of the position of labial-velars within morphemes in several languages.

2.1.1 Adele, Ono, Ibibio, Eggon

In Adele, a Kwa language of Ghana, /kp/ and /gb/ are never found morpheme-medially (Kleiner 1989). In fact, there are only two situations in which labial-velars are found word-internally. The first is in reduplicated forms, such as *gbà-gbà* 'really.' The other situation is in nouns. Nouns generally have a noun class prefix, and following this prefix the noun stem can begin with any consonant of the language, including /kp/ and /gb/: *è-kpènà* 'ghost', *gè-gbá* 'shirt'. There are also cases where nouns themselves include reduplication, e.g., *è-kpá-kpá* 'cockroach'.

With Ono, from Papua New Guinea, we find a similar pattern. The sole labial-velar in this language is /gb/, and it occurs only word-initially with the exception of reduplicated forms (Phinnemore 1985). That is, all cases of labial-velars in Ono are morpheme-initial.

In Ibibio also, Bruce Connell (pc) notes that labial-velars occur only in morpheme-initial position, and that the few cases in which labial-velars occur morpheme-medially are clearly exceptional.

In Eggon, though not mentioned explicitly in the dictionary of Blench & Hepburn (1995)[2], almost all nouns begin with vowels, particularly the non-high vowels *a, e, o*, which evidently are prefixes marking noun classes. Of the approximately 180 words listed which contain labial-velars (this is somewhat inflated since multi-word expressions have separate entries), Eggon has approximately a dozen reduplicated forms, e.g. *gbagbagba* 'swaying,' *gbyingbyin* 'of necessity' but only eight that appear to be

[2] The Eggon dictionary from which information here was taken is in-progress and accessible on the Internet at http://lucy.ukc.ac.uk/dz/alda.data.html.

morpheme-medial, e.g. *asakpa* or *eshekpa* 'entrance hut.' The overwhelming majority of labial-velar stops are found either word-initially in verbs and adverbs, or following the vocalic noun class prefix. In the case of Eggon, labial-velars are almost exclusively morpheme-initial.

While the pattern of restricting labial-velars to morpheme-initial position is clear and definite in these languages, in others the situation has changed historically, as we see below.

2.1.2 Kɔnni and Buli

Kɔnni and Buli form a subgroup of their own in the Oti-Volta branch of Gur (Naden 1988, 1989). These languages are considered together because they shed light on the historical developments relevant to positions of labial-velars. Also very relevant is the practical consideration that I have more data at my disposal for these two languages than for most languages. The Buli data is taken from the dictionary of Kröger (1992), and the Kɔnni data from my own field notes, parts of which appear in Cahill (1992).

Kɔnni freely allows only nasals and /l/ syllable-finally, and only the nasal *ŋ* word-finally. Buli allows a slightly wider range of consonants word-finally, including /k, b/ and /m, n, ŋ/. Labial-velars pattern the same as other consonants in not appearing in these positions. Word-internally, labial-velars appear in many words, including some seemingly monomorphemic ones. As we shall see, it is quite probable that these words were at least historically polymorphemic. We shall examine cases of labial-velars in several situations, beginning with cases of compounds, in which the words in question are clearly bimorphemic:

(1)	Kɔnni compounds		Buli compounds	
a.	haŋ-gbaaŋ (bush-dog)	'leopard'	bí-kpíŋ (child-die)	'orphan'
b.	bitie-gbarɪŋ (jaw-lower?)	'beard'	víá-kpīāk (valley-fowl)	'partridge (sp)
c.	nu-kpaŋ (arm-?)	'thumb'	nán-kpìēŋ (?-big)	'cattle-yard'
d.	na-kpaŋ (leg-?)	'big toe'	sūēŋ-kpārūk (rabbit?-farm)	'mongoose (sp)'

Some elements of the compounds cannot be assigned specific glosses at this point, and perhaps never will (cf. English *cran-* in *cranberry*). However, identification of at least one component can be made for the examples above. Some labial-velars occur not in compound words, but in other words which can be identified as polymorphemic, either with the adjective *-kpɪɪŋ/-kpieŋ* 'big' or in reduplicated forms, as below:

(2)	Kɔnni		Buli	
	productive morpheme break			
a.	lɔlɪŋ-kpɪɪŋ	'high (big) voice'	mogi-kpieŋ	'big lake'
	reduplications			
b.	gbaga-gbaga	'be feverish'	gbáŋ-gbáŋ	'very red'
c.	gbuŋ-gbuŋa	'chicken w/out feathers'	gbīŋ-gbíŋ	'chicken w/out feathers'
d.			gbìtì-gbìtì	'loudly'

There are a number of words in both languages which seem to be monomorphemic, but investigation shows to be at least historically polymorphemic. Some samples of these which we will examine include:

(3)	Kɔnni		Buli	
a.	sɪŋkpááŋ		sùŋkpàām	'groundnut'
	(sìmé 'bean', kpááŋ 'oil')		(sumi 'bean', kpáám 'oil')	
b.	kpìbíŋ		chìkpèbì	'louse'
c.	gɪgbɪŋ	'rib'	gbèìn	'meatless'

The word for 'groundnut' (or 'peanut' in American terminology) is *sìŋkpááŋ* in Kɔnni, *sùŋkpàām* in Buli. Kröger (1992) gives the etymology of *sùŋkpàām* as derived from *sumi* 'bean' and *kpáám* 'oil'. Since peanuts do indeed resemble beans and contain oil, this is a reasonable etymology. (Kröger does not tell us whether his etymologies are based on historical reconstruction, interviews with native Buli speakers, or inspection of likely candidates.) All in all, we can take the case of 'peanut' as being polymorphemic in Kɔnni and Buli as well established, and thus the *kp* is actually morpheme-initial in this word.

'Louse' is *kpìbíŋ* in Kɔnni and *chìkpèbì* in Buli; the difference relevant to our discussion is *chì-* in the Buli form. If the Buli form is taken in isolation, it appears to be a case of *kp* occurring morpheme-internally. However, in the Kɔnni form, the first syllable

chì- has been stripped off, leaving *kp* word-initial, and by hierarchical implication, also morpheme-initial. Most consistent with the thesis being developed for these languages is that *chì-* is a prefix of some sort in Buli, with unknown meaning. Supporting this is the fact that *chì-* occurs with many other words, some of which also have second elements with identifiable meanings, such as *chíchámá* 'doubts', *cham* 'to doubt'. Thus in the historical development, Kɔnni speakers eventually dropped the initial morpheme. An alternative explanation is that Kɔnni deleted the *chì-*, but not by dropping a morpheme *per se*. Rather when *chìkpèbì* was historically re-interpreted as a single morpheme, Kɔnni, not tolerating a morpheme-internal labial-velar, dropped the initial syllable.

With this approach, we can examine other cases of putative intramorphemic labial-velars and see if they, too, might have a reasonable polymorphemic compositional explanation. Such a case is *gɪgbɪŋ* 'rib' in Kɔnni above. The Buli form for 'rib' is *nyípík kōbī*, literally 'chest bone,' bearing no resemblance to the Kɔnni term.

When closely related languages have totally unrelated forms for a term, one distinct possibility (besides borrowing or the less common practice of coining of a totally new word) is that one language has used a compound word or phrase for the item in question. This could be done for metaphoric or euphemistic purposes (Hock & Joseph 1996, Ch. 7), as was evidently done in the general Kɔnni word for 'snake,' *javukiŋ*, literally 'wriggling thing' which bears no resemblance to the Buli *wááb* (Tony Naden, pc). The original proto-Buli-Kɔnni word lives on in Kɔnni in the form *wáákpɪ́ŋ* 'python,' literally 'big snake.'

We see a very good possibility of the same type of process producing Kɔnni *gɪgbɪŋ* 'rib.' The Buli adjective for 'meatless' is *gbèìn*, and of course, ribs do not bear an abundance of meat compared to some bones in an animal. Combining this with a prefix or noun *gɪ-*, then we have *gɪgbèìn* becoming Kɔnni *gɪgbɪŋ* by regular sound changes. Admittedly, we have no idea at present what meaning or even word category *gɪ-* has. However, this was also the case with the *chì-* of *chìkpèbì* examined above. Thus it is possible to present a reasonable hypothesis for the origin of a seemingly synchronically monomorphemic word as polymorphemic.

Of course, just because a clever linguist can invent a good story about a word does not mean it is true, or even if true, then active on a conscious level for modern speakers of a language. It seems likely that there is a continuum in processes like these. At one end of the continuum, a word can be polymorphemic and the morphology perfectly transparent to native speakers. Moving along the continuum, the word is still recognizable as two morphemes, but the native speaker has to exert some effort to separate the two; it is not the first analysis of the word that comes to mind. At the other extreme, all traces of separate morpheme composition have been obliterated in the speaker's mind; polymorphemicity has now become a historical relic, and synchronically the word is monomorphemic.

At this point, there are words in both Buli and Kɔnni which have labial-velars word-internally but defy decomposition into separate morphemes. At least synchronically, these may be monomorphemic:

(4) *synchronically monomorphemic?*

	Kɔnni		Buli	
a.	jɪŋmɪŋ	'evening'	sākpāk	'witch'
b.	kàgbá	'straw hat'	tákpárúk	'window'

It is possible that these may eventually be discovered to be composed of two distinct morphemes, or that were at one time polymorphemic, but historical change has obscured their origins. Of the 65 words in the Kɔnni database containing word-medial labial-velars, about a dozen appear synchronically monomorphemic. The ratio is 10 out of 60 in Buli.

2.1.3 Basa, Gbari[3]

We conclude our examination of individual languages with a brief look at two languages of Nigeria. Unfortunately, the sources for these languages are not complete enough to allow us to reach definite conclusions on the distribution of labial-velars, but I include them to broaden the database of this study and in the hope that more information will eventually elucidate the patterns of these languages.

[3] The dictionaries from which information in this section was taken are in-progress and accessible on the Internet at http://lucy.ukc.ac.uk/dz/alda.data.html.

The Basa dictionary of Blench, Imoh, & Hyslop (1991) contains approximately 90 forms with labial-velars. Of these, 31 have word-medial labial-velars. Of these, 13 appear to be reduplications, e.g. *i-kpekpe* 'chili pepper', leaving 18 cases of apparent morpheme-medial labial-velar stops, e.g. *u-sekpe* 'guinea-yam.' In the present state of the manuscript, the authors do not mark any nouns as compounds. More knowledge of the language is needed to decide the question of possible internal composition of such words.

Similarly, the Gbari dictionary of Blench & Doma (1993) has about 270 entries for words containing labial-velar stops. Of these, exactly half, 135, have a word-initial labial-velar, so the number of words with word-internal labial-velars is large. Some of these, as above, can be identified as reduplicants, as *gbwegbwe* 'groundnuts,' and others can be identified as morphologically complex, especially since a large number have the "suffix" *-gba* 'expertise, specialty.' However, there is still a considerable number of apparently monomorphemic words with an internal labial-velar, such as *tsukpa* 'a sore.'

These may be languages in which labial-velars do freely occur morpheme-internally, but in light of the discussion above for Kɔnni and Buli, it is also quite possible that the labial-velars occur only morpheme-initially and this outside linguist has not been able to analyze the morphemic composition

To sum up this section, while in some languages a minority of labial-velars may occur word- and morpheme-internally, in many other languages there is a definite and overwhelming tendency to occur only in morpheme-initial position.

2.2 Position in roots vs. affixes

I know of no languages in which labial-velars occur in either prefixes or suffixes. They always occur in roots. In Adele, Kɔnni, Buli, Eggon, Gbari, Kaanse, and Basa, for which dictionaries or wordlists of several hundred words are available, all entries containing labial-velars are listed as noun, verb, adjective, or more rarely, adverb. The only seeming exception is Gbari, in which *-gba* 'expertise' is listed as a suffix. However, *egba* 'expertise' is also listed as a noun, with the note that it often appears as a "suffix" *-gba*. It seems likely that *-gba* is not a true suffix, but a noun which commonly forms compounds.

The lack of labial-velars in affixes is not surprising, since affixes in languages commonly use considerably less than the full segmental inventory available in the language, and the expectation is that the least marked segments (unlike labial-velars) would be the ones most commonly used. For example, in Konni only 11 of the 24 available consonants are used in suffixes.

From another point of view, there are no labial-velars found in function words, such as prepositions, pronouns, conjunctions, time-depth or other particles; all are in lexical items.

2.3 Labial-velars in consonant clusters

In all the languages mentioned, a nasal consonant may precede a labial-velar stop, either as a syllabic nasal or as a coda of the preceding syllable. Labial-velar stops rarely enter into consonant clusters other than with nasals. This is quite possibly due to the fact that the predominant syllable structure in many of the languages in which they occur allows either only open syllables or else syllables with only nasal codas. (Though Buli above does allow /b, k/ word-finally, these are noun suffixes and do not occur syllable-finally within a word.) Below I examine the few cases I am aware of in which labial-velars occur in consonant clusters besides those with preceding nasals.

Eggon, a Niger-Kordofanian language of Nigeria, has several stop clusters unusual for African languages, e.g. [kp, bg]. Labial-velars also can participate in at least some stop clusters; [k͡pk] and [g͡bg] exist, as in *ak͡pki* 'stomach' and *g͡bga* 'grind' (Ladefoged & Maddieson 1996:334-5, Maddieson 1982). Interestingly, as Ladefoged & Maddieson note, the first member of a stop cluster is clearly released. In the spectrogram of *og͡bga* they provide, the vocalic transition between *g͡b* and *g* is approximately half the duration of the full vowel o̲ preceding it, and shows clear transitional formants out of the labial-velar stop. Presumably a similar release would be present in the sequences *g͡br* and *k͡pr* as found in a few words in Blench & Hepburn (1995). Maddieson (1982) asserts that these clusters are within the same syllable, basing this on morpheme boundaries. Better evidence is that these clusters may occur word-initially. Also, it seems likely that nasals are the only syllable codas allowed; by far the majority of entries in Blench & Hepburn (1995) end with vowels, and the few that end in consonants all end with nasals.

In Ewe, there is a sequence of labial-velar plus lateral, as with other stops, as in *kplo* 'to lead', *gbla* 'to exert oneself' (Ansre 1963).

In Adele, spoken in an area where Ewe is a trade language, Kleiner (1989) notes that in a CICV sequence, where I represents a high vowel, the I may be optionally reduced to the point of deletion; no vowel quality can be discerned by the ear. Also, the second consonant must be either /r/, /l/, or /n/, each of which is pronounced as a flap with "lax articulation" in these circumstances. With labial-velars in the first consonantal position, all the cited cases from her wordlist of 725 items have /l or r/ as the second consonant.

Crouch (1994) reports Dɛg, a Gur language of Ghana, has the ideophone *kpírkpírkpír* 'very black,' but mentions no other labial-velars in clusters except for a preceding nasal. This seems to be on the fringe of the normal phonology, being a reduplicated ideophone.

Gwari and Mada, Nupoid and Platoid languages, respectively, from Nigeria, are interesting in that both have labial-velar stops releasing into nasals. In her survey of the various Gwari lects, Rosendall (1992) posits CNV as a syllable type, on the basis of forms like *tnútnu* 'send,' *dnásò* 'river,' and *knúβʷa* 'ear.' Labial-velars also follow this pattern, with forms like *gbmínà* 'feather,' *kpmà* 'take off.' A nasal can both precede and follow the labial-velar, as in *wi̋édʒíŋgbmà* 'dark.'

Mada, as reported in Price (1989), takes the pattern a step further with a nasal following a labial-velar functioning as the nucleus of the syllable, though infrequently, in words like *kpm̀* 'to plow,' *kāgbm̄* 'to go home.' Mada also, like Adele and Ewe, may have a liquid following labial, velar, or labial-velar (but not coronal) consonant. Price refers to this as a "liquid feature" and transcribes the release as a superscript rather than a full segment, as in *kpˡa* 'unmarried,' *gbʳe* 'ripe.'

All of the cases discussed here have the second consonant following the labial-velar. However, the nature of the following phonetic material in each case is such that release characteristics of the labial-velar stop are preserved, either in a vocalic transition in Eggon, the lateral resonant in Ewe, or the sonorants in Adele, Gwari, and Mada.

2.4 Positional neutralization of labial-velars in Amele, Ndyuka, Efik

We have discussed the licensed positions of labial-velars across a variety of languages. Also relevant is the active neutralization of labial-velars when they occur underlyingly in positions in which they are not licensed.

In Amele (PNG), /b/ is realized as [p] at the end of polysyllabic words, e.g. [bɔˈlɔp] 'trap,' and [b] elsewhere: [be] 'his neck', [duˈbɪn] 'stalk', [sib] 'rubbish' (Roberts 1987). Crucially for our discussion, /gb/ is neutralized with /b/ word-finally. The first person plural agreement marker on verbs is [gb] word-medially: [ˈho-gb-ə] 'we came (today)', but [p] word-finally -- [hɔ-ˈlɔ-p] 'we used to come.'

In Ndyuka, the ideophone [ffagbgb] 'ideophone for swift action' varies with [vvabb] (Huttar & Huttar 1994). (The transcription [gbgb] denotes a longer duration for [gb], not two separate articulations.) Again we see the neutralization of a labial-velar, in this case optional.

In Efik, [kp] appears in syllable-initial position, but [p] does not, and [p] appears in syllable-final position, but [kp] does not (Ward 1933, Welmers 1973). It appears, then, that [p] and [kp] can be treated as allophones of phonemic /kp/ (Welmers 1973:48). In syllable-final position, the velar component of /kp/ is lost. The same distribution is found in the closely related Ibibio (Boys 1979).

3. Constraints on labial-velar positions

Recently there has been considerable attention in the literature to constraints linked to certain positions in words. Some work has focused on a strictly positional perspective, such as word-initial or final position, as in Beckman's (1997) work showing that Shona vowels exhibit more contrasts in the first syllable of a word than elsewhere. Steriade (1994, 1995, 1997) has focused more on specific phonetic environments to explain why contrasts are found more robustly in certain positions than others. Finally, Casali (1997) has also considered semantic and informational functional explanations, such as preserving monosegmental morphemes from deletion. In this section, we will examine how phonetic and morphosyntactic factors play a role in the distribution of labial-velar phonemes.

3.1 Positional constraints on labial-velars

3.1.1 Phonetic constraint

Recall that labial-velar phonemes are never found word-finally as phonetic labial-velars. Very few languages even have underlying labial-velar phonemes in this position, and the languages which do have them (Amele, Ndyuka, Efik, Ibibio in Sec. 2.4) neutralize them as plain labials word-finally. Again, only Amele to my knowledge has a labial-velar syllable-finally.

Thus there is a near-absolute prohibition against labial-velars in syllable- or word-final position. The question arises whether it is the prosodic position which is the cause, or the distribution can be plausibly traced to a combination of phonetic factors, as Steriade (1995, 1997) has demonstrated with retroflex and voicing neutralization. Let us examine what phonetic factors may be relevant in the environment preceding and following labial-velars.

To review the results of the preceding sections, a labial-velar consonant is commonly preceded by silence (if utterance-initial, which entails word-initial), a vowel, or a nasal. The fact that only nasal consonants precede labial-velars is quite likely a result of the fact that in all these languages, nasals are commonly the only codas allowed. In most of these languages, a NC cluster is the only consonant cluster type allowed. The preceding environment varies widely and thus may or may not have transitions into the labial-velar or any cues to the following labial-velar.

As for the environment following a labial-velar, cross-linguistically, a labial-velar consonant is almost always followed by a vowel (whether full vowel or a transition) or a sonorant (liquid or nasal). A phonetic characteristic of all these is that the following environment allows the release characteristics of a labial-velar to be manifested.

It appears, then, that labial-velars are only licensed in phonetic environments which allow their release bursts and transitions into another sonorant to be manifested. However, a natural question is whether the distribution of labial-velars is at all different than other stops in the relevant languages. As previously mentioned, most of these languages license only nasals in codas, and in these languages labial-velars merely follow the same pattern as other non-nasal consonants. However, Buli licenses both a labial *b* and a velar *k* word-finally, but not a labial-velar. Most pertinently, the cases of Efik,

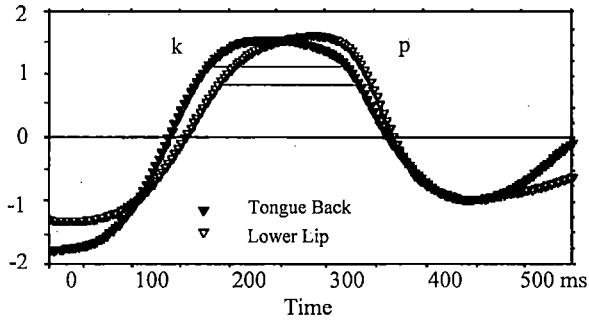
Ibibio, Amele, and Ndyuka, in which a labial-velar is neutralized, show that labial-velar licensing must have a ranking separate from other stops.

(5) **KP-son**: Labial-velars are licensed only before sonorants.

The above constraint will cover all cases except Amele in which *gb* can occur syllable-finally. A relevant question is if there is in fact a transitional vowel as in the case of Eggon. Roberts (pc) states definitely that there is no transitional vowel between [gb] and [d] in ['tugb.dɔʔ] 'to butcher,' and for the present I have no account for this.

What are the cues that identify labial-velars, especially word-initially? In spectrographs from several languages, the transition from a vowel into a labial-velar has velar characteristics, and the release has labial burst characteristics (Connell 1994, Ladefoged & Maddieson 1996). The reason for this is shown in the diagram below showing electromagnetic articulographic measurements of an Ewe labial-velar stop: the velar gesture slightly precedes the labial one. This direct measurement of articulator movements explains the spectrographic evidence.

(6)



Coordination of lower lip and tongue back movements in the Ewe word **akpa**. Y-axis is vertical displacement; horizontal lines indicate the likely duration of actual contact of the articulator. (Ladefoged & Maddieson 1996)

Intervocalically, both the transition into the labial-velar and the following burst are salient. If a labial-velar occurs between a nasal and a vowel, the place cues of the nasal and the burst suffice to distinguish labial-velars from both labials and velars. The phonetic cues needed to distinguish the labial-velar stops /kp, gb/ from the labial stops /p,

b/ in word-initial position need more detailed examination. All have labial releases; what distinguishes them word-initially?

While more investigation is certainly in order, I have enough recordings of Buli and Konni to suggest some tentative answers. In both languages, while voiceless stops in general are aspirated, the [kp] is not.[4] Word-initial voiced stops are pre-voiced (negative VOT), though not pre-nasalized, and voicing continues throughout the entire stop. Furthermore, the acoustic characteristics of this pre-voicing are different for [gb] than for [b]. For [gb], the resonating cavity is blocked off at the soft palate, while for [b], the resonating cavity extends to the lips. Thus we may speak of a velar characteristic of pre-voicing for [gb], but a labial characteristic of prevoicing for [b]. The word-initial phonetic differences may be summarized as below.

(7) Phonetic differences between word-initial labials and labial-velars (Buli & Konni)

	aspirated	"velar" pre-voicing	"labial" pre-voicing
kp			
p	x		
gb		x	
b			x

The cues to differentiate [p] and [kp] word-initially are manifested in the release, while the cues that differentiate [b] and [gb] are segment-internal. Not having detailed phonetic information on other languages, it is hazardous to draw too strong a conclusion. However, it is suggestive that the only segment-external cue differentiating a labial from a labial-velar occurs following the segment in question and would need some environment to the right where it can be realized. This is fully consistent with KP-son.

3.1.2 Morphological constraints

The phonetically-based constraint of (5) is necessary to account for the near-universal tendency for labial-velars to not occur word- or syllable-finally, but does not

[4] This is characteristic of voiceless labial-velar stops in general. In many languages, they have an implosive air mechanism, but even when they do not, labial-velars are generally not aspirated, though other voiceless stops in a language typically are. An extreme case of this is Phwin, a Gur language of Bukina Faso, in which all voiceless stops are *contrastively* aspirated, with the sole exception of /kp/ (Kevin Warfel, pc).

explain the strong tendency for labial-velars, when word-internal, to occur morpheme-initially rather than morpheme-medially. We now turn to an examination of this pattern.

As noted in Section 2.1, it is quite common, though not quite universal, for languages to restrict labial-velars to morpheme-initial positions in a word. This may be either word-initial, in a noun stem following a noun class prefix, as a member of a compound, or in a reduplicated form. There is no obvious phonetic basis for such a restriction in distribution (but see discussion below); in Adele, for instance, a word-medial labial-velar may occur intervocalically, but *only* if it also begins a morpheme. In such languages, we need a morphosyntactically-based constraint to account for this surface generalization:

(8) **KP-mi**: Labial-velars are licensed only morpheme-initially

This is unlike most constraints in OT literature in that it is based on a syntactic entity. This constraint has a distinct communicative function, which is to more clearly demarcate the edge of a morpheme.

A question that naturally arises is whether this morpheme-initial position might in fact be phonetically different, perhaps stronger in some way (force of articulation, amplitude, etc.), than a morpheme-medial position would be. If so, then there could be a greater number of phonetic cues available, and the licensing of the labial-velar would be tied directly to phonetic rather than morphological factors.[5] At this time, I have no data to bear on this point. The detailed phonetic records or tape recordings necessary to decide this issue are not available to me for the languages (Adele, Ono, Ibibio, Eggon) for which labial-velars occur strictly morpheme-initially. Interestingly, even if there are shown to be phonetic cues which are more common or present in positions in which labial-velars occur, these cues would be a consequence of being in the morpheme-initial position, and thus while **KP-mi** could be looked on as a kind of shorthand for the relevant phonetic dues, these cues themselves are due to the morpheme boundary.

---

[5] Ward (1933) makes a similar point for Efik when he notes that the consonants t̲ and k̲ weaken intervocalically to r̲ and x̲ respectively if not *root*-initial. Root-initial t̲ and k̲ remain unchanged phonetically, as Ward says, "evidently because there is stress on the verb root" (p.3), though stress is not contrastive in Efik

Presumably increased robustness of morpheme-initial phonetic cues would lead to more robust psycholinguistic identification of segments in this position, as it does for word-initial position. However, though much research has been done on *word*-initial segment recognition in psycholinguistics studies (Cutler 1995, Marslen-Wilson 1987 etc.), there has not been the same concentration on recognition of segments or other processing in *morpheme*-initial positions (M. Pitt, pc), so there is little if any relevant psycholinguistic literature in this area.

Besides this constraint, which as we have seen is sometimes violated, we need another constraint to express the generalization, exceptionless to my knowledge, that labial-velars never occur in affixes or function words, but only in roots: nouns, verbs, adjectives, adverbs. This will be:

(9) **KP-rt**: Labial-velars are licensed only in roots

From a communicative point of view, roots are more salient than affixes or function words; they carry the major semantic load, as shown by phenomena ranging from baby talk to telegraphic communications. As we have seen for Kɔnni, more contrastive segments appear in roots than in affixes or function words, and examples could be multiplied from other languages.

It may be possible to subsume **KP-rt** and **KP-mi** under one constraint, **KP-ri**, allowing labial-velars only in root-initial position. However, as presently viewed, the constraint **KP-rt** applies differently from **KP-mi** in two ways. First, while **KP-mi** would allow labial-velars in morpheme-initial position in affixes and function words, **KP-rt** would rule them out. Second, while **KP-rt** allows morpheme-medial labial-velars, **KP-mi** rules them out. Both constraints are necessary, since they apply in different situations. Also, cross-linguistically, **KP-rt** seems never to be violated, while **KP-mi** sometimes is.

3.1.3 Interaction of constraints and typology

As far as is known, **KP-rt** is never violated in any language, so it is universally undominated and will not be considered in the candidates in tableaux below. **KP-son**, too, seems to be never violated (except in the singular case of Amele). However, we have seen **KP-mi** violated in some languages. Therefore, the pertinent typologies, considering

only **KP-son** and KP-mi, are either an indeterminate ranking or **KP-son** outranking **KP-mi**. We will see these below.

If Efik is analyzed as having [kp] and [p] as allophones of one phoneme (recall [p] occurs word-finally and [kp] occurs word-initially), then Efik displays an example of indeterminate ranking of both the relevant constraints on labial-velar position. (A similar tableau could be constructed for Amele.)

(10) Efik: indeterminate ranking; [ísip] 'kernel'

UR: /isikp/	KP-son	KP-mi	MAX(lab)	MAX(dors)
☞ a. isip				*
b. isikp	*!	*!		
c. isik			*!	

Candidate (b), which preserves the underlying word-final /kp/, fatally violates both KP-son and KP-mi. The difference between candidates (a) and (c) is which of the place features gets deleted. Since [dorsal] is deleted in preference to [labial] we see that MAX(lab) must outrank MAX(dors). Interestingly, it would only be in the case of neutralization of underlying labial-velars that these rankings could be determined. In other cases, if there is an underlying labial or velar, it simply surfaces as such.[6]

In Basa, there is the apparently morpheme-medial labial-velar in *u-sekpe* 'guinea-yam.' If, as I have asserted, KP-son is cross-linguistically undominated, then it must dominate KP-mi in Basa.

[6] Another way of looking at the pattern involves a closer look at the nature of labial-velars. Rather than considering the labial and velar components as equal as was done above, we can consider an alternate geometry. Cross-linguistically, where evidence is available, it seems that labial-velars pattern primarily as labial consonants. (Besides the word-final neutralization in Amele, Efik, Ibibio, and Ndyuka mentioned here, labial-velars also pattern with labials in consonant co-occurrence constraints in Ngbaka and Kukú, vowel restrictions in Nupe and Yoruba, and blocking of [round] harmony in Nawuri. Also, it is quite common for labial-velars to change to plain labials historically. For details of these, see Cahill 1999.) The dorsal component is then secondary. In this view, an alternative would be to posit a constraint C that would simply disallow secondary articulations word-finally. Seeing that [dorsal] is the secondary articulation, this [dorsal] would delete, retaining [labial] as the primary articulation.

(11) Basa: KP-son >> KP-mi

UR: u-sekpe	KP-son	MAX (lab)	MAX (dors)	MAX (seg)	DEP (seg)	KP-mi
☞ a. u-sekpe						*
b. u-sekp	*!			*!		*
c. u-sekpte	*!					
d. u-sepe		*!				
e. u-seke			*!			
f. u-kpe				*!*		

It is only by noting the surface generalization that **KP-mi** is sometimes violated in Basa, but **KP-son** never is, that we can be confident in ranking **KP-son** above **KP-mi**. Generating a candidate which violates **KP-son** but not **KP-mi**, with no other complications, is impossible with the given input. Violating **KP-son** would involve removing the vowel following the *kp*, or else inserting a consonant. Removing a vowel, as in (b), violates **MAX** constraints, which I have generalized as **MAX(seg)** above. Inserting a consonant as in (c) violates **DEP** constraints which I have generalized as **DEP(seg)** above. It is impossible to separate out the relative contributions of the **MAX** and **DEP** violations and the **KP-son** violations with this type of data. Changing the value of the underlying labial-velar to either a plain labial or a plain velar will be ruled out presumably by the relevant **MAX** constraints, as in candidates (d) and (e) above, or possibly by a **MAX** constraint specifically applying to labial-velars. Candidate (f) violates neither **KP-mi** nor **KP-son**, but involves two violations of **MAX(seg)**.

3.2 Multiply-articulated consonants

In this section we examine the possibility of subsuming the proposed positional constraints on labial-velars under more general constraints on multiply-articulated consonants. Besides labial-velar stops, multiply-articulated consonants include clicks, which have multiple closures, and possibly other stops with secondary articulation, i.e. labialized, velarized, or palatalized stops. In inventories of the world's languages, these are the more marked sounds, being articulatorily more complex.

It is possible, even likely, that the phonetically-based **KP-son** can be subsumed under a more general constraint against having any stops with multiple articulations in

syllable-final or word-final position. Let us briefly examine distributions of other consonants with multiple articulations.

Clicks occur as phonemes in far fewer languages than labial-velars, these being the Khoisan languages and a few neighboring Bantu languages such as SiSwati. The total number of languages with clicks is probably limited to a few dozen. Of these, none have clicks in any position but syllable-initial. There are no attested cases of clicks word-finally or even syllable-finally (Miller-Ockhuizen 1997).

Cross-linguistically, then, it seems reasonable to propose a general constraint **MULT-son**, analogous to the previous **KP-son**.

(12) **MULT-son** - multiply articulated consonants are licensed only before sonorants

In view of the common Slavic (and possibly other) language patterns of allowing palatalized stops word-finally, we must ask whether **MULT-son** is merely often violated in Slavic or if the patterns noted in this paper could best be captured by another generalization. One possibility is that multiply articulated consonants must be *released.* This release could be into a vowel or other sonorant, but also could be merely a released stop rather than unreleased, as with the Slavic cases. If released in some way, then the crucial cue of the burst of the consonant would be present.

Then the question arises of whether **KP-son** should be re-formulated in terms of release rather than followed by a sonorant. This question needs more attention at a more opportune time.

3.3 Summary

In this paper, I have shown definite distributional restrictions on the occurrence of labial-velars. They never occur outside of roots. They almost never appear syllable- or word-finally. There is an extremely strong tendency for labial-velars to appear only morpheme-initially. These generalizations can be formulated as the constraints **KP-rt**, **KP-son**, and **KP-mi**. While the interactions of these constraints with others in the relevant languages needs more study, in particular demanding that they be studied in relation to other general constraints in these languages, a positive result of this study is that both phonetically-based constraints, such as **KP-son**, and morphosyntactically-based constraints, such as **KP-mi**, are necessary in phonological theory.

References

Ansre, Gilbert. 1963. Reduplication in Ewe. Journal of African Languages 2: 128-132.

Beckman, Jill N. 1997. Positional Faithfulness, Positional Neutralization, and Shona Vowel Harmony. Phonology 14.1:1-46.

Bendor-Samuel, John (ed.). 1989. The Niger-Congo Languages. Lanham, MD: University Press of America/SIL.

Blench Roger, and Musa Doma. 1993. A Dictionary of the Gbari Language. ms, http://lucy.ukc.ac.uk/dz/alda.data.html.

Blench, Roger, Paul Imoh, and Robert Hyslop. 1991. A Dictionary of the Language of the Bas(s)a People. ms, http://lucy.ukc.ac.uk/dz/alda.data.html.

Blench, Roger, and I.D. Hepburn. 1995. A Dictionary of Eggon. draft ms., http://lucy.ukc.ac.uk/dz/alda.data.html.

Boys, William E. 1979. Ibibio Phonology. Ph.D. dissertation, Ohio State University.

Cahill, Michael. 1992. A Preliminary Phonology of the Kɔnni Language. Collected Language Notes No. 20. Legon: Institute of African Studies, University of Ghana.

Cahill, Michael. 1999. Labial-velars: Phonetics, History, and Phonology. ms.

Casali, Roderic F. 1997. Vowel Elision in Hiatus Contexts: Which Vowel Goes? Language 73.3:493-533.

Connell, Bruce. 1994. The structure of labial-velar stops. Journal of Phonetics 22:441-476.

Crouch, Marjorie. 1994. A Phonology of Dɛg. Unpublished ms, GILLBT.

Cutler, Anne. 1995. Spoken word recognition and production. In Speech, Language and Communication.

Hock, Hans Heinrich, and Brian Joseph. 1996. Language History, Language Change, and Language Relationship. New York: Mouton de Gruyter.

Huttar, George L., and Mary L. Huttar. 1994. Ndyuka. London: Routledge.

Kleiner, Renate. 1989. Phonology Notes of Gɪdɪrɛ, the Language of the Adele. Unpublished ms., GILLBT, Tamale, Ghana.

Kröger, Franz. 1992. Buli-English Dictionary. Münster: Lit Verlag.

Ladefoged, Peter, and Ian Maddieson. (1996). The Sounds of the World's Languages. Cambridge, MA: Blackwell Publishers.

Liêm, Nguyên-Đang. 1970. Vietnamese Pronunciation. Honolulu: University of Hawaii Press.

Maddieson, Ian. 1982. Unusual Consonant Clusters and Complex Segments in Eggon. Studies in African Linguistics, Supp. 8: 89-91.

Maddieson, Ian. 1984. Patterns of Sounds. Cambridge: Cambridge University Press.

Marslen-Wilson, William. 1987. Functional parallelism in spoken word-recognition. Cognition 25: 71-102.

McElhanon, K.A. 1967 Preliminary Observations on Huon Peninsula languages. Oceanic Linguistics 6.1:1-45.

Miller-Ockhuizen, Amanda. 1997. Why Khoisan Clicks are Root Initial. ms.

Naden, Tony. 1988. The Gur Languages. In Kropp-Dakubu, M.E. (ed), The languages of Ghana. London: Kegan Paul Institute. pp 12-49

Naden, Tony. 1989. Gur. In Bendor-Samuel, John (ed), The Niger-Congo Languages. New York: SIL/University Press of America. pp 140-168

Phinnemore, Thomas R. 1985. Ono Phonology and Morphophonemics. Papers in New Guinea Linguistics No. 22, 173-214. Pacific Linguistics Series A 63.

Price, Norman. 1989. Notes on Mada Phonology. Language Data, Africa Series, Publication 23. Dallas: Summer Institute of Linguistics.

Roberts, John R. 1987. Amele. New York: Croon Helm.

Rosendall, Heidi James. 1992. A Phonological Study of the Gwari Lects. Dallas: Summer Institute of Linguistics.

Rountree, S. Catharine. 1972. The Phonological Structure of Stems in Saramaccan. In Grimes, Joseph E. (ed) Languages of the Guianas. Norman: SIL/University of Oklahoma, 22-27.

Smalley, William A. 1964. Manual of Articulatory Phonetics (Revised Edition). Tarrytown, NY: Practical Anthropology.

Steriade, Donca. 1994. Positional Neutralization and the Expression of Contrast. ms, UCLA

Steriade, Donca. 1995. Licensing Retroflexion. ms, UCLA.

Steriade, Donca. 1997. Licensing Laryngeal Features. ms, UCLA.

Welmers, Wm. E. 1966. Efik. Occasional Publication No 11, Institute of African Studies, University of Ibadan, Nigeria.

Welmers, Wm. E. 1973. African Language Structures. University of California Press, Berkeley and Los Angeles, California.