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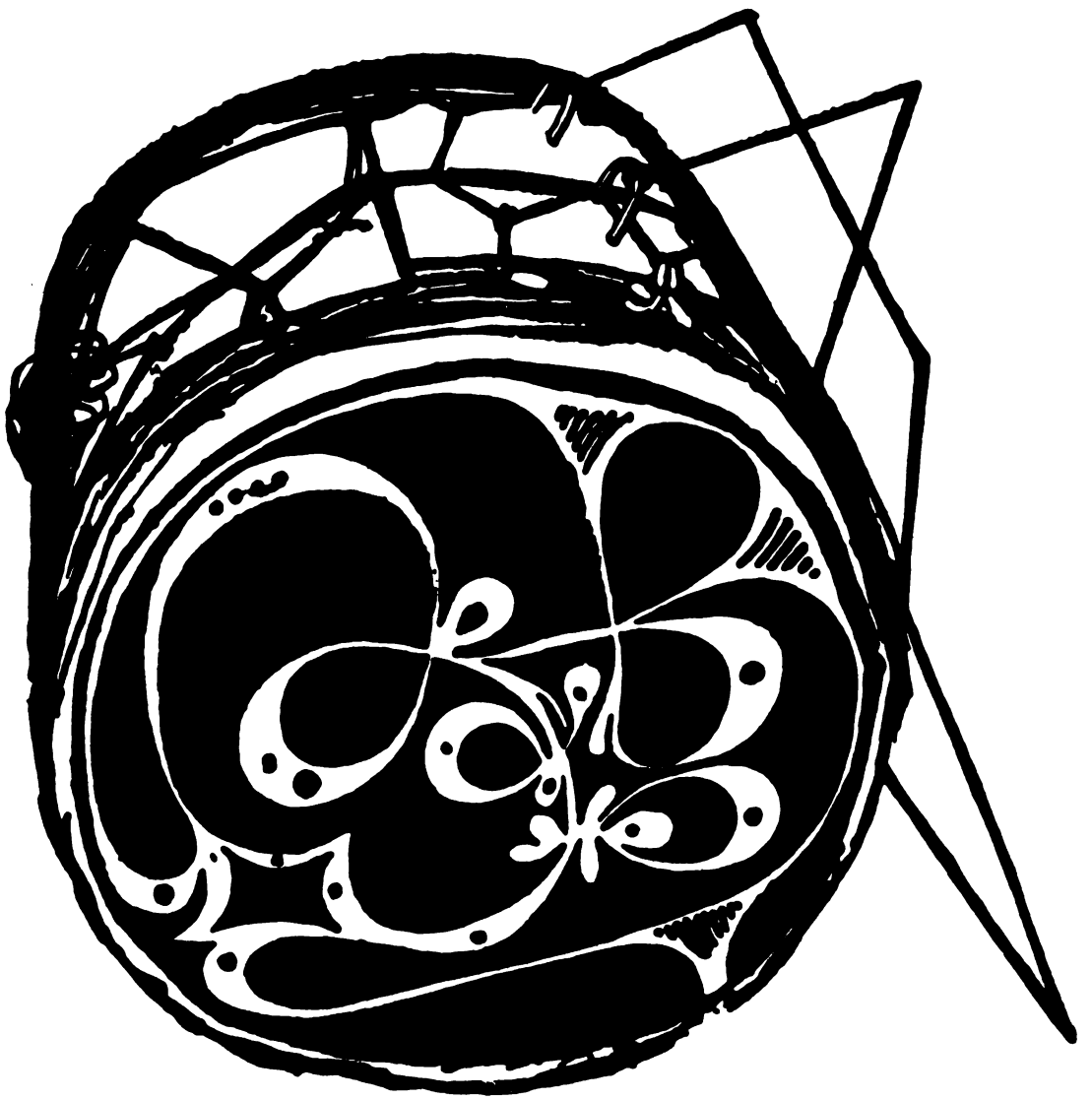

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THE FORMATION OF LABIAL-VELARS IN SAWABANTU: EVIDENCE FOR FEATURE GEOMETRY

Ngessimo M. Mutaka and Carl Ebobissé
University of Yaounde 1

In a number of Bantu languages spoken in the western part of Cameroon, there are striking correspondences in the cognates between the labial-velars **gb**, **kp**, **ŋm** and the labialized consonants **ɓw**, **kw**, and **mw**, respectively. Our hypothesis is that the labialization of **ɓ**, **k**, **m** derives from a back round vowel in early Sawabantu and that labiovelarization is a further development of these labialized consonants. In this paper, we present evidence for such a reconstruction and explain the formation of these labial-velars from the labialization process. The analysis of the data in this article relies on a theory that takes the feature rather than the segment as the primitive for building up segments.

Dans un certain nombre de langues bantoues parlées à l'ouest du Cameroun, il existe des correspondances frappantes entre les labiovélaires **gb**, **kp**, **ŋm** et les consonnes labialisées **ɓw**, **kw**, et **mw**, respectivement. L'argument de base démontré dans cet article est que la labialisation des consonnes de ces langues résulte d'une voyelle postérieure arrondie dévocalisée et que la labiovélarisation de ces consonnes est un développement ultérieur issu de cette labialisation. L'analyse des données dans cet article s'appuie sur une théorie phonologique qui prend le trait distinctif comme élément de base pour la construction des segments dans une langue.

0. INTRODUCTION

In a number of Bantu languages spoken in the western part of Cameroon,[1] and that Ebobissé (1989) identifies as Sawabantu,[2] there are striking correspondences in the cognates between the labial-velars **gb**, **kp**, **ŋm** and the labialized consonants **ɓw**, **kw**, **mw**, respectively. Our hypothesis is that the labialization of **ɓ**, **k**, **m** derives from a back round vowel in early Sawabantu and that labiovelarization is a further development of these labialized consonants. In this article, we present evidence for such a reconstruction and explain the formation of these labial-velars from the labialization process. The article is organized such that in the first section we present the labial-velars in prefixes and in the stems, and demonstrate why the labial-velars derive from the labialized consonants. In §2, we discuss the labiovelarization formation. Our analysis in this second section relies heavily on the conception of the feature and not the segment as the primitive of the phonological theory (Chomsky and Halle 1968, Archangeli and Pulleyblank (1993)), and also the hierarchical feature organization as in Clements (1985), Sagey (1986a), Steriade (1987).

1. LABIAL-VELARS IN PREFIXES AND STEMS

With respect to the feature of labiovelarization, the Sawabantu languages clearly subdivide into two groups: a west branch where labial-velar consonants are attested and an east branch where they are not. The west branch includes Mboko, Kpe, Bubia, Isu, and Kolɛ, and the east branch includes the remaining Sawabantu languages, that is, Mongo, Pondo, Duala, Mulimba, Oli, Bodiman, Batanga, Banɔhɔ, Bapuku, and Yasa. This is shown in the consonant correspondences in the tables (1) and (2) that have been

[1] The data for this paper were collected by Carl Ebobissé as part of his research project on Cameroonian languages funded by the University of Yaoundé. We are particularly grateful to the authorities of the University of Yaoundé I. We also wish to thank Keith Snider and an anonymous JWAL reviewer for their extensive comments on an earlier draft of this paper. Any remaining inconsistency remains our entire responsibility.

[2] The following abbreviations stand for the following Sawabantu languages: MON = Mongo, PON = Pongo, DUA = Duala, OLI = Oli, BID = Bodiman, MUL = Mulimba, BAN = Banɔhɔ, BAT = Batanga, BAP = Bapuku, YAS = Yasa, MBO = Mboko, KPE = Kpe, BUB = Bubia, ISU = Isu, KOL = Kolɛ. Note that Bodiman appears as BID (Bidiman) in Ebobissé (1989). We keep the acronym BID, i.e., Bidiman, for easy reference to Ebobissé's work on Sawabantu languages from which we took the data for this article.

established from the data discussed in this article and of which samples are presented below each table.[3]

(1) Labial-velar correspondences in Sawabantu prefixes

MBO	KPE	BUB	KOL	ISU	MON	PON	DUA	MUL	OLI	BID	BAT	BAN	BAP	YAS
gb	**gb**	**gb**	**gb**	**gb**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**
kp	**kp**	**kp**	**kp**	**kp**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**
ŋm	**ŋm**	**ŋm**	**ŋw**	**ŋm**	**mw**	**mw**	**mw**	**mw**	**mw**	**mw**	**mw**	**mw**	**mw**	**mw**

e.g.: tree **ɓw-elé** (MON, PON, DUA, OLI, BID, MUL)
gb-èlé (ISU)
gb-eré (KOL)
gb-èé (KPE)

cassava **kw-amba** (MON, PON, DUA, MUL, OLI, BID)
kp-amba (BUB, ISU, KOL, MBO, KPE)

child **mw-ána** (MON, OLI, BID, BAT, BAP, YAS)
ŋm-ána (MBO, KPE, BUB, ISU)
ŋw-ánà (KOL)

age-group **mw-embá** (MON, PON, DUA, OLI, BID, MUL)
ŋm-embá (MBO, KPE, BUB, ISU)
nw-èmbá (KOL)

(2) Labial-velar correspondences in Sawabantu stems

MBO	KPE	BUB	KOL	ISU	MON	PON	DUA	MUL	OLI	BID	BAT	BAN	BAP	YAS
gb	**gb (w)**	**gb**	**gb**	**gb (w)**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**	**ɓw**
kp	**kp**	**kp**	**kp**	**kp (kw)**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**	**kw**
ŋgb	**ŋgb**	**ŋgb**	**ŋgb**	**ŋgb (ŋgw)**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**	**ŋgw**

e.g.: diarrhea **kúɓwako** (MON, PON, DUA, MUL, BAT, BAN, BAP)
kúgbako (KOL, BUB, MBO)
kúwako (ISU)
kúuwa (KPE)

one hundred **e-ɓwéa** (PON, DUA, MUL, BAT, BAN, BAP)
e-gbéa (KOL, MBO, BUB,ISU)

partridge **kwalé** (MON, DUA, PON, OLI, BID)
kpaé (KOL, MBO, KPE, ISU, BUB)
kwaɗé (MUL).

sword **kwátá** (MON, PON, DUA, MUL, OLI, BID, BAT, BAN, BAP, YAS)
kpátá (BUB, ISU, KOL)

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[3] To put the data in context, we would like to mention the following phonemic inventory of stops and nasals found in Sawabantu languages.

p	**t**	**k**	**kp**	
ɓ	**ɗ**			
b	**d**	**g**	**gb**	
m	**n**	**ŋ**	**ŋm**	

The plosives [**t, k**] and the nasals [**m, n, ŋ**] are found in all the Sawabantu languages. The consonant [**p**] is also found everywhere except in Kolɛ, Mboko, Kpe, and Bubia. Whereas [**b**] and [**d**] appear everywhere in the nasal complexes [**mb**] and [**nd**], [**b**] is only found in Kolɛ as a separate segment. The implosive [**ɓ**] is found in Pondo, Duala, Oli, Bodiman, Mulimba, Batanga, Banɔhɔ, Bapuku, and Yasa. The implosive [**ɗ**] is found in Kolɛ, Mongo, Pondo, Duala, Bodiman, Mulimba, Batanga, Banɔhɔ, Bapuku, and Yasa (see Ebobissé 1989:66). Whereas the sequence [**ŋw**] is fairly frequent in the Sawabantu languages, [**gw**] is rather rare and is found in the nasal complex [**ŋgw**].

to throw **àŋgwà** (MON, PON, DUA, ISU,BAT, BAN, BAP)
àŋgbà (KOL, BUB)
àŋgbá (KPE)
áŋgbà (MBO)

As shown in these two tables, the west branch (henceforth WSB) is characterised by the labial-velars **gb, kp, ŋm/ŋw, ŋgb** which correspond to **ɓw, kw, mw, ŋgw**, respectively in the east branch (henceforth ESB). In the table in (2), the labial-velar **w** and the labialized consonants **kw** and **ŋgw** have been put between parentheses to show that they also occur in some words along with the consonants **gb, kp, ŋgb** in Isu. Our interpretation of the correspondences in these tables is that, only the labialized consonants were attested in early Sawabantu languages, i.e., the Proto-Sawabantu languages (henceforth PSB), and that the labial-velar consonants in the WSB derived from these labialized consonants in a way that will be explained in §2. The existence of both the labial-velars **gb, kp, ŋgb** along with the labial(ized) consonants **w, kw, ŋgw** in Isu can be interpreted as showing that the process of labiovelarization is not yet complete in the stem of this language.

In order to understand our assumption that the labial-velar consonants derived from the labialized consonants, examine the following forms. The gloss is given before forms in Sawabantu.

(3) badness (ESB) **ɓo-ɓé** (PON, DUA, BAT, BAN, BAP, MUL)
ɓo-bée (MON)
ɓo-bí (OLI, BID)
(WSB) **bo-bé** (KOL)
ɓo-ßée (MBO, BUB, ISU)
wo-ßée (KPE)
face (ESB) **ɓo-só** (PON, DUA, OLI, BID)
ɓo-sóo (MON)
ɓo-hó (MUL)
(WSB) **ɓo-sóo** (KOL)
wo-sóo (MBO, BUB, ISU)
wo-zóo (KPE)
brain (ESB) **ɓɔ-ŋgɔ́** (MON, PON, DUA, BID, MUL)
ɓɔ-ɣɔ́ (OLI)
ɓɔ-ŋgú (BAT, BAN, BAP, YAS)
(WSB) **wɔ-ŋgɔ́** (MBO, BUB, ISU)
wɔ́-ŋgɔ (KPE)

What we need to observe in (3) is that the sequence **ɓo-/ɓɔ-** followed by a consonant in ESB corresponds to either **ɓo-/ɓɔ-** or **wo-/wɔ-** in WSB. Because of the prevalence of **ɓo/ɓɔ** over **wo/wɔ** in these forms, and also because on grounds of phonetics and markedness, that is, as it is more likely for ***ɓo** to become **wo** than ***wo** to become **ɓo**, we posit **ɓo/ɓɔ** in the PSB. The consonant **[ɓ]** is more phonetically complex than **[w]**, and less common cross-linguistically, and so more marked. Sounds tend to change toward more common sounds, rather than towards less common ones, though exceptions exist.[4] Already, we see that ESB maintained **ɓ** in the **ɓo/ɓɔ** sequence whereas WSB changed **ɓ** into **w** in certain forms. Note also that ***ɓo** changed into **bo** in Kolɛ which does not have the implosive **[ɓ]** in its consonantal inventory.

Now compare the forms in (3) with forms where **ɓo/ɓɔ** is followed by a vowel as in (4).

[4] We are indebted to a JWAL anonymous reviewer for this clarification.

(4)	tree	(ESB)	**ɓw-elé** (MON, PON, DUA, OLI, BID, MUL)
		(WSB)	**gb-elé** (ISU)
	canoe	(ESB)	**ɓw-álo** (OLI, BID, BAT, YAS)
		(WSB)	**gb-álo** (MBO)
			gb-áyo (BUB)
			w-álo (KPE, ISU)
	goodness	(ESB)	**ɓw-ámu** (BAT, BAP, YAS)
			ɓw-áam (MON, PON, DUA, OLI, BID, MUL)
		(WSB)	**gb-ámu** (KOL, MBO, KPE, BUB, ISU)
	length	(ESB)	**ɓw-aɓá** (MON,PON,DUA,OLI,BID,MUL,BAT,BAN,BAP)
		(WSB)	**gb-aßá** (KOL, ISU)

In the (ESB) forms, the sequence **ɓo-** which is the same prefix as in (3), surfaces as **ɓw** when it appears before a vowel. We can therefore posit a gliding rule that changes **ɓo** into **ɓw**. This rule is informally stated in (5).

(5) Gliding: $[+\text{round}] \rightarrow [-\text{syll}] \;/\; \underset{V}{\_\_\_} \; \underset{V}{[-\text{hi}]}$

This rule says: a round vowel desyllabifies when it occurs before a non-high vowel.

Notice that in the (WSB) forms the consonant corresponding to the labialized consonant of the (ESB) forms is a labial-velar consonant. Consequently, we must conclude that, diachronically, the labialized consonant **ɓw** of PSB developed into the labial-velar consonant **gb** in WSB. The development of **mw** into **ŋm** can be explained in a similar way as will be demonstrated below.

Consider the examples in (6) where the prefix **mu-** is followed by a consonant.

(6)	colour	(ESB)	**mu-sonɔ** (MON, PON, DUA)
			mu-hɔnɔ (MUL)
		(WSB)	**mo-sɔnɔ** (MBO, KOL, BUB, ISU)
			mo-ʒɔnɔ (KPE)
	vein	(ESB)	**mu-sisá** (MON, PON, DUA)
		(WSB)	**mo-sisá** (MBO, KOL, BUB, ISU)
			mo-ʒiʒá (KPE)
	breaking of wind	(ESB)	**mú-sudí** (PON, DUA)
			mú-sudú (MON)
			mú-sulí (OLI, BID)
		(WSB)	**mó-sulí** (BUB)
			mo-sidi (KOL)
			mó-sulú (ISU)

In these examples, the prefix **mu-** in ESB changed into **mo-** in WSB languages. Since the PB prefix is **mu-** we can reconstruct **mu-** here as the PSB form. Consider now the forms in (7) where the sequence **mu-** is followed by a vowel.

(7)	age-group	(ESB)	**mw-embá** (MON, PON, DUA, OLI, BID, MUL)
		(WSB)	**ŋm-embá** (MBO, KPE, BUB, ISU)
			ŋw-embá (KOL)
	bat	(ESB)	**mw-eémá** (MON, PON, DUA, MUL)
			mw-eéma (OLI, BID)
		(WSB)	**ŋm-ɛéme** (MBO, KPE, ISU, BUB)
			ŋw-ɛéme (KOL)

child	(ESB)	**mw-ána** (MON, OLI, BID, BAT, BAP, YAS)
	(WSB)	**ŋm-ána** (MBO, KPE, BUB, ISU)
		ŋw-ána (KOL)

As shown in the (ESB) forms, the prefix **mu-** surfaces as **mw**. This means that the vowel of the prefix underwent the rule of gliding posited in (5). Instead of maintaining a labialized nasal in the (WSB) forms, notice the surfacing of a labial-velar **ŋm** in most of these languages and **ŋw** in Kolɛ. Since the sequence **mu-** exists in WSB where it precedes a consonant, and that the sequence **ŋmw** is never found in WSB as a possible prefix that would derive from **ŋmu-** on a par with **mw-** derived from the prefix **mu-**, we conclude that **ŋm** and **ŋw** in WSB must have developed from the labialized consonant **mw** in PSB.

Consider also the forms in (8) where the sequence **ko-** or **ku-** is found in both ESW and WSB languages as occurring before a consonant.

(8)	diarrhea	(ESB)	**kúɓwako** (MON, PON, DUA, MUL, BAT, BAN, BAP)
		(WSB)	**kúgbako** (KOL, BUB, MBO)
			kúuwa (KPE)
	skin	(ESB)	**koɓo** (MON,YAS, BAP)
		(WSB)	**kowo** (MBO, ISU, KPE, BUB)
	to cover	(ESB)	**ikúdmanɛ** (MON, PON)
			kúdumanɛ (DUA)
		(WSB)	**likúmanɛ** (ISU)
			likúmenɛ (KPE)
			ibúmerɛ (KOL)

What is important to notice here is that no labial-velar is ever found in WSB as alternating with a **ko/ku** sequence which is followed by a consonant. Compare these forms with the forms in (9).

(9)	partridge	(ESB)	**kwalé** (MON, DUA, PON, OLI, BID)
			kwaɗé (MUL)
		(WSB)	**kpaé** (KOL, MBO, KPE, ISU, BUB)
	sword	(ESB)	**kwátá** (MON, PON, DUA, MUL, ...)
		(WSB)	**kpátá** (BUB, ISU, KOL)
	death	(ESB)	**kwédí** (MON, PON, DUA, MUL, OLI, BID)
		(WSB)	**kpélí** (MBO, KPE, BUB, ISU)
			kpérí (KOL)

Although it is not quite clear why an underlying **ko/ku** sequence has to be reconstructed for the **kw** in the (ESB) forms, external evidence from ProtoBantu does show that the forms for 'partridge' and 'death' which are ***koade** and ***kuedi**, respectively have the sequence **ko/ku** followed by a vowel (Guthrie 1971). Assuming that the **ko/ku** sequence of these words was maintained in PSB, we can then explain the **kw** sequence in the (ESB) forms as resulting from the gliding rule posited in (5). Since the sequence **kpw** is never found in the (WSB) languages, we conclude that **kp** developed from the **kw** of PSB.[5]

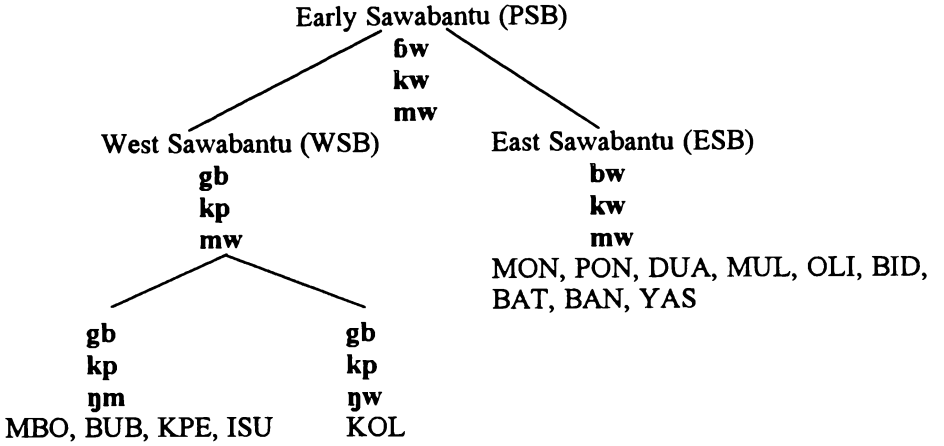
To sum up, it has been shown that the Sawabantu languages consist of two main groups, the east branch (ESB) and the west branch (WSB). In the early Sawabantu (PSB), we have identified the application of a gliding rule that desyllabifies a round

[5] We would also like to mention the fact that we have not found the sequence **[kpu]** in the West Sawabantu languages that have the labial-velar **[kp]** which would correspond to **[ku]**. This lends additional support to our reconstruction of **[kw]** as the origin of the labial-velar **[kp]**. We are grateful to an anonymous JWAL reviewer for this observation.

vowel when it precedes a non-high vowel. The labialized consonants **ɓw**, **kw**, **mw** found in the ESB languages are a result of this rule. We have proposed that the labial-velars **gb**, **kp**, **ŋm** in WSB are derived from these labialized consonants.

The table in (10) retraces these developments.

(10) Labial-velar development in Sawabantu languages



As shown in (10), we have interpreted labiovelarization as a shared innovation in the west branch (WSB) that resulted from labialization (i.e., the result of the gliding rule) in PSB. We interpret the appearance of **ŋm** as occurring later than the labial-velars **gb** and **kp** precisely because the appearance of **ŋm** in Mboko, Kpe, Bubia, and Isu corresponds with **ŋw** in Kolɛ.[6] If **ŋm** were to have developed from **mw** at the same time as the other labial-velars **gb** and **kp**, it would be difficult to infer that **ŋw** developed from **ŋm**. By having **ŋm** and **ŋw** develop directly from **mw**, these sequences do not pose any problem as to the primacy of **ŋw** or **ŋm**.[7]

Before proceeding to §2 where we propose to account for the formation of these labial-velars, a few observations on the labial-velars that are preceded by a homorganic nasal are in order here.

First, notice that the **N-bw** sequence in ESB (where N stands for a nasal consonant) corresponds to **N-gb** in WSB as expected. The nasal merely takes the place of articulation of the following consonant. This is shown in (11).

(11) dog (ESB) **mbwáa** (MON, OLI, BID, BAP, YAS, BAT)
(WSB) **ŋgbáa** (KOL, MBO, KPE, BUB, ISU)

The homorganic nasal that appears in the initial position of these forms is the class 9 prefix commonly found in narrow Bantu languages. Guthrie (1971) reconstructs the stem for this word as ***-boa** or ***-bua**. We assume that the same reconstructed forms have been retained in PSB as the underlying forms on which the gliding rule posited in (5) applied. The labialized consonant in (ESB) is thus a result of this gliding rule as is the case in ESB, and the labial-velar in (WSB) is a further development of the labialized consonant into a labial-velar in WSB as has been argued previously.

Secondly, consider the following forms that contain the **ŋgw-ŋgb** correspondence that we have not discussed so far.

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[6] Notice that Kolɛ is unique also in other respects: it is the only language among the Sawabantu languages to have retained the Proto-Bantu [**b**] (other languages have [**ɓ**] or [**ɗ**] or [**w**] in the case of Mboko); it is also the only language which developed [**r**] from the Proto-Bantu [**d**] among the Sawabantu languages (see Ebobissé 1989:66).

[7] A similar grouping of the five languages that constitutes the WSB languages can be found in Ebobissé (1989:60) as appearing at the top of his computer-generated table of Sawabantu languages based on the comparison of the similarities between various linguistic items of these languages.

(12) to sift (ESB) **sɛŋgwɛ** (MON, PON, MUL, DUA, OLI, BID)
(WSB) **sɛŋgbɛ** (BUB, MBO, KOL)
zɛŋgbɛ (KPE)
sɛŋgwɛ (ISU)
to lick (ESB) **nyáŋgwa** (PON, MON, MUL, YAS, DUA)
(WSB) **nyáŋgba** (KOL, BUB)
nyáŋgwa (ISU)

Notice that, internal reconstruction cannot help determine whether the sequence **ŋgw** in the (ESB) languages, is the result of the gliding rule posited earlier or if it is an underived sequence. Whatever the case, what is interesting here is that the labialized velar in the **ŋgw** sequence changed into a labial-velar in the (WSB) forms as expected. The only exception is in Isu where labiovelarization did not obtain. Our interpretation of the lack of labiovelarization in Isu is that the sequence **ŋgw** was present in PSB and in the two branches that developed from PSB, that is, ESB and WSB. Looking back at (10), labiovelarization of **ŋgw** is a late innovation that distinguished MBO, BUB, KPE from ISU. Some evidence showing that labiovelarization of **ŋgw** is a late development can be seen in the exceptional forms in WSB languages where this labiovelarization does not equally obtain as illustrated in (13).

(13) to help (ESB) **óŋgwanɛ** (MON, PON, DUA, ISU, KOL, MUL)
(WSB) **óŋgwana** (KPE, BUB, MBO)
óŋgwanɛ (ISU)

Not only ISU, but also the rest of the WSB languages still retain **ŋgw** instead of the expected **ŋgb**.

2. LABIAL-VELAR FORMATION AND FEATURE HIERARCHY

From §1, we observed that the west branch of the Sawabantu languages developed the labial-velars **gb**, **kp**, **ŋm** from **bw**, **kw**, **mw**, respectively from a CV_1V_2 sequence where V_1 is a round vowel and V_2 is a non round vowel. If we were to write a diachronic sound change, it would look like the following:

(14) Labial-velar sound formation:
a. **ɓw** > **gb**
b. **kw** > **kp** in the west branch of Sawabantu
c. **mw** > **ŋm**

Note that this sound change is not illuminating at all as it does not tell us why the **w** becomes either **g** or **p** or **ŋ** in the resulting segments. One could easily relate **ɓ** and **p** to **w** in that they have a labial feature. **ŋ** in **ŋm** could also be related to **w** by its velarity, more precisely the features [+back] and [+high]. Using the SPE framework (Chomsky and Halle 1968), the phonological processes in (14) could be rewritten as (15).

(15) Labial-velar sound formation (revised):
a. **ɓ** > **gb** / ___**w**
b. **k** > **kp** / ___**w** in the west branch of Sawabantu
c. **m** > **ŋm** / ___**w**

Notice that what this sound change implies is that there was an intermediary stage where **w** was still part of the sound, i.e., the changes were as in (16).

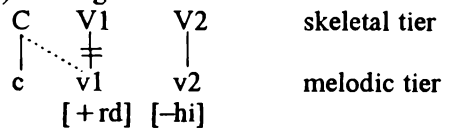
(16) Process of labial-velar formation:

a. **ɓw**	>	**gbw**	> **gb**	
b. **kw**	>	**kpw**	> **kp**	in the west branch of Sawabantu
c. **mw**	>	**ŋmw**	> **ŋm**	

It should be noted that we have not found evidence of this intermediary stage in our data. The empirical question is: was there any rule that deleted the **w** after the labial-velars? Our proposal is that such an intermediary stage is a lure suggested by the rule notation used. A more illuminating view that we adopt is that the feature is the primitive of the phonological theory as is generally accepted in generative phonology (e.g., Chomsky and Halle 1968, Archangeli and Pulleyblank (1993)). We further assume the correctness of the representation of features in a hierarchical structure as in Sagey (1986a) and Clements (1985). The reason **w** actuated the changes in the present labial-velar segments is that it basically has the dorsal features [+high +back] and the labial feature [+round]. These features link, in various ways, in the hierarchical structure of the segment of **ɓ**, **k**, **m** in a way we discuss in the present section.

As noted earlier, the gliding of a round vowel followed by the vowel **a** or any non-high front vowel regularly started the process of labiovelarization. We informally re-state the gliding rule in (5) here as in (17) for convenience.

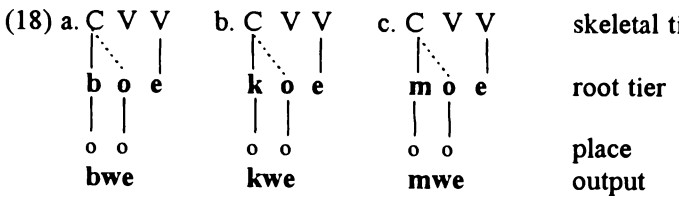
(17) Gliding



This rule says: a round vowel becomes [–syllabic], i.e., it docks onto a consonantal position when it precedes a non-high vowel. It thus becomes a glide and is specified as [+high] by an appropriate redundancy rule.

Using a hierarchical feature representation adapted from Sagey (1986a), let us consider how **bw**, **kw**, **mw** are derived in the sequence **boe**, **koe**, **moe**.

(18)



As shown in these derivations, gliding results in the desyllabification of the round vowel that precedes a non-high vowel by linking its root node to the skeletal slot of the consonantal onset position. Both the consonant in the onset position and the desyllabified vowel keep the whole range of their segmental features. That is why they surface unscathed. Given this representation of two root nodes linked to a single skeletal slot, gliding contributes to the formation of a contour segment (Sagey 1986b). Let us now see how the **w** actuates labiovelarization in the preceding consonant.

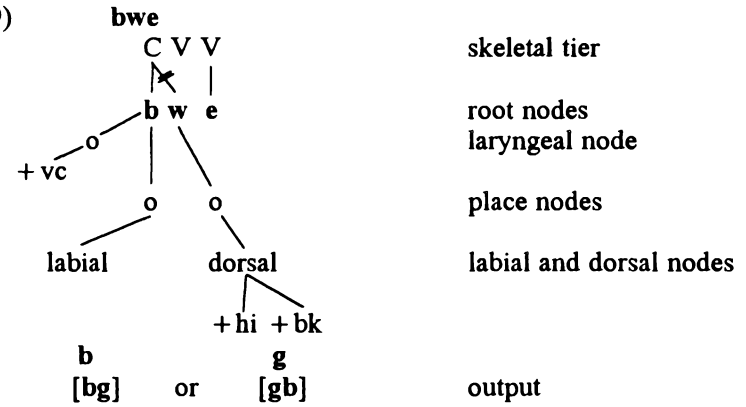
Before proceeding to some illustrative derivations, we would like to make the following points.

First, the labial-velars **gb**, **kp**, **ŋm**, and **ŋw** constitute single segments and not a sequence of segments. Although the notation suggests that they consist of a sequence of ordered segments, the utterance of the labial and velar parts of the segments are rather simultaneous, as observed by Welmers (1973) about the labial-velars in African languages. In the analysis that follows, we therefore assume that the labial-velars are complex segments, rather than contour segments, as Sagey (1986b) convincingly demonstrated for the formation of the complex segments in Kinyarwanda.

Secondly, we note that the syllable structure of the languages that developed the labial-velars is basically CV. To a certain degree, the CGV (consonant glide vowel) structure is seen as having a complex onset. Therefore, the language discards these types of structures by delinking the root node of the **w** segment. This results in the stranding of the **w** features, that is, the labial feature [+rd] and the dorsal features [+hi +back] as will be illustrated in the derivations. In the formation of the labial-velars, we argue that it is these stranded features that re-associate to the feature geometry of the onset position. Let us now look at individual cases.

In the case of **gb**, we propose that the **g** part of the segment results from the linking of the dorsal node, i.e., the [+hi +back] features of the **w** segment, to the place node of the consonant **b**. The round feature of **w** remains unrealized probably because it is essentially a vowel feature: it thus fails to link to the labial node of the segment **b**. This is illustrated in (19).

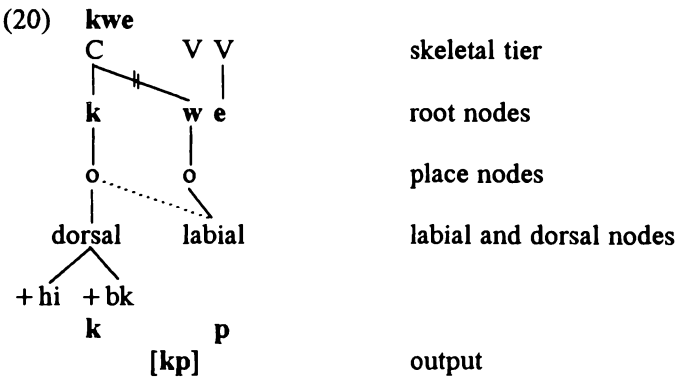
(19)



As shown in this representation, the dorsal node of **w** links to the place node of **b**. As noted earlier, the resulting segment is a complex segment whose two consonants are unordered. Although one could argue that it is the place node of **w** rather than its dorsal node that links to the **b** segment, we propose that, since the two features [+hi +back] are acting as a unit through the dorsal node, they are the ones that seek and find a landing site under the place node of **b**, leaving out the labial feature [+round].

The derivation of **kp** from **kw** proceeds in the same way as **gb** with the only difference that it is rather the labial feature of **w** that links to the place node of **k**, thus generating **kp**. This is best shown in the derivation in (20).

(20)

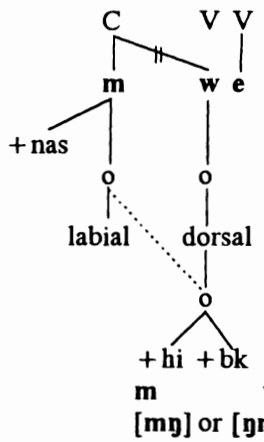


As mentioned earlier, the [+round] feature of the labial node is essentially a vowel feature. When the labial node links to the place node of the **k** segment, it is realized as the feature [+lab] which, in combination with the [–continuant] feature of the **k**

segment surfaces as **p**.[8] This **p** acquires the [–voice] feature of **k** since it now shares the laryngeal feature that was originally belonged to **k**. The dorsal node of **w** is stray erased. The whole complex segment is thus **kp**.

As for the formation of **ŋm** from **mw**, it also proceeds like **gb** except that the nasal feature of **m** that is directly attached to the root node makes the whole complex segment [+nasal]; the labial node is realized as **m** and the [+hi +back] features of the dorsal node of **w** are realized as **ŋ**. This is shown in the derivation in (21).

(21) **mwe**

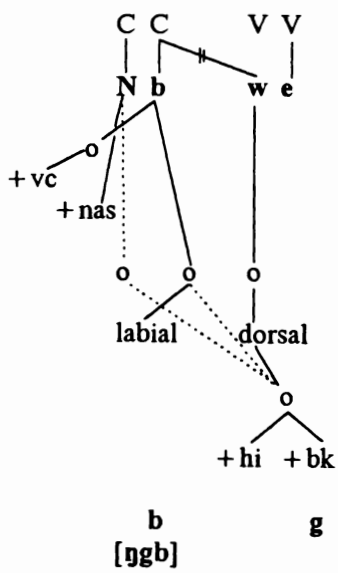


skeletal tier
root nodes
place nodes
labial and dorsal nodes
output

The [+round] feature of **w** which is essentially a vowel feature is unrealized. The resulting complex segment whose two elements are unordered is realized as **[ŋm]**.

As for the sequence **ŋgb** discussed earlier, we propose that the nasal constitutes a separate root node and it acquires its place features from the dorsal node of the following segment. This is shown in (22).

(22) **N-bwe**



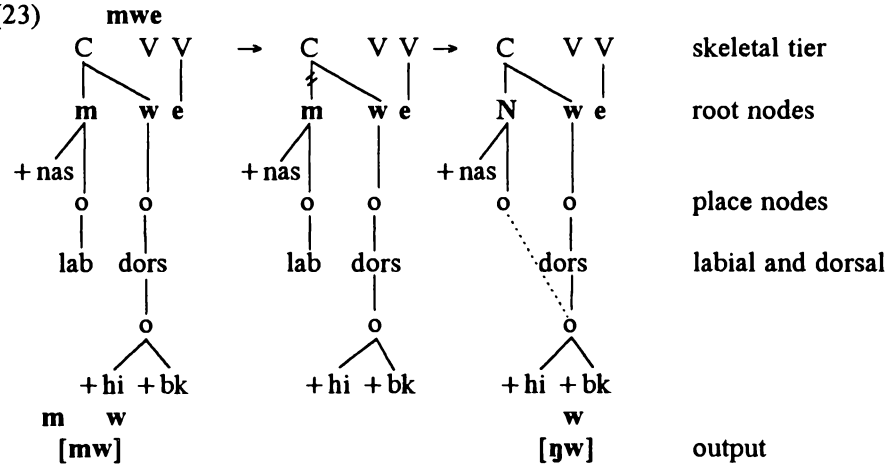
skeletal tier
root nodes
laryngeal node
place nodes
labial and dorsal nodes
output

[8] Another way of saying this is to assume that Lab is interpreted as [+rd] when associated to vowels and [+lab] when associated to consonants. We are indebted to Keith Snider for this suggestion.

One question arises here: why does the nasal acquire its place node from the dorsal features rather than the labial feature of the complex segment **gb**? While we have no definite answer to this question, we note that, in terms of feature compatibility, the nasal feature seems to select the velar features [+hi +back] as the default features to fill out its place node as observed by Ferre (1988).[9] This might explain why the dorsal features are also selected here rather than the labial features.

The spreading of the dorsal node of **w** onto the place node of the nasal is also instantiated in the formation of **ŋw**. As observed in the data, the sequence **mw** corresponds with **ŋw** in some Sawabantu languages. To account for the formation of the labial-velar **ŋw**, we propose that, unlike **gb** or **kp** where the root node of **w** is delinked to leave the dorsal features floating and in need to re-associate to the place node of the segment **b** or **k**, here it is rather the root node of the nasal **m** that delinks leaving its nasal feature floating. The dorsal node of the remaining semivowel **w** then fills up the place node of this nasal and the whole root node of the nasal re-associates to the skeletal slot of **w** formerly occupied by **mw** after gliding as shown in (23).

(23)



As shown in this derivation, the nasal feature is realized as **ŋ** after combining with the dorsal features of **w**. Notice that the root node on which the nasal is linked must associate to the skeletal slot to produce the correct complex segment [**ŋw**]; if the nasal feature were to associate to the root node of **w** and if the labial feature of **m** was maintained (as shown in the medial representation in (23), this would have resulted in a **ŋm**.[10]

5. CONCLUSION

To conclude, we have established that in Sawabantu the labial-velars **gb**, **kp**, **ŋm** are complex segments that developed from the proto-Sawabantu sequences **bw**, **kw**, **mw**, respectively. To explain the formation of the labial-velars, we have proposed that the root node of the **w** segment first delinked from its skeletal slot, thus leaving the labial and dorsal features stranded. We have proposed that the dorsal features of **w** re-associate to the place node of the preceding segment, thus creating a complex segment whose elements are unordered. As for the formation of **ŋw** from **mw**, we have pro-

[9] The coronal node is usually argued to be the default node for consonants. This might be the case for nasals in certain languages as pointed out by Rosenthall (1989). (See also Piggot (1992), Pagett (1991), Sagey (1986a)).

[10] Notice that [**ŋw**] behaves like **kp**, **gb**, and **mw** with respect to compensatory lengthening that is caused by the desyllabified vowel as can be verified in such words like **bwáa** 'murder' and **mweea** 'guest'. These words derive from **/bo-a/** and **/mo-eni/** and the vowel **a** or **e** spreads onto the position of **o** after gliding which reassociates it to the skeletal position of the onset.

posed that it is the root node of the nasal **m** that delinks from the skeletal slot, thus leaving the nasal feature stranded. This nasal acquires the dorsal features of the **w** segment to fill out its place node and its root node re-associates to the skeletal slot of **w**. To obtain these results, we have assumed that a theory that takes the feature rather than the segment as the primitive for building up segments is better suited to account for these correspondences. We have adopted the hierarchical feature of Sagey (1986a) with some adaptations, mainly by stressing the fact that the round feature is essentially a vowel feature and that it regularly drops when its root node bearer is under a consonantal skeletal slot.

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