CHAPTER THREE

SEGMENTAL PHONOLOGY

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1 INTRODUCTION

As in other parts of the grammar, Bantu segmental phonology can be characterized as a theme and variations: despite the large number of languages and great geographic expanse that they cover, the most noteworthy properties concerning Bantu syllable structure, consonant/vowel inventories, and phonological processes are robustly attested throughout the Bantu area. However, these shared features, although striking, mask a wide range of differences which are equally, if not more, important in understanding Bantu phonology in general. It is helpful in this regard to consider both the phonological system inherited from Proto-Bantu (PB), as well as the innovations, often areally diffused, which characterize present-day Bantu subgroups and individual languages.

2 PROTO-BANTU

According to most Bantuists, e.g. Meeussen (1967), PB had the relatively simple consonant and vowel systems in (1).

\[(1) \begin{array}{ll}
(a) \text{consonants} & (b) \text{vowels (long and short)} \\
\text{p t c k} & j u \\
\text{b d j g} & i u \\
\text{m n p} & e o \\
\text{ } & a \\
\end{array} \]

Of the two series of oral consonants in (1a), all scholars agree that the voiceless series *p, *t, *k were pronounced as stops. There is, however, disagreement as to whether *b, *d, *g should be reconstructed as stops or as continuants, i.e. *β, *l, *γ, as they are pronounced in many daughter languages today. It also is not clear whether *c and *j should be viewed as palatal stops or affricates – or whether they were palatal at all. Many Bantu languages realize *c as /s/, and some realize *j as /z/. Realizations of the latter as /y/ or /j/ (i.e. [dʒ]) are, however, probably more common. Although various scholars have occasionally posited additional consonants and series of consonants (e.g. fortis vs. lenis stops) in the proto system, none of these have been demonstrated to the satisfaction of the Bantuist community. On the other hand, much more complex systems have been innovated in the daughter languages as seen in Chapter 2 and below.

There is, by comparison, more stability in the vowel system, which is reconstructed as in (1b). Most scholars agree that PB had seven distinct vowels (7V). As transcribed in (1b), there would have been an opposition in the high vowels between [+ATR] *i [i] and *u [u] and [−ATR] *i [ɨ] and *u [ʊ]. Such a system, exemplified from Nande DJ42 in (2a),
is widely attested, especially in eastern Bantu:

\[(a) \quad \text{lim-} \quad \text{‘exterminate’} \quad \text{lim-} \quad \text{‘be animated’} \]
\[\text{lim-} \quad \text{‘cultivate’} \quad \text{lim-} \quad \text{‘bite’} \]
\[\text{lem-} \quad \text{‘fail to carry sth. heavy’} \quad \text{tom-} \quad \text{‘put aside’} \]
\[\text{lamm-} \quad \text{‘heal’} \]

\[(b) \quad \text{ting-} \quad \text{‘hook’} \quad \text{tung-} \quad \text{‘become thin’} \]
\[\text{beng-} \quad \text{‘chase’} \quad \text{tóng-} \quad \text{‘construct’} \]
\[\text{kéng-} \quad \text{‘observe’} \quad \text{tóng-} \quad \text{‘gather up’} \]
\[\text{tang-} \quad \text{‘flow’} \]

Other Bantu languages such as Koyo C24 in (2b) have the 7V system /i, e, ε, u, o, o, a/, where there is instead an advanced tongue root (ATR) opposition in the mid vowels. Such a system is particularly frequent in western Bantu. (See Stewart 1983 and Hyman 1999 for further discussion of the reconstructed PB vowel system.)

The syllable structures allowed in PB were limited to those in (3).

\[(a) \quad \text{CV, CVV} \quad (b) \quad \text{V, N} \]

Most syllables in PB had one of the two shapes in (3a): a single consonant followed by a vowel that was either short (V) or long (VV), e.g. *pád- ‘scrape’, *péad- ‘quarrel’. The syllable shapes in (3b) were most likely limited to prefixes, e.g. *à- ‘class 1 subject prefix’, *ñ- ‘class 9 noun prefix’. PB roots with non-identical vowels in sequence have also been reconstructed, e.g. *báit- ‘carve’, *bjad- ‘give birth’, but may have involved ‘weak’ intervening consonants, e.g. glides, that dropped out in pre-PB. Many vowel sequences, including some identical ones, e.g. *-tú-*d- ‘rest, put down load’, are analyzable as heteromorphemic, such that Meeussen (1979) questioned whether PB actually had long vowels at all. Others have subsequently arisen through the loss of PB consonants, e.g. *gúb-, *gídá, *ng-jug > Kamba E55 gú ‘baby sling’, n-zu ‘hunger’, n-zou ‘elephant’ (Hinnebusch 1974). In many languages this consonant loss is restricted and results in synchronic alternations between C and O. For example, while *did- ‘cry’ is realized li-a (with FV -a) in Swahili G42, the final *d is realized [l] before the applicative suffix -i-: lil-i-a ‘cry to/for’. Since this form derives from *did-id-a, Swahili appears to disallow /l/-deletion in two successive syllables (forbidding *li-i-a in this case, even though words with three vowels in a row do appear in the language, e.g. teu-a ‘appoint’). In contrast with PB *VV sequences, which are tautosyllabic, neo-VV sequences typically remain heterosyllabic. On the other hand, many Bantu languages have lost the inherited V/VV opposition, e.g. *dóot- ‘dream’ > Tonga M64 lót-, Cewa N31b lót-, Tswana S31 lór-. Others have lost the vowel length contrast only in onsetless syllables, but have retained and even favor CVV, where possible. This is the case in roots such as -j(y)er- ‘sweep’ in Ganda EJ15, where the initial ‘unstable-y’ is realized in all environments except when preceded by a CV- prefix with which the following vowel fuses, e.g. tw-éer-a ‘we sweep’ vs. a-yér-à ‘he sweeps’, n-jér-a ‘I sweep’.

The last syllable type, a low tone nasal, is reconstructible in classes 9 and 10 noun prefixes, while syllabic nasal reflexes of the first person singular subject- and object prefixes derive from earlier *ni-. The nasal of morpheme-internal nasal complexes (NC) sequences appears never to be itself syllabic, although it frequently conditions length on a preceding vowel, e.g. *gënd- [gë:nd-] ‘walk’. If correctly analyzed as two segments, NC constitutes the only consonant cluster in PB. This includes heteromorphemic N+N sequences, although these are subsequently degeminated in many Bantu languages.
At the same time, new syllabic nasals often derive from the loss of the vowel of \*mV- prefixes, especially \*mu-CV > m-CV > N-CV.

Some Bantu languages have developed additional syllable structures, typically by the loss of vowels or consonants – or through borrowings. Most word-final vowels have been lost in Ruwund L53, whose word-final syllables therefore usually end in a consonant, e.g. \*m-b\*a\*d\*a, \*d\*u-k\*i\*n\*j\* > n-vil ‘rain’, r\*i-k\*i\*n ‘firewood’ (Nash 1992). Basaâ A43, on the other hand, has not only lost final vowels, e.g. \*mu-d\*u\*m > n-l\*om ‘male’, but also creates non-final closed syllables by syncopating the medial vowel of CV.CV stems, e.g. \*t\*i\*j\*i\*l ‘untie’ + a ‘passive suffix’ \(\rightarrow\) \*t\*i\*g\*l\*a (Lemb and de Gastines 1973). Closed syllables may also be found in incompletely assimilated borrowings, e.g. Swahili G42 m-k\*r\*i\*s\*t\*o ‘Christian’; Yaka H31, m\*\*/t\*\*t\*\*r\* o ‘hammer’ (\(<\) French m\*\*/t\*\*r\*me\*\*au).

Most Bantu languages maintain a close approximation of the PB situation as far as syllable structure is concerned. The open syllable structure is, in fact, reinforced by the well-known Bantu agglutinative morphology. The typical structures of nouns and verbs are schematized in (4).

### (4)

#### (a) Nouns

<table>
<thead>
<tr>
<th>AUGMENT-</th>
<th>PREFIX-</th>
<th>STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>CV</td>
<td>CV(V)CV</td>
</tr>
<tr>
<td>V</td>
<td>N</td>
<td>CV(V)</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>VCV</td>
</tr>
</tbody>
</table>

**e.g.** Bukusu EJ31  
\(k\*\*i\*-\*m\*\#\*k\*x\*o\*n\*o\) ‘arm’ (class 3)  
\(\*\*\*o\*-\*m\*\#\*x\*a\*s\*i\) ‘woman’ (class 1)  
\(\*\*\*e\*n\*j\*u\*x\*i\) ‘bee’ (class 9)  
\(\*\*\*c\*i\*n\*j\*u\*x\*i\) ‘bees’ (class 10)  
\(\*\*\*l\*i\*i\*b\*e\*e\*l\) ‘breast’ (class 5)

#### (b) Verbs

<table>
<thead>
<tr>
<th>PI-</th>
<th>SP-</th>
<th>NEG</th>
<th>TP-</th>
<th>AP-</th>
<th>OP-</th>
<th>STEM</th>
</tr>
</thead>
</table>
| CV  | CV  | CV  | CV  | CV  | CV  | CV(V)CV ...
| V   | V   | V   | N   |

**e.g.** Nande DJ42  
\(m\*\*o\*-\*t\*u\*-\*t\*e\*t\*a\)-\(\*y\*a\)-\(\*m\*\#\*t\*\*m\*-\*a\)  
‘we didn’t go and send him’

\((\*p\*i\*) = preinitial morpheme, including augment; \(\*s\*p\*) = subject prefix; \(\*n\*e\*g\*) = negative; \(\*t\*p\*) = tense prefix; \(\*a\*p\*) = aspect prefix; \(\*o\*p\*) = object prefix; \(\*f\*v\*) = inflectional final vowel)  

#### (c) Verb stems

<table>
<thead>
<tr>
<th>ROOT-</th>
<th>EXTENSION(S)-</th>
<th>FV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>VC</td>
<td>V</td>
</tr>
</tbody>
</table>

**e.g.** Cewa N31b  
\(l\*i\*m\*-\*i\*t\*s\*i\*-\*l\*i\*n\*-\*a\)  
\(\*r\*o\*o\*t\*-\*c\*a\*u\*s\*-\*a\*p\*p\*-\*r\*e\*c\*-\*f\*v\)  
‘cause to cultivate for each other’

\((\*c\*a\*u\*s\*) = causative; \(\*a\*p\*p\*) = applicative; \(\*r\*e\*c\*) = reciprocal)  

In the above schemas, V stands for any of the seven PB vowels, while C stands for any of the proto-consonants, including, potentially, NC. The most common shape of each morpheme is given in the first row. As seen in (4a,b), pre-stem morphemes (prefixes) are restricted to the shapes CV-, V-, and N-. In (4c), on the other hand, we see that post-root morphemes (suffixes) have the shapes -VC- and -V-. Since most roots begin and end with a C, morpheme concatenation provides almost no potential for consonant clusters, but rather a general alternation of consonant-vowel-consonant etc. The one exception to this occurs when Vs meet across a morpheme boundary. In this case specific rules modify the
resulting \( V+V \) inputs (see §3.2). Other assimilatory and dissimilatory alternations occur when morphemes meet, some of which are restricted to specific domains, e.g. the stem (root + suffixes). Many of these alternations produce output segments beyond those in the above \( V \) and \( C \) inventories. The most widespread phenomena are treated in the following sections, first for vowels (§3), then for consonants (§4).

3 VOWEL PHONOLOGY

While PB had the 7V system in (1b), the majority of Bantu languages spoken in a large and contiguous area have merged the degree 1 and 2 vowels to achieve the five-vowel (5V) system in (5a).

\[
\begin{array}{ccc}
\text{Swahili G40} & \text{Budu D35} & \text{Bafia A53} \\
(a) & i & u \\
& e & o \\
& a & e \\
& i & u \\
& e & o \\
& a & a \\n\end{array}
\]

A few languages have gone the other direction and developed the 9V system in (5b). While this system appears to be underlying in Budu D35 (Kutsch Lojenga 1994a), other languages such as Nande DJ42 in nearby Northeast République Démocratique du Congo and the Sotho-Tswana S30 group in South derive the eighth and ninth vowels [e] and [o] from the tensing/raising of the degree 3 vowels \( *e \) and \( *o \), respectively. Finally, some of the languages in zone A, such as Bafia A53 in (5c), have developed ‘rectangular’ vowel systems with back unrounded vowels (see Guarisma, Ch. 17, this volume) and also nasalized vowels, e.g. in the Teke B70 group, both of which also appear in Grassfields Bantu (see Watters, Ch. 14, this volume).

3.1 Distributional constraints on underlying vowels

As indicated in §2, Bantu phonology is highly sensitive to morphological considerations. Underlying vowel distribution within specific morphological slots and morphological or prosodic domains is thus highly restricted in both 7V and 5V languages. Meeussen (1967), e.g. allows for the following vowels in each of the indicated positions:

\[
\begin{array}{cccccccc}
*\text{i} & *\text{u} & *\text{i} & *\text{u} & *\text{e} & *\text{o} & *\text{a} \\
\text{first stem syllable} & x & x & x & x & x & x & x \\
\text{final stem vowel} & x & x & x & x & x & x & x \\
\text{elsewhere} & x & x & x & x & x \\
\end{array}
\]

As seen, the seven vowels of PB contrast in the first and last syllables of a stem, but not in prefixes, extensions or stem-internal position, where only four vowels contrast. In a few cases involving reduplication, the vowel \( *\mu \) appears in the first two syllables of a verb, e.g. \( *\text{dudum}-\) ‘rumble, thunder’, \( *\text{pupum}-\) ‘boil up, boil over’. The root \( *\text{takun}-\) ‘chew’, on the other hand, appears to be exceptional.
Some languages, particularly 5V ones, have further restricted this distribution by position within the stem or word. Thus, Punu B43, which has the underlying system /i, u, e, a, a/ restricts /e/ and /o/ to stem-initial syllables only (Kwenzi Mickala 80). In Bobangi C32 (7V), /u/ may not occur in prefixes, nor may any of the rounded vowels /u, o, œ/ appear later than the second syllable in stems.

3.2 Vowel alternations

In addition to underlying constraints on vowel distribution, most Bantu languages severely restrict the sequencing of vowels, particularly within stems. Thus, while Punu B43 allows only /i, u, a/ in post-stem position, /a/ is reduced to schwa in this position, and the expected post-stem sequences [œCi] and [œCu] surface instead as [iCi] and [uCu], e.g. the historical suffix sequences /-am-il-/ (positional-applicative) and /-am-ul-/ (positional-reversive tr.) are realized [-imin-] and [-umun-]. In addition, a post-stem /a/ ([œ]) assimilates to a FV-i, and both post-stem /a/ and /i/ assimilate to a FV-u (Fontaney 1980). The Punu case demonstrates two general properties of Bantu vowel systems: (i) there are typically more contrasting underlying vowels in the stem-initial syllable, and (ii) vowels in this position may be exempt from reduction and assimilation processes that post-stem vowels undergo. Ruwund L53 (5V) once had the same vowel distribution as Punu, disallowing mid vowel from post-stem position. However, it has since undergone considerable vowel reduction, e.g. by dropping most word-final vowels, e.g. *mũ=kʌdʒ > mũ=kaj ‘wife’ (Nash 1992). While unusual in tolerating word-final closed syllables (analyzed with a phantom vowel by Nash), Ruwund is perhaps unique in its overall vowel system in (7a).

(7) (a) i u ii uu
    ee oo
    a a
(b) *e > i e.g. *dèm- > lìm ‘be lame’, *dèd- > -lil ‘raise (child)’
    *o > a e.g. *bôn- > -màn ‘see’, *pôt- > pwàt ‘twist’

As seen in (7a), short /e, o/ are missing, since they have reduced, respectively, to the peripheral vowels [i] and [a], respectively, as illustrated in (7b). In this atypical case, vowels in the stem-initial syllable were successfully targeted.

By far the most widely attested assimilatory process is vowel harmony, particularly vowel height harmony (VHH). As indicated in (8) and (9):

(8) Front height harmony (FHH)
    (a) General: i → e / {e, o} C ___
    (b) Extended: i → e / {e, o, a} C ___

(9) Back height harmony (BHH)
    (a) General: u → o / {o} C ___
    (b) Extended: u → o / {e, o} C ___

the historical degree-2 vowels (*i, *u) harmonize in height with a preceding mid vowel. The process is frequently different with respect to the front vs. back vowel (Bleek 1862). In a wide range of central and eastern Bantu languages, degree-2 /i/ lowers after both /e/ and /o/, while degree-2 /u/ lowers only after /o/. Examples of such ‘asymmetric’ FHH vs. BHH are seen from Nyamwezi F22 in (10), based on
Maganga and Schadeberg (1992):

(10) Root + Applicative -il- Root + Separative -ul-

(a) βίσ-il- ‘hide for/at’ βίσ-úl- ‘find out’
   gub-il- ‘put on lid for/at’ gub-úl- ‘take off lid’
   pimd-il- ‘bend for/at’ pimd-úl- ‘overturn’
   shuun-il- ‘gnaw for/at’ shuun-úl- ‘show teeth’
   gáá-il- ‘divide for/at’ gáá-úl- ‘divide’
(b) bón-il- ‘see for/at’ hong-úl- ‘break off’
(c) zeeng-el- ‘build for/at’ zeeng-úl- ‘build’

There is no harmony in (10a), where the root vowel is either high or low. In (10b) VHH applies to both -il- and -ul- when the root vowel is /o/. However, in (10c), where the root vowel is /e/, -il- lowers to -el-, but -ul- remains unchanged. This contrasts with the situation in the E40 group, e.g. Gusii E42 (7V), as well as in many Northwest Bantu languages, e.g. Mongo C61 (7V), whose vowel systems are analyzed as /i, e, u, o, ə, a/.

In languages such as Mongo-Nkundo in (11), the back degree-2 vowel also harmonizes, and FHH and BHH are thus ‘symmetric’:

(11) Root + Applicative -el- Root + Separative -ol-

(a) -íy-el- ‘steal for/at’ -íso-l- ‘uncover’
   -lík-el- ‘paddle for/at’ -kund-ol- ‘dig up’
   -ét-el- ‘call for/at’ -bét-ol- ‘wake up’
   -tóm-el- ‘send for/at’ -komb-ol- ‘open’
   -kamb-el- ‘work for/at’ -búk-ol- ‘unite’
(b) -kt-ol- ‘cut for/at’ -móm-ol- ‘unglue’
   -kend-el- ‘go for/at’ -tèng-ol- ‘straighten out’

As indicated in (8b), harmony of /i/ to [e] after /a/ is also attested, particularly in languages towards the Southwest of the Bantu zone, e.g. Mbundu H21a, Kwangali K33a, Herero R31. While VHH is generally perseverative and limited to the stem domain minus the FV, some languages – particularly those with symmetric FHH/BHH – have extended harmony to the FV and to prefixes. It is important to note that in many 5V Bantu languages, only those /i/ vowels that derive from *i harmonize, while those that derive from *i do not. Other languages have modified this original situation and harmonize the perfective ending *-id-e as well (Bastin 1983b). In Yaka H31 and certain dialects of Kongo H10, VHH is anticipatory and is triggered primarily by the *-e of perfective *-id-e. In addition, some of the same languages that have symmetric VHH have extended the process to prefixes, e.g. Mituku D13 (7V) /tú-mú-lok-é/ → tô-mó-lok-é ‘we bewitch (subjunctive)’. For more discussion of variations in Bantu VHH, see Leitch (1996), Hyman (1999) and references cited therein.

Besides height, other features may also participate in vowel harmony. Closely related Konzo DJ41 and Nande DJ42 have introduced an ATR harmony, whereby /i, o, e, ə/ become [i, u, e, o] when followed by /i/ or /y/. They thus have an underlying 7V system (cf. (2)), but introduce two additional, non-contrasting vowels, [e] and [o], by ATR harmony. Clements (1991) provides an overarching framework to treat VHH and ATR harmony in related fashion. Other Bantu languages have innovated rounding harmonies, e.g. perseverative i → u / u _ in Lengola D12 vs. anticipatory i → u / _ u in Punu B43. In Maore G44D, regressive rounding harmony even reaches the root vowel: u’#finiki-a ‘cover’, u’#fanuku-a ‘uncover’. Finally, it should be noted that many Northwest Bantu 7V languages modify /a/ to [e] after /e/ and to [ɔ] after /ɔ/, e.g. Bakweri A22, Tiene B81, Lingala C36d or, in the case of Bembe H11 (5V), to [e] and [o], respectively.
The above shows the assimilation of one vowel to another across a consonant. When vowels occur in direct sequence, they typically undergo gliding or deletion. Thus, in Ganda EJ15, when followed by a non-identical vowel, e.g. the FV -a, the front vowels /i, e/ glide to [y], as in (12a), and the back vowels /u, o/ glide to [w], as in (12b):

(12) (a) /li-a/ ‘eat’ [lyáá …] cf. a#li-dd-è ‘he has eaten’
/kè-a/ ‘dawn’ [kyáá …] lú#kè-dd-è ‘it has dawned’
(b) /gu-a/ ‘fall’ [gwa …] a#gù-dd-è ‘he has fallen’
/mo-a/ ‘shave’ [mwa …] a#mwé-dd-è ‘he has shaved’
(c) /bá-a/ ‘be’ [báá …] a#bá-dd-è ‘he has been’
/tá-a/ ‘let go’ [tàa …] a#tá-dd-è ‘he has let go’

[(SM + Root + Perf + FV)]

As seen in the outputs, gliding of /i, e/ and /u, o/ is accompanied by compensatory lengthening of the following vowel. In Ganda, this length will be realized if word-internal (or if the above verb stems are followed by a clitic). Otherwise it, as well as the length obtained from concatenation of /a/+ /a/ in (13c) will undergo final vowel shortening (FVS), e.g. ku#lyàa = kò ‘to eat a little’ vs. ku#lyà ‘to eat’.

The details of vowel coalescence may depend on whether the vowels are tautomorphic vs. heteromorphic, and whether the vowel sequence is contained within a word or not. Thus, instead of gliding, the mid vowels /e, o/ join /a/ in undergoing deletion when followed by a non-identical vowel across a word boundary:

(13) (a) mu#sibè + o#mù → [mu.si.bòò.mù] ‘one prisoner’
mu#walà + o#mù → [mu.wa.lòò.mù] ‘one girl’
(b) m#bogò + e#mù → [m.bo géè.mù] ‘one buffalo’
n#dígà + e#mù → [n.di.geè.mù] ‘one sheep’
(c) ba#sibè + a#bà-o → [ba.si.bàà.bo] ‘those prisoners’
ba#kò + a#bà-o → [ba.káá.bo] ‘those in-laws’

As also seen, deletion, like gliding, is accompanied by compensatory lengthening.

In many cases, the expected glide may not be realized if preceded by a particular consonant or followed by /a, o/. In Ganda, an expected [w] is not realized when preceded by /f, v/, e.g. /fu-a/ → fw-aa → [fàa …] ‘die’. Similarly, an expected [y] is ‘absorbed’ into a preceding by /sI, zI/ or palatal consonant, e.g. /se-a/ → sy-aa → [sàa …] ‘grind’. In Ruwund L53, [w] is usually absorbed when preceded by an /m/ or /k/ and followed by /oI, e.g. /ku#ooò-à/ → [kwoò] ~ [koo] ‘to burn’.

In cases where /a/ is followed by /i/ or /u/ (typically from PB *i and *u), a coalescence process can produce [ee] and [oo], respectively, e.g. Yao P21 /ma#íso/ → méésò ‘eyes’. This coalescence also occurs in the process of ‘imbrication’ (§4.2), whereby the [i] of the perfective suffix is infixed and fuses with a base vowel, e.g. Bemba M42 isal-il-e → isail-e → iseel-e ‘close (tr.) + perfective’.

With these observations, we now can summarize three of the five sources of vowel length in Bantu: (i) from underlying representations (lim- ‘cultivate’, liim- ‘extinguish’); (ii) from vowel concatenation, e.g. /bá#agàl-a/ → [báágàla] ‘they want’; (iii) from gliding + compensatory lengthening, e.g. /tú#agàl-a/ → [twàágàla] ‘we want’. A fourth source is the rule of vowel lengthening that occurs before a moraic nasal + consonant, e.g. /ku#n#sib-a/ → [kùùnsìba] ‘to tie me’ (cf. §4.1.5). A fifth source is penultimate vowel lengthening, which occurs in most eastern and southern Bantu languages which have lost the lexical vowel length contrast, e.g. Cewa N31b, t-a#meyn-à ‘we have hit’, t-a#meny-eel-à ‘we have hit for’, t-a-meny-el-aan#à ‘we have hit for each other’.
Besides these lengthening processes, vowel shortening may also apply in one of three contexts. First, there may be FVS with languages varying as to whether this occurs at the end of a word or phrase (or ‘clitic group’, as in Ganda EJ15). Second, there are a number of languages which restrict long vowels to penultimate or antepenultimate position. Thus, any long vowel that precedes phrase-antepenultimate position will be shortened in Mwiini G412 (Kisseberth and Abasheikh 1974): reeba ‘stop’, reeb-er-a ‘stop for’, reber-an-a ‘stop for each other’. Similar observations have been made about the Kongo H10 languages and nearby Yaka H31 (which also restricts long vowels to occurring within the stem-initial syllable): zááy-á ‘know’, zááy-il-á ‘know + appl’, zááy-is-á ‘cause to know’; but: zááy-ákán-á ‘be known’, with shortening. In Safwa M25, the shortening process appears to count the two moras of a CVV penultimate syllable: a-gaa≠gúz-y-a ‘he can sell’, a-ga≠buúz-y-a ‘he can ask’ vs. a-ga≠buz-y-aág-a ‘he may ask’. Finally, a few languages have closed syllable shortening, e.g. before geminate consonants in Ganda EJ15: /tú-a-eé≠tt-a/ → [twéttà] ‘we killed ourselves’.

In addition to length, vowel height may be sensitive to boundaries. In a number of Interlacustrine languages, historical *i and *u lower to [e] and [o] at the beginning of a constituent. This is particularly noticeable in comparing the augment + prefix sequences across languages, e.g. class 3/4 u-mu-/i-mi- in Rwanda DJ61 vs. o-mu-/e-mi- in Haya EJ22. In Nyambo EJ21, lowering of /i/ and /u/ occurs only initially in a phrase. As a result, the lowered [o] of the phrase-initial form, o-mu≠kázi ‘woman’, alternates with [u] in ku-bón ú-mu≠kázi ‘to see a woman’, where the final -a of ku≠bón-a ‘to see’ has been deleted – in this case, without compensatory lengthening. Besides lowering, vowels are sometimes deleted initially, especially in roots, e.g. PB *jib-a > ib-a > Cewa N31b [ba] ‘steal’. Although restructured as a prefix, the original [i] appears in the imperative form iba ‘steal!’ (phrase-finally, [iba]), where it is needed to fill out the bisyllabic minimality condition on Cewa words.

4 CONSONANT PHONOLOGY

As indicated in §2, PB is believed to have had a relatively simple consonant system. In addition, all syllables were open in PB, and syllable onsets mostly consisted of a single consonant. The two possible exceptions to this are nasal + consonant and consonant + glide.

4.1 Nasal + consonant

Besides the consonants in (1a), PB and most present-day languages also have NC, written mp, mb, nt, nd, nk, ng, etc., and analyzed either as clusters of homorganic nasal + consonant or single prenasalized consonants, e.g. *büm-b- ‘mould’, *geng- ‘go’, *tAvg- ‘read’ (Herbert 1986). The class 9/10 PB first person singular morpheme is also often realized as a homorganic nasal in present-day languages, e.g. Ganda EJ15 m≠bal-a ‘I count’, n≠dúm-á ‘I bite’, ḗ≠gw-a ‘I fall’. While the prefix is an underspecified homorganic N- in 9/10, we know from such forms as Yao P21 n-áá≠dip-il-é ‘I paid’, where the nasal appears before a vocalic tense marker, that the 1sg prefix has an underlying /n/. In some languages where 9/10 is N-, the 1sg prefix has a CV shape, e.g. Swahili G42, Cewa N31b ni-, Shona S10 nd-, Nande DJ42 jui- (alternating with n-).
The 9/10 prefix \(N^−\), on the other hand, rarely occurs directly before a vowel, since roots generally begin with a consonant.

In PB, noun and verb roots did not begin with NC. Root-initial NC has subsequently been introduced in Bantu languages which have lost root-initial \(*jj\) or \(*ji\), e.g. Kalanga S16 \(ngin-a\) ‘enter’ (*\(j\)ingid-), \(mb-\)á ‘sing’ (*\(j\)imb-). This is true also of the root -\(ntu\) ‘person, thing, entity’, which derives from \(*j\)intu. In other cases where a stem appears to begin with NC, the nasal may have originally been a prefix, e.g. transferred from 9/10 with the \(N^−\) to another class, which then imposes its own prefix. It is sometimes still possible to analyze such forms as double prefixes, e.g. Cewa N31b \(chi-m\#bombó\) 7/8 ‘glutton’ (cf. \(m\#bombó\) 1/2 ‘greedy person’).

While most Bantu languages preserve NC, many have restrictions either on which \(N+C\) combinations are possible, or in where within the word structure NC may occur. Thus, Tiene B81 allows NC across morpheme boundaries, e.g. class 9 \(n\#tábà\) ‘goat’, but simplifies stem-internal NC, e.g. \(mú\#ótò\) ‘person’ (*-(\(j\)i)ntu). In the same language, stem-internal \(*mb\), \(*nd\) become \([m, n]\) with compensatory lengthening or diphthongization of the preceding vowel, while \(*ŋ\) is deleted with no trace, e.g. \(tùùm-\)á ‘cook’ (*\(#\)mb-\), \(kùùn-\)á ‘desire’ (*\(#\)nd-), \(tí-\)á ‘build’ (*\(#\)ng-\). On the other hand, Yao P21 deletes a root-initial voiced consonant after the 1sg prefix \(N^−\), but not after the 9/10 prefix \(N^−\). Thus, /\(ku-n\#gaadil-a/ → kuu-\#gáadila/ ‘to stare at me’ vs. \(ŋ\#gùbò\) ‘cloth’ (< PB \(ŋ\#gùbô\)).

Where a consonant C is realized differently (C') after N, it is important to note that this may be due to either of two logical possibilities: C is modified to C' after N; or C' becomes C except after N. The latter situation is frequently found with respect to the post-nasal consonant, the various \(N+C\) inputs can undergo a variety of processes:

### 4.1.1 Nasal + voiceless stop

Perhaps the most widespread process affecting NC is post-nasal voicing, attested in Nande DJ42, Kikuyu E51, Bukusu EJ31c and Yao P21. Examples from Yao are illustrated in (14).

\[
\begin{align*}
(14) \quad \text{(a) } & \text{ku-\#pélék-a} & \text{‘to send’} & \text{(b) } & \text{kùù-m\#bélèk-a} & \text{‘to send me’} \\
& \text{ku-\#túm-\á} & \text{‘to order’} & \text{kuu-n\#dúm-a} & \text{‘to order me’} \\
& \text{ku-\#cápíl-a} & \text{‘to wash’} & \text{kuu-\#jápíl-a} & \text{‘to wash for me’} \\
& \text{ku-\#kwéél-\á} & \text{‘to climb’} & \text{kuu-\#gùwéél-a} & \text{‘to climb on me’}
\end{align*}
\]

Another process affecting voiceless stops is aspiration, e.g. in Cewa N31b, Kongo H10, Pokomo E71 and Swahili G42. The illustration in (15) is from Kongo:

\[
\begin{align*}
(15) \quad \text{(a) } & /\(ku-N\#pun-\á/) → ku-\#m\#phun-\á/ & \text{‘to deceive me’} \\
& /\(ku-N\#tál-\á/) → ku-\#n\#thál-\á/ & \text{‘to look at me’} \\
& /\(ku-N\#kiyíl-a/) → ku-\#n\#khiyíl-a/ & \text{‘to visit me’}
\end{align*}
\]

The resulting NCh unit may then undergo nasal effacement (\(nt\#nth\#th\)), as in Swahili G42, or de-stopping (\(nt\#nth\#nh\)), as in Rwanda DJ61, Rundi DJ62, and Shona S10, where \(*umù\#(\(j\)i)ntu\) ‘person’ is realized as \((u)mu\#nhu\) (cf. Nyamwezi F22 \(m\#nhu\)).
The resulting \( Nh \) may then simplify to \( N \). This is presumably the chain of events that have characterized the southern Tanzanian languages Hehe G62, Pangwa G64 and Kinga G65, which have \( nt > n \), as seen from closely related Wanji G66, which has \( nt > nh \).

4.1.2 Nasal + voiceless fricative

Three different strategies are also commonly seen when a nasal is followed by a voiceless fricative. First, the nasal may simply be effaced, even in languages such as Yao P21, which voice post-nasal voiceless stops, e.g. \( ku-n\#\text{sôosa} \rightarrow kuu\#\text{sôosa} \) ‘to look for me’.

The second strategy is seen in Nande DJ42, which extends post-nasal voicing to include fricatives, e.g. \( o\#\text{lu\#sângâ} \) ‘pearl’, pl. \( e\#\text{n\#sângâ} \). A third strategy found in languages such as Kongo H10, Yaka H31 and Venda S21 is affrication. As seen in the Kongo forms in (16), post-nasal affrication can also affect voiced fricatives:

(16) Post-nasal affrication in Kongo (Carter 1984)

\[
\begin{align*}
(16) \quad & (a) \quad /\text{ku-N}\#\text{fil-}a/ \rightarrow k\text{ú-m}\#p\text{fil-}a \quad \text{‘to lead me’} \\
& /\text{ku-N}\#\text{tsib-}a/ \rightarrow k\text{ú-n}\#\text{tsib-}a \quad \text{‘to curse me’} \\
& (b) \quad /\text{ku-N}\#\text{vun-}a/ \rightarrow k\text{ú-m}\#\text{vun-}a \quad \text{‘to deceive me’} \\
& /\text{ku-N}\#\text{zöl-}a/ \rightarrow k\text{ú-n}\#\text{dzol-}a \quad \text{‘to love me’}
\end{align*}
\]

In Tuki A64, which has nasal effacement before voiceless consonants, \( /n+s/ \) becomes \( [ts] \), as expected, but \( /nt+f/ \) becomes \( [p] \), e.g. \( /a\#n\#\text{seya-}r\text{í} \rightarrow a\#t\text{seya-}m \) ‘he abuses me’, \( /a\#n\#\text{fununa-}r\text{í} \rightarrow a\#\text{pununa-}m \) ‘he wakes me up’. This is presumably because \( [f] \) comes from earlier \( *p \). Thus, besides conditioning changes which can be characterized as ‘strengthening’ or ‘fortition’, a nasal can block the opposite lenition processes (e.g. \( *p > f \)).

4.1.3 Nasal + voiced consonant

As mentioned above and seen in (17a),

(17) (a) \( /\text{ku-n}\#\text{búúcil-}a/ \rightarrow k\text{uu}\#\text{múúcil-}a \) ‘to be angry with me’

\( /\text{ku-n}\#\text{láp-}a/ \rightarrow k\text{uu}\#\text{náp-}a \) ‘to admire me’

\( /\text{ku-n}\#\text{jiim-}a/ \rightarrow k\text{uu}\#\text{niim-}a \) ‘to begrudge me’

\( /\text{ku-n}\#\text{gónék-}a/ \rightarrow k\text{uu}\#\text{nónek-}a \) ‘to make me sleep’

(b) \( /\text{ku-n}\#\text{mál-}a/ \rightarrow k\text{uu}\#\text{mál-}a \) ‘to finish me’

\( /\text{ku-n}\#\text{nósy-}a/ \rightarrow k\text{uu}\#\text{nósy-}a \) ‘to take care of me’

\( /\text{ku-n}\#\text{pál-}a/ \rightarrow k\text{uu}\#\text{nádil-}a \) ‘to cut me in small pieces’

\( /\text{ku-n}\#\text{ňádil-}a/ \rightarrow k\text{uu}\#\text{nádil-}a \) ‘to play around with me’

Yao P21 deletes post-nasal voiced consonants other than \( [d] \), e.g. \( ku-n\#\text{dipa} \rightarrow kuu-n\#\text{dipa} \) ‘to pay me’. This includes nasal consonants in (17b), since many Bantu languages do not tolerate NN sequences. On the other hand, voiced continuants may alternate with stops (or affricates) after a nasal, e.g. Ganda EJ15 \( /n\#\text{láb-}a/ \rightarrow n\#\text{dáb-}a \) ‘I see’, Tuki A64 \( /a\#n\#\text{rama-}r\text{í} \rightarrow a\#\text{dama-}m \) ‘he pulls me’.

Post-nasal voiced consonants may also be nasalized, in which case a geminate nasal is produced. This is most readily observed in the case of Meinhof’s Law. Known also as the Ganda Law, and illustrated from that language in (18):

(18) \( /n\#\text{bomb-}a/ \rightarrow m\#\text{momb-}a \) ‘I escape’

\( /n\#\text{limb-}a/ \rightarrow n\#\text{nimb-}a \) ‘I lie’

\( /n\#\text{jung-}a/ \rightarrow n\#\text{unjung-}a \) ‘I join’

\( /n\#\text{gend-}a/ \rightarrow n\#\text{dend-}a \) ‘I go’
a nasal + voiced consonant becomes a geminate nasal when the next syllable also begins with a nasal. The original motivation for this change is seen as the simplification of NCVNC sequences (cf. §4.5). However, many of the languages have extended the process to include forms where the second nasal is not an NC complex, e.g. Ganda EJ15 /n#lim-a/ → n#nim-a ‘I cultivate’. Interestingly, Yao P21, which fails to delete [d] after a nasal in an oral context, will as a result of Meinhof’s Law do so if the following syllable is an NC complex, e.g. /ku-n#diing-a/ → ku-n#niing-a → kuu#niing-a ‘to try me’.

4.1.4 Other processes

The above seems to indicate that Bantu languages prefer that post-nasal consonants be [+voice] rather than [−voice] and [−continuant] rather than [+continuant]. Voiceless stops tend to become aspirated, and voiced stops tend to become nasalized. While these generalizations reflect the common processes affecting post-nasal consonants, it is important to note that opposing ‘counter-processes’, though less common, are also found. For example, voiced stops are devoiced and variably pronounced as ejectives in Tswana S31 and Sotho S33: bôn-a ‘see!’, m#pôn-a ‘see me!’; dis-à ‘watch’, n#tis-à ‘watch me!’. Aspirated stops are deaspirated in Nguni languages, e.g. Ndebele S45 ulu#thi ‘stick’, pl. izin#ti. Affricates become deaffricated in a number of languages, e.g. Shona S10 bvum-a ‘agree, admit’, vs. m#vum-o ‘permission, agreement’. Finally, and perhaps most unusual, nasal consonants are denasalized after another nasal in Punu B43, Lingala C36d, Bushong C83, Kongo H10, Yaka H31, e.g. Yaka m#bák-ini ‘I carved’ (mak- ‘carve’), n#diük-ini ‘I smelt’ (nuuk-).

4.1.5 Moricity

In most Bantu languages there is no vowel length opposition before an NC complex. Rather, as seen in many of the cited examples, the preceding vowel is frequently lengthened. The standard interpretation is that this nasal is ‘moraic’, i.e. it contributes a unit of length or ‘beat’, which readily transfers to the preceding vowel. It also is potentially a tone-bearing unit. This is most transparently seen in languages which allow NN sequences, or when the nasal is syllabic and phrase initial, e.g. Haya E22 m-bwa ‘dog’. However, even when the nasal loses its syllability and compensatorily lengthens the preceding vowel, some languages still treat it as a tone-bearing unit, e.g. Ganda EJ15, while others do not, e.g. Haya EJ22, Bemba M42 (see Ch. 4).

4.1.6 New cases of NC

While the preceding subsections characterize the phonology of NC complexes inherited from PB, many Bantu languages have introduced new sequences of N+C. The most common source is the loss of [u] in mu- prefixes, e.g. Swahili G42 m#thu ‘person’, m#toto ‘child’. The resulting syllabic [m] may then undergo homorganic nasal assimilation, as it does in most dialects of Yao P21, e.g. j’#külú ‘elder sibling’ 1, n’#sééNgó ‘horn of antelope’ 3, b’#gólo-golo ‘in the weasel’ 18 (N’ = syllabic). The loss of the [u] of mu-prefixes also extends to the second person plural SP and the class 1 OP, but will frequently not take place if followed by a vowel or NC, e.g. Yao mu#uso ‘bow of boat’ 3, muu#ndu ‘person’ 1, mw-ii#gaasa ‘handful’ 18 (cf. di#gaasa ‘palm of hand’ 5). Vowel-deletion can also be blocked if the stem is monosyllabic, e.g. mu#si ‘village’ 3.
The resulting NC may contrast phonetically or phonologically with PB *NC in several ways. First, as the Y ao examples illustrate, the nasal from *mu- is typically syllabic, while the nasal from *NC loses its syllabicity (Hyman and Ngunga 1997). Second, the nasal from *mu- does not condition the same alternations on the following consonant (e.g. voiceless stops do not become voiced after N’- in Y ao). In Tswana S31, where m+b is normally realized [mr] (cf. §4.1.4), mu- loses its vowel when followed by stem-initial /b/, which in turn is realized [m], e.g. mu=bú-s-i → m=mú-si ‘governor’ (cf. bú-s-a ‘to govern’). Contrast this last example with Matumbj P13 (Odden 1996), where class 9/10 N- does not condition changes on voiced stops (lú=gój ‘braided rope’, pl. yú=gói), but N’- from *mu- does (e.g. mu=gáala ~ y=gáala ‘in the storage place’ 18). A third difference is that N’- does not condition lengthening on the preceding vowel, cf. Haya EJ22 /a-ka-n-bing-a/ → a-káá-m-bíng-a ‘he chased me’ vs. /a-ka-mú-bíng-a/ → a-ka-mí-bíng-a ‘he chased him’. Finally, there can be a tonal difference, even in cases where there is no difference in syllabicity. Thus, in Basaá A43, class 3 N- (<*mu- > (a) *pí > pʰi > pí > fi
(b) *bí > bʰi > bvi > vi
(c) *tí > tʰi > tsí > si
(d) *dí > dʰi > dzi > zi
(e) *kí > kʰi > ksi > tsí > si
As indicated, these changes are first triggered by the development of ‘noise’ in the release of a consonant before the tense high vowels *i and *u. Indicated as "nu" in (19), the present-day reflex can, in fact, be aspiration, as in Makua P31 – cf. Kalanga S16 thúm-á ‘saw’ (*túm- > túm- ‘send’ (*-túm-). Similarly, /t, d/ are aspirated before /i/ in Doko C31 (7V): /ká=tíyá /i-díyá’ → [ká=tíyá] ‘traverse’, [i=tíyá] ‘tooth’. In most languages, however, C” is further modified either to an affricate or fricative, as indicated, e.g. Ngom B22h kfuža ‘chicken’ (*kúža). Such modifications are found in all 5V languages except Lengola D12, as well as in many 7V systems (Schadeberg 1994–5).

As seen above in (6), *u was almost entirely restricted to the first and last stem syllables in PB, although it also occurs in stem-internal position in the PB root *-takun-, ‘chew’ which has reflexes such as Cewa N31b tafun-a, Pende L11/K52 tafun-a, Venda S21 tafun-a, Yao P21 tawun-a, and (with metathesis), Nkore-Kiga EJ13/14 and Nyambo EJ21

4.2 Consonant + high vowel

Besides the post-nasal environment, consonants are frequently realized differently before high vs. non-high vowels. First and foremost is the process of frication which affects consonants when they are followed by *i, and *u, producing changes such as those schematized in (19).

(19) (a) *pí > pʰi > pí > fi
(b) *bí > bʰi > bvi > vi
(c) *tí > tʰi > tsí > si
(d) *dí > dʰi > dzi > zi
(e) *kí > kʰi > ksi > tsí > si

As indicated, these changes are first triggered by the development of ‘noise’ in the release of a consonant before the tense high vowels *i and *u. Indicated as "nu" in (19), the present-day reflex can, in fact, be aspiration, as in Makua P31 – cf. Kalanga S16 thúm-á ‘saw’ (*túm- > túm- ‘send’ (*-túm-). Similarly, /t, d/ are aspirated before /i/ in Doko C31 (7V): /ká=tíyá /i-díyá’ → [ká=tíyá] ‘traverse’, [i=tíyá] ‘tooth’. In most languages, however, C” is further modified either to an affricate or fricative, as indicated, e.g. Ngom B22h kfuža ‘chicken’ (*kúža). Such modifications are found in all 5V languages except Lengola D12, as well as in many 7V systems (Schadeberg 1994–5).

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fútan-a. Synchronic alternations are found in languages which use the *-*u suffix to derive adjectives or nouns from verbs, e.g. Ganda EJ15 nyee-‘become fat’ → nyééf-ü ‘fat’; lebe-‘be loose’ → lebévé-ü ‘loose’; tamii-‘become drunk’ → mu#tamiv-ü ‘drunkard’.

*i* also most frequently occurred in the first and last stem syllables in PB, but also in noun class prefixes, e.g. class 8 *bi- >* Shona S10 class 8 *zi- (with a ‘whistled’ labioalveolar [z]). In many Bantu languages, synchronic alternations are conditioned by one or more of the three suffixes reconstructed with *i*. The first of these is the causative suffix *-i- (which must in turn be followed by a FV). As seen in the Bemba M42 forms in (20):

(20) (a) -leep- ‘be long’ → -leef-i- ‘lengthen’ [leef-y-a]
- lub- ‘be lost’ → -luf-i- ‘lose’ [luf-y-a]
(b) -fítt- ‘be dark’ → -fiis-i- ‘darken’ [fiis-a]
-cind- ‘dance’ → -cins-i- ‘make dance’ [cins-a]
-lil- ‘cry’ → -lis-i- ‘make cry’ [liš-a]
-buuk- ‘get up (intr)’ → -buus-i- ‘get [s.o.] up’ [buus-a]
-lúng- ‘hunt’ → -lúns-i- ‘make hunt’ [lúns-á]

when followed by causative *-i-, labial /p, b/ become [f] and lingual consonants become [s] (subsequently modified to [š] by palatalization, e.g. /sit-/ → [šit-] ‘buy’). The second suffix is *-i, which derives nouns, often agentives, from verbs, as in Ganda EJ15 o-mú#ddus-i ‘fugitive’ (<‘ddu- ‘run (away)’), o-mu#lez-i ‘guardian’ (<‘ler- ‘raise (child)’). Finally, the bimorphemic ‘perfective’ suffix *-id-e also frequently conditions frication (Bastin 1983b), e.g. Nkore E13 -réet-‘bring’, perfective -réets-ir-e; Rundi DJ62 rir- ‘cry’, perfective riz-e (<rir-y-e <*did-ij-e).

While such frications occur frequently throughout the Bantu zone, there is considerable variation. Not only can the exact reflexes differ, but so can the environments in which they occur. In Bemba M42, for instance, only causative *-i- regularly conditions frication. In Yao P21, frication before causative *-i- is more widespread than before perfective *-id-e, but may also always occur before the latter if the preceding consonant is either [l] or [k], i.e. the two consonants which occur most frequently in extensions (Ngunga 2000). What this indicates is that frication, although originally an across-the-board phonological process, has acquired morphological restrictions and, in some cases, has been leveled out completely. Thus, the [i] of Bemba M42 -il-e not only fails to condition frication, but has been restructured, on analogy with suffixes such as applicative -il/-el-, to undergo, e.g. fík-il-e ‘arrive + perfective’ vs. beb-el-e ‘lie + perfective’. The perfective suffix -il-e continues to differ from the applicative -il- in its ability to fuse or ‘imbricate’ with verb bases that end in a range of consonants, e.g. kíngub- ‘gather’ → perfective kíngwiib-e vs. applicative kíngub-il-a (Bastin 1983, Hyman 1995a).

The vowels *i* and *u* may have effects on preceding consonants other than frication. While nasals are usually exempt from the effects of degree 1 high vowels, Ganda EJ15, *i* palatalizes /n/; e.g. o-mu#son-i ‘tailor’ (<‘son- ‘sew’). A much more frequent phenomenon concerns the realization of PB *d, which may be preserved as [d] before [i], but realized as [l] or [r] before other vowels. This occurs both in 7V languages, e.g. Duala A24, Tienne B81, Bobangi C24, as well as in 5V languages, e.g. Kongo H16, Lwenia K14, Kwezo K53, Dciriku K62, Kete L21 and certain dialects of Yao P21. In the 5V languages *di* is typically realized as [dzi] or [zi], and *di* is realized [di]. (Unless preceded by a nasal, *d is realized as [l] or [r] before other vowels.) The synchronic situation is considerably obscured in Ruwund L53, where *di is realized [di] and *de is realized as [li] (cf. §3.2). In other languages the effect is extended to the high back vowel *u, e.g. Tswana S31.
(7V). In Kalanga S16 (5V), *\text{du}" is realized [\text{du}], while *\text{du}" is realized [\text{lu}] (Mathangwane 1999). Finally, Cewa N31b exhibits the ‘hardening’ of /l/ to [d] only before glides, e.g. dy-‘eat’, bad-w-‘be born’ (cf. bal-a ‘bear (child)’). Occurring in both eastern and western Bantu – indeed, throughout the zone – there is dialectal evidence in both the Kongo H10 and Sotho-Tswana S30 groups that the [d] was originally pronounced as retroflex [ɾ] before high vowels (cf. also much of Caga E60, where *d is realized [r ~ ɾ] before *i, *u, elsewhere as [l] or Ø - see also Ch. 24).

4.3 Consonant + glide

The post-consonant glides [y] and [w] are typically derived from underlying vowels. As a result, consonants often show the same alternations before the glides [y] and [w] as before the corresponding high vowel. Thus, [y, w] from *i, *u produce frications, while [y, w] from *i, *u or *e, *o typically do not. An exception to this is found in the Mongo C60 group (7V). In some dialects of Mongo, /t/ is realized [ts] before the high tense vowels /i, u/, while /l/ (< *d) is realized as [d]. However, all dialects appear to produce the affricate realizations before [y, w] – even if they derive from /e, o/:

\[ ēc, ēk, ēd \quad \text{‘cup’, ultimately ēci = kōpô. While different patterns of velar palatalization are found throughout the Bantu zone (Hyman and Moxley 1992), some languages in the Congo basin show analogous developments with respect to alveolar consonants. While /li/ is realized [di] in both Luba Kasai L31a and Pende L11/K52, /ri/ is realized ci [tši]: Luba mac-il-‘plaster + appl’ (mat-), Pende sic-il- (~ šit-il-) ‘close + appl’ (šit-).

While a [y] glide (or offglide) can trigger palatalization, [w] is responsible for velarization, e.g. in the Rundi-Rwanda DJ60 and Shona S10 groups. Meeussen (1959) summarizes the reflexes of labial+glide and coronal+glide complexes in Rundi as in (21).

\begin{align*}
& (21) \quad (a) \quad (b) \\
& \text{bw} [bg] \quad \text{fy} [f'y] \\
& \text{fw} [fk] \quad \text{vy} [v'y] \\
& \text{mw} [mn] \quad \text{my} [mn] \\
& \text{tw} [tkw] \quad \text{ty} [rtyk, r'ky] \\
& \text{rw} [rgw (gw)] \quad \text{ry} [rgy] \\
& \text{sw} [skw, skw] \quad \text{sy} [sk'y] \\
& \text{zw} [z'w] \quad \text{ny} [ny, n'y] \\
& \text{tsw} [tskw, ts'w] \\
& \text{cw} [tkw, t'kw] \\
& \text{jw} [tjw, tjw] \\
& \text{shw} [k,jw, fkw, j'kw] \\
\end{align*}

As seen in (21a), Cw hardens to Ck/Cg/CN, and the labial offglide is lost (absorbed) when the C is labial. (22a) shows that Cy undergoes a comparable hardening process.
When the C is velar, one obtains the expected Cw sequence. Similar processes occur in the Shona S10 complex. In Kalanga S16, /w/ becomes [g] before [w], e.g. tól-a ‘take’, tóg-w-a ‘be taken’. Compare also Basaá A43, where the class 4 mi- and class 8 bi- prefixes are realized yw- and gw- when directly followed by a vowel, e.g. bi¬ tôyо ‘horns’ vs. gw¬ 5m ‘things’ (y¬ 5m ‘thing’ 7) – cf. the object pronouns yw¬ 5 (cl. 4) and gw¬ 5 (cl. 8). Finally, geminate w + w and y + y become, respectively, [ggw] and [ggy] in Ganda EJ15:

(22) (a) /pô-a/ → wo-a → ww-aa → ggwaa … ‘become exhausted’
(b) /p¬a/ → wi-a → yy-aa → ggyaa … ‘get burnt’

As seen, both glides derive from *p – cf. m¬pw¬ëdd¬é ‘I have become exhausted’ and m¬p¬ëdd¬é ‘I have gotten burnt’ (~ n¬f¬ëdd¬ê).

4.4 *j + consonant

Consonants may harden not only after nasals or before glides, but also after PB *j, particularly when this vowel is either word-initial or preceded by a vowel. Thus, Tswana S31 devoices stops not only after N-, but also after reflexive i-: i¬pón-é ‘see yourself!’, i¬tís-é ‘watch yourself!’ (bôn-, dis-). In Lega D25, PB *t normally becomes [r], but is preserved as [t] after the class 5 prefix *i, e.g. i¬táma ‘cheek’, pl. ma¬ráma. Ganda EJ15, on the other hand, develops geminates from *j-i. Thus, compare o-mu¬sájjá ‘man’ and baij¬a ‘carve’ with Haya EJ21 o-mu¬sáija and baij¬a. This process also produces root-initial geminates, e.g. t¬-á ‘kill’ and bb¬-á ‘steal’, and singular/plural alternations in classes 5/6 such as e¬g¬ulu ‘sky’, pl. a-ma¬gulu (cf. Haya EJ21 i¬-a, i¬-a, e¬i¬gulu). While class 5 *j- typically ‘strengthens’ following consonants, it is known also to condition voicing (and implosion), e.g. Zezuru S12 bângá ‘knife’ (pl. ma¬pângâ), dângá ‘cattle enclosure’ (pl. ma¬iângâ), gângâ ‘large helmeted guinea-fowl’ (pl. ma¬kângâ).

4.5 Long-distance consonant phonology

In all of the processes discussed thus far, the trigger of the phonological process is adjacent to the targeted consonant. Bantu languages also are known for the ability of a consonant to affect another consonant across a vowel (and beyond). There are several such cases.

The first, Meinhof’s Law, was seen already in §4.1.3, whereby a nasal + voiced stop is realized NN or N when followed by a second nasal complex (sometimes just N) in the next syllable. Another version of this simplification occurs in Kwanyama R21, where the second nasal + voiced stop loses its prenasalization (Schadeberg 1987): *N¬gombe > on¬gobe ‘cattle’, *η¬gandu > on¬gadu ‘crocodile’. These dissimilatory changes have the effect of minimizing the number of NC complexes in a (prefix +) stem. Another well-known dissimilatory process is Dahl’s Law, whereby a voiceless stop becomes voiced if the consonant in the next syllable is also voiceless. This accounts for the initial voiced reflexes in Nyamwezi F22 roots such as -dákun¬- ‘chew’ (*-tákun¬-), -guht¬ ‘short’ (*-kípi). Dahl’s Law is also responsible for the /t/ or /k/ of prefixes to become voiced (and sometimes continuant), e.g. Kuria E43 /ko¬tema/ → [yo¬tema] ‘to beat’. While there is considerable variation (Davy and Nurse 1982), multiple prefixes may be affected, e.g. Southern Kikuyu E51 /ke¬ke¬ko¬eta/ → [ye¬ye¬yw¬eet¬a] ‘he (cl. 7) called you’. Alternations are also sometimes found stem-internally, as in Rundi DJ62 -bád¬-ik¬- ‘transplanter’, -bád¬-uk¬- ‘pousser bien’ vs. -bátt¬-ur¬- ‘arracher (plantes) pour repiquer’.
Other long-distance consonant processes are assimilatory in nature. In Bukusu EJ31c, an /l/ will assimilate to a preceding [r] across a vowel, e.g. -fúk-il- ‘stir + appl’ vs. -bír-ir- ‘pass + appl’. The process is optional when the trigger [r] is separated by an additional syllable, e.g. -rám- ‘remain’, -rám-il- ~ -rám-ir- ‘remain + appl’. Several languages in the western Lacustrine area show a process of sibilant harmony which disallows or limits the co-occurrence of alveolar and alveo-palatal sibilants, e.g. [s] and [ʃ]. In Rwanda DJ61 and Rundi DJ62, /s/ becomes alveo-palatal across a vowel, when the following consonant becomes (alveo-)palatal as the result of a y-initial suffix, e.g. soonz- ‘be hungry’ vs. a-ra#shoonj-e ‘he was hungry’ (<soon-ye). In Nkore-Kiga EJ13/14, the process produces alternations in the opposite (depalatalizing) direction, e.g. shígish- ‘stir’, o-mu#sígis-i ‘stirrer’. Finally, a third long-distance assimilation involves nasality. A wide range of Bantu languages nasalize [l] or [d] to [n] after an NV(V) syllable, e.g. Bemba M42 cit-il- ‘do + appl’ vs. lim-in- ‘cultivate + appl’. While Suku H32 optionally extends this process across additional syllables, creating extension variations such as -am-ik-il- ~ -am-ik-in-, such long-distance assimilation is obligatory in Kongo H10 – and in nearby Yaka H31, e.g. ziik-il- ‘bury + appl’ vs. makin- ‘climb + appl’, mitikut-in- ‘sulk + appl’, nutuk-tin- ‘lean + appl’.

Other forms of apparent long-distance phonology are highly morpheme-specific. Thus, the passive suffix -w- (*-u-) causes the palatalization of a preceding labial consonant in the Sotho-Tswana S30 and Nguni S40 groups, e.g. Ndebele S45 dal-w- ‘be created’ (dal-) vs. bunj-w- ‘be moulded’ (bumb-). In Ndebele and other Nguni languages, this process can actually skip syllables, e.g. funjath-w- ‘be clenched’ (<umbath-), vunjulu-l-w- ‘be uncovered’ (<umbulul-). In a number of languages, where causative *-i- condition frication, the effect is sometimes seen on non-adjacent consonants. In Bemba M42, the roots lub- ‘be lost’ and lil- ‘cry’ form the causatives lub-j-nil- and lili-nil-, the applicatives lub-nil- and lili-nil-. However, their applicativized causative forms are -luf-is-y- and -lisi-s-y-, with frication applying twice. As seen in (23), this is the result of a ‘cyclic’ application of the frication process (Hyman 1994):

(23) | UR | MORPHOLOGY | PHONOLOGY | MORPHOLOGY | PHONOLOGY |
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>-lub-</td>
<td>→ -lub-j-</td>
<td>→ -luf-i-</td>
<td>→ -luf-il-j-</td>
</tr>
<tr>
<td>'be lost'</td>
<td>'lose'</td>
<td>'lose for/at'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>-lil-</td>
<td>→ -lil-j-</td>
<td>→ -lisi-j-</td>
<td>→ -lisi-il-j-</td>
</tr>
<tr>
<td>'cry'</td>
<td>'make cry'</td>
<td>'make cry for/at'</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the second morphology stage, applicative -il- is ‘interfixed’ between the fricated root and the causative suffix *-i- (> y before a vowel). Bemba and certain other Bantu languages show the same multiple frications when the *-id- of perfective *-id-e is interfixed, e.g. luf-is-i-e [luﬁs] ‘lose + perfective’. In other languages, frication appears to apply non-cyclically, affecting only the applicative consonant, e.g. Mongo C61 /kál-/ ‘dry’, /kál-j-/ (→ [káj-a] with FV -a) ‘make dry’, /kál-el-j- → kál-el-j- ‘make dry + applicative’ (→ [kál-ej-a] with FV -a). Still others show evidence of cyclicity by ‘undoing’ frication in a fixed (often non-etymological) manner. In Nyamwezi F22, the verb /gul-/ ‘buy’ is causativized to /gul-j- ‘sell’, which undergoes frication to become guj-j- (> surface [gguja] by gliding of j to [y] and absorption of [y] into the preceding alveo-palatal affricate). However when guj-j- is applicativized, yielding intermediate guj-el-j-, the result is gug-eg-j- (→ [gug-eg-a]). The [j] is ‘undone’ as velar [g], on analogy with -og- ‘bathe intr.’, -aj-j- ‘bathe (s.o.)’, -og-eg-j- ‘bathe + appl’, not as the [I] one would expect if the process were non-cyclic. The most extreme version of this process is seen in languages such as Nyakyusa M31, which uses a ‘replacive’ [k] no matter what the input...
consonant of an applicativized causative. Thus, -kees-‘make go by’ (the causative of -keend- ‘go by’) is applicativized first to -kees-el-‘make go by + appl’ (→ [keek-es-y]).

5 CONCLUSION

The above gives a sketch of some of the phonological properties of syllables, consonants, and vowels in Bantu languages. It emphasizes languages which have preserved the basic morphological and phonological structure inherited from PB. In order to be complete, it is necessary to point out that quite a few languages in zones A and B have modified this structure significantly, e.g. by allowing closed syllables, developing back unrounded vowels, etc. The tendency to break down the inherited structure is even more pronounced in groups just outside ‘Narrow Bantu’, e.g. Grassfields Bantu.

REFERENCES