

Universal phonological processes in eastern Bantu: a theoretical analysis

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Kim, Hyung-Soo. 1999. Universal Phonological Processes in eastern Bantu: a theoretical analysis. *Linguistics* 7-1, 199-225. In this paper the concept of universal phonological process in Foley's Theoretical Phonology is utilized to first introduce five phonological processes that commonly occur in eastern Bantu languages and then explain two important problems in morphophonemic alternation occurring in Luganda first singular present forms and Swahili adjectives. The five processes introduced are glide formation, syncope, glide strengthening, assibilation, and dissimilation. These processes are argued to be universal because 1) they occur not only in many Bantu languages but also in remotely related languages such as Korean and 2) their knowledge is required as a prerequisite to finding a coherent explanation of the two morphophonemic alternations. A brief comment on the ramifications of the analysis for the phonological theory in general is also included, especially the difficulties that a constraint-based approach may face in analyzing phonological problems of this type. (Jeonju University)

1. Introduction

In this paper we consider certain phonological processes in eastern Bantu languages, under the concept of universal phonological process. There are many phonological processes traditionally recognized in Bantu, and perhaps still many more remain to be discovered. Since it is impossible to include all of the universal phonological processes that occur in eastern Bantu in this introductory paper, we concentrate on the following processes:

- 1) glide formation: the process by which high vowels become

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corresponding glides before another vowel

- 2) syncope: the loss of medial vowel
- 3) glide strengthening: the process by which a glide acquires a stop onset.
- 4) assibilation: the addition of a sibilant release to an occlusive
- 5) dissimilation: becoming dissimilar of two sufficiently similar consonants or consonant clusters

Universal phonological process is a concept that underlies the phonological theory developed by James Foley (Theoretical Phonology: Foley 1977, 1981). This concept maintains that a limited number of phonological processes occur as part of the definition of Language, to which all of the phonological rules in the languages of the world must belong. The implication is that the description and explanation of phonological phenomena must be done by referring to the conditions on and reflexes of these processes. In this paper, this concept of phonological explanation is applied to analysis of the above phonological rules occurring in Bantu languages.

Our main concern in this paper is to introduce the common universal phonological processes often observed in eastern Bantu languages to further our understanding of Bantu phonology in general. But in view of the recent development of constraint-based approach in phonological theory, we have included at the end a brief discussion in justifying our approach, which favors conditions on processes and successive derivations rather than constraints. The paper proceeds in the following order. First, we briefly introduce the above five processes and their application in eastern Bantu. Since we are dealing with 'universal' processes, examples are often drawn not only from Bantu, but also from any languages in the world with relevant examples, particularly Korean. After gaining this general knowledge of universal phonological rules applying in Bantu, we will analyze two important phonological problems observed in certain eastern Bantu languages; one concerns the first singular present forms of certain verbs in Luganda, an eastern Bantu

language spoken in the country of Uganda, and the other the syllabification of nasals and stop implosion in Swahili. This latter section continues to utilize the concept of universal process, because it is our knowledge of the above five phonological processes that leads to coherent explanation of these problems. It is also here that we argue for the processual approach, which requires positing intermediate stages in the derivation, something that is not allowed in a constraint-based approach. The paper concludes with a brief summary of the analysis and its ramification for phonological explanation.

2. Universal phonological processes often observed in Bantu languages

2.1. Glide formation

Glide formation is conversion of an unstressed *i* or *u* to the corresponding glide before another vowel. This is one of the rules often observed in languages when vowels occur in hiatus. In Luganda, for example, the noun class prefix *mu-* as occurring in *muganda* "brother/sister" has an allomorph *mw-* before stems beginning with a vowel. Consider

<i>mwami</i> <* <i>mu-ami</i> "chief"	cf. pl. <i>ba-ami</i> "chiefs"
<i>mwana</i> <* <i>mu-ana</i> "child"	cf. pl. <i>ba-ana</i> "children"

Note also that the class 7 prefix *ki-* and its plural class 8 prefix *bi-* as occurring in *ki-be* "jackal" and *bi-be* "jackals" change to *ky* and *by* respectively before stems beginning with a vowel:

<i>kyenyi</i> <* <i>ki-enyi</i> "forehead"	pl. <i>byenyi</i> <* <i>bi-enyi</i>
<i>kyalo</i> <* <i>ki-alo</i> "village"	pl. <i>byalo</i> <* <i>bi-alo</i>

In Korean glide formation applies not only to high vowels *i* and *u* but also to *o* as in

- glide formation before *i*: kyə <*ki-ə "crawl"
 glide formation before *u*: kkəwə <*kkcu-ə "wake up (causative)"
 glide formation before *o*: po-ta. pwa <*po-a "see"¹⁾

From the above observation, we could deduce that glide formation is most likely to occur to high vowels such as *i* and *u* as in Luganda and then generalize to include midvowels such as *o*, as in Korean. This observation implies that if in a language a mid vowel such as *o* undergoes glide formation to *w* before another vowel, then a high vowel such as *u* must also undergo glide formation. In other words the relation between the following two glide formation rules

- 1) $u \rightarrow w / __V$
 2) $o \rightarrow w / __V$

is such that occurrence of 2) in a language necessarily implies occurrence of 1) in the same language. This is because the universal condition on glide formation is that it occurs preferentially to high vowels.

1. Note that there are many phonological problems associated with glide formation in Korean, one of which (as pointed out by the anonymous reviewer) is nonapplication of the rule in verbs such as *cōh-ta* "be good(like)": **cōh-a* > *coa*~*cowa* but not the incorrect *ɕwa*. The same rule, however, occurs in verbs such as *noh-ta* "put", **noh-a* > *noa*, *nwa*, though not with glide insertion, not *ɲowa*. These problems have been left untouched here for two reasons: 1) We are concerned only with exposition of the rule's application as it relates to problems in Bantu phonology and 2) These problems in their magnitude require a separate paper. For a background understanding of these problems and their theoretical analysis, consult H-S Kim(forthcoming) and the references therein.

2.2. Syncope

This is another well known phonological process by which unstressed medial vowels are lost. Note, for example, the optional loss of unstressed medial schwa in English, e.g. Catholic[kæθ(ə)lɪk], sophomore[saf(ə)mər], etc. One of the universal conditions on syncope relevant to our discussion concerns the number of consonants surrounding the medial vowel. For example, in middle Korean the post-verb morpheme *bi* (cf. H-S Kim 1993), which derives descriptive verbs from action verbs, drops its vowel preferentially after one consonant as in

miypta "to be hateful" <*mü-bi-ta
nollapta "to be surprising" <*nolla-bi-ta

but

mitpita "to be reliable" <*mit-bi-ta
paspita "to be busy" <*pas-bi-ta

The universal rule is thus

$$i \rightarrow \emptyset / VC^n _ CV \quad \text{where } |n| \leq d$$

d=1 for middle Korean

Almost the same rule also occurs in Luganda, although in this language it is the number of consonants following (rather than preceding) the medial vowel that is relevant. Consider

<u>singular</u>	<u>plural</u>
eggumba <*e-li-gumba	ama-gumba "bone"
eliggwa <*e-li-ggwa	ama-ggwa "thorn"

eggumba is derived from **e-li-gumba* by applying first a syncope rule that applies preferentially when the medial vowel is followed by one

consonant and then gemination of *g* after the strong liquid with subsequent devolution of the liquid (see below for more explanation of gemination):

e-li-gumba	e-li-ggwa	
elgumba	"	preferential syncope
elggumba	"	gemination
eggumba	"	devolution of the liquid

The universal rule for the above Luganda data is then

$$i \rightarrow \emptyset / \text{VC_C}^n\text{V where } |n| \leq d$$

d= 1 for Luganda

It is noteworthy that middle Korean and Luganda essentially share the same preferential condition on syncope. This shows that syncope, being a universal process, is a common process that often occurs in languages.

Another condition on syncope that we should keep in mind analyzing Luganda is that application of syncope sometimes depends on the relative strength of the consonant preceding (or following) the medial vowel. Consider the following examples

ebbeere <*e-li-beere "breast" (cf. Luyia libeere)
 embala <*e-ni-bala "I count" (cf. oku-bala "to count")

but

ekibeere <*e-ki-beere "udder"
 ebibeere <*e-bi-beere "udders"

where the medial vowel drops after a liquid and a nasal but not after stops.

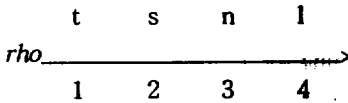
A similar rule is also observed in modern Korean forms with the suffix *-ini*:

mək-ta "eat"	məgini
cap-ta "hold"	cabini
ssis-ta "wash"	ssisini
tam-ta "fill"	tamini
but nol-ta "play"	noni < *nol-ini

The medial *i* first drops preferentially after the strong liquid *l*, then the liquid itself drops in contact with the *n* as in Kor. *sonamu* < *sol-namu "pine tree". Consider the following derivation:

mək-ini	tam-ini	nol-ini	
"	"	nolni	preferential syncope (L__)
"	"	noni	l --> Ø / __n
məgini	"	"	k --> g / V__V

Although the conditions on syncope in Luganda and Korean appear to differ on the surface, they are indeed derived from the same abstract condition that the consonant preceding the medial vowel be sufficiently strong. The sufficient strength in this case is determined on the *rho* phonological parameter²⁾



(*t* for stops, *s* for fricatives, *n* for nasals, and *l* for liquids)

The universal rule is thus

2. See Foley 1977 chapter 3 for arguments establishing this and other parameters used in the paper.

$V \rightarrow \emptyset / VC_1 _ C_2V$ where $|C_1| \geq D$

D = 4 for modern Korean

D = 3 for Luganda

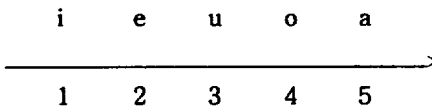
Finally, note that application of syncope also depends on the quality or strength of the medial vowel elided as it applies to weak vowels in preference to strong vowels. In Luganda, for example, syncope applies to medial *i* but not to medial *u*, as in

ebbeere <*e-li-beere "breast" (cf. Luyia libeere)

but

oluganda <*o-lu-ganda "brotherhood"

This is because on the vowel parameter



i is weaker than *u*, thus more likely to drop by the weakening process of syncope.

2.3. Glide strengthening

Glide strengthening is strengthening of a glide by acquiring a stop onset. A traditional example of glide strengthening is Holtzmann's Law in Germanic languages where Germanic **w* and **y* strengthens to *g^h* and *d^h* or *g^ʰ*, as in

<u>Germanic</u>	<u>Old Norse</u>	<u>Gothic</u>	<u>OHG</u>	
*twajje	tveggja	twaddje	zwei	"of two"
*drewwa	tryggvar	triggwa	triuwa	"faith"

The same rule also applies in Bantu languages. In Tswana, for example, the noun class prefix *mo-* appears as *ŋw* when attached to a stem commencing with a vowel as in

ŋwana "child" <*mwana <*mo-ana
 ŋwaga "year" <*mwaga <*mo-aga
 ŋwedi "moon" <*mwedi <*mo-edi

This is because after the glide formed by glide formation strengthens to *g^h*, the preceding nasal assimilates to the velar *g* with subsequent nasal assimilation and degemination, as in

mu-ana	
mwana	glide formation
mgwana	glide strengthening
ŋgwana	assimilation of place
ŋŋwana	nasal assimilation
ŋwana	degemination

The same rule is also observed in Luganda where geminate-cum-glide clusters in the infinitive forms such as *okuggwa* "be exhausted" and *okuggya* "burn" are traditionally derived from the geminate glides **ww* and **yy*, from **okuwwa* and **okuyya* (Meeussen 1955). An obvious question is what process or processes are responsible for the conversion of *ww* to *ggw* and *yy* to *ggy*. In other words, just saying that *ww* and *yy* change to *ggw* and *ggy* respectively is not enough because we are interested in explanation rather than description of phonological changes. To find a solution in this direction we may propose two universal processes, glide strengthening and gemination (with subsequent devolution), both of which occur after a glide, the sufficiently strong resonant. Consider the following derivation:

o-ku-wwa	o-ku-yya	
okuwgwa	okuygya	glide strengthening (G__)
okuwggwa	okuyggya	gemination (G__)
okuggwa	okuggya	devolution of the resonant

2.4. Assibilation

The glide strengthening as explained in the preceding section also occurs in the assibilation mechanism (as postulated in Foley 1977, p92) according to which Spanish *joven* [Xoβen] "young" from Latin *iuvenis* has the following derivation:

1. yoven
2. dyoven Holtzmann's Law (i.e. glide strengthening)
3. dzyoven assibilation proper
4. džoven combination of *z* and *y* into *ž*
5. žoven lenition, loss of stop onset
6. šoven medieval Spanish sibilant devoicing
- 7 Xoven Spanish velarization

Step 4 corresponds to the assibilated reflex of *y* in Italian *giovane* [džovane], step 5 to French *jeune* [žæn], and step 7 to Spanish *joven*.

The same assibilation routine is observed to occur in Bantu. For example, one of the prefixes that often occurs with language names in Bantu is the class 7 prefix *ki-*, e.g. *Ki-swahili*. The same prefix, however, appears as *ʃi* in Herero, e.g. *Otji-herero*, and *ʃi* in Ndonga, e.g. *Oshi-ndonga*. Meinhof (1932, p14) describes the change occurring in Herero as regressive assimilation saying that 'in Herero and elsewhere, *ki* frequently becomes *tʃi* because the *k* has approached the point of articulation of the *i*', but such an explanation fails to note that the reflex of the same 'assimilation' in Ndonga is not *ʃi* but *ʃi*. A better explanation is thus in terms of the assibilation routine,

- ki-
- kyi 1) palatalization
- ktyi 2) glide strengthening and voicing assimilation
- ktsyi 3) assibilation proper
- tsyi 4) cluster simplification
- ʃi 5) contraction of *s* and *y* into *ʃ*
- ʃi 6) lenition

where step 5) corresponds to Otji-herero and step 6) to Oshi-ndonga.

2.5. Dissimilation

Dissimilation is a process by which two similar elements become dissimilar when they are sufficiently similar. In general, there are two types in consonant dissimilation: dissimilation between two sufficiently similar consonants and that between two sufficiently similar consonant clusters. Although in this paper we are mainly concerned with the latter type, it is interesting to note that both types exist in Bantu as well as in Korean.

An example of dissimilation between two similar consonants in Korean is the rule $p \text{ } \xi \text{ } p \text{ } \rightarrow \text{ } p \text{ } \xi \text{ } k$ as occurring in

- pup > puk "drum"
- kəpup > kəpuk "turtle"
- puəp > puək, puəkh "kitchen"

while an example of dissimilation between two consonant clusters is the nasal dissimilation rule occurring in

- pyəŋyŋ > piyŋ "name of the capital city in North Korea"
- koŋyŋ > koyŋ "offering of food to Buddha"
- coŋyŋhi > coyŋhi "quietly"
- saŋŋgaŋ > saŋŋ > seŋ "ginger"

The rule is

$$\eta CV\eta(C,\#) \rightarrow CV\eta(C,\#)$$

where *C* includes the glide *y* as well and the word boundary which serves the function of a consonant in phonological environment.

A more telling example of dissimilation between consonant clusters is the liquid dissimilation in the so called *ri-* and *rə-*irregular predicates in middle Korean(H-S Kim 1995):

*nɦrɦr-	"arrive"	nɦrɦ-tá	nɦrɦ-kó	nɦrɦ-mié	nɦrɦ-é
*phɦrɦr-	"be blue"	phɦrɦ-tá	phɦrɦ-kó	phɦrɦ-mié	phɦrɦ-é
*nɦrɦr-	"be yellow"	nɦrɦ-tá	nɦrɦ-kó	nɦrɦ-mié	nɦrɦ-é
*ɦɦrɦr-	"flow"	ɦɦrɦ-tá	ɦɦrɦ-kó	ɦɦrɦ-mié	ɦɦɦé
*phɦrɦr-	"call"	phɦrɦ-tá	phɦrɦ-kó	phɦrɦ-mié	phɦɦé

In the conjugation of verbs such as **phɦrɦr-* and **nɦrɦr-*, the stem final liquid drops by dissimilation with the preceding liquid before consonant initial endings but is retained before vowel initial endings. The rule is

$$\text{dissimilation of liquids: } rVrC \rightarrow rVC$$

The same dissimilation rule also occurs in the conjugation of verbs such as **ɦɦrɦr-* and **phɦrɦr-* where the stem final liquid drops before consonant initial endings by the above rule. But unlike the verbs of the first group, these verbs lose the medial vowel before vowel initial endings. This vowel elision depends on two preferential conditions in Middle Korean: syncope of low toned vowel in preference to high toned one and preferential syncope after or before one consonant. The vowel elision cannot occur unless these two preferential conditions are met. Where no vowel elision occurs, the dissimilation of liquids occurs, dropping the second of two similar liquids in preconsonantal position:

phir̥r-kó	phir̥r-ó	h̥ir̥r-kó	h̥ir̥r-ó	
"	"	"	h̥ir̥r-ó	preferential syncope
phiri-kó	"	hiri-kó	"	dissimilation of liquids
"	"	"	hill-ó	miscellaneous rules

This analysis shows that once the preferential conditions on syncope and dissimilation are known, these traditionally irregular predicates can be explained as perfectly regular. But more importantly for our purpose, it illustrates a dissimilation between two liquids that applies only when the second liquid is in a consonant cluster.

An example of dissimilation between similar consonants in Bantu is the so called Dahl's Law. In Kikuyu (Armstrong 1967, p45), for example, *k* converts to *ɣ* by dissimilation with another voiceless consonant in the next syllable. Consider the infinitive prefixes in

yo-tɔŋgera "to run"
 yo-kuna "to carry"
 yo-cina "to burn"
 yo-ita "to strangle"
 yo-oka "to come"
 yo-ðeka "to laugh"

but

ko-ruya "to cook"
 ko-meɲa "to know"
 ko-niina "to finish"
 ko-ɣaya "to divide into"
 ko-hota "to be able"
 ko-oria "to ask"

According to Davy and Nurse (1982, p160) who have done some field work concerning application of Dahl's Law in Kikuyu, *ð* in examples such as *yo-ðeka* "to laugh" is essentially voiceless whereas *h* in examples such as *ko-hota* is voiced (i.e. [fi]). Hence the application of

the rule in the former but not in the latter.

An example of dissimilation between similar consonant clusters is so called Meinhof's Law in Bantu, defined by Meinhof (1932, p183) as

"When two successive syllables both begin with a nasal plus following voiced plosive, the plosive of the first syllable is lost"

There are a couple of problems with this definition. First is that the reflex of Meinhof's Rule (often so called because the law admits many exceptions in Bantu) is a geminate nasal rather than a simple nasal in many eastern Bantu languages. That is, the result of applying this dissimilation rule in the second syllable is assimilation between the nasal and the plosive, not elision of the plosive, i.e. NCVNC --> NNVNC, not NVNC. Consider the following data in Luganda

ngenda <*N-genda "I go"	cf. ogenda "you go"
mmumba <*N-bumba "I mould"	cf. obumba "you mould"
nninda <*N-dinda "I wait"	cf. olinda <*o-dinda "you wait"

The second is that in certain languages such as Bemba (and Luganda as well; see below) the rule occurs not only between two nasal compounds but also between a nasal compound and a simple nasal. (Recall that the dissimilation of liquids in Korean also occurs even though the first liquid is not in a consonant cluster) In other words, the canonical form of the rule is not NCVNC --> NNVNC but rather NCVN(C) --> NNVN(C). Consider

<u>singular</u>	<u>plural</u>	
ulubansa	immansa	"court-yard"
ululamba	innamba	"river-bank"
uluuni	igguni	"honey-guide bird"

The third example in this data is particularly interesting because it also

shows that Meinhof's Rule also occurs to the velar nasal compound in Bemba, contrary to Meinhof's statement (Meinhof 1932, p184) that the nasal compound *ng* is not affected. Consider the following derivation:

ulu-yuni	ini-yuni	
"	inyuni	syncope of <i>i</i> in preference to <i>u</i>
"	igguni	assimilation
uluuni	"	lenition: $\gamma \rightarrow \emptyset / V_V$
"	igguni	Meinhof's Rule: NCVN(C) \rightarrow NNVN(C)

The important point about Meinhof's Rule is that it is dissimilation between two compounds of nasal plus voiced plosive but sometimes the second compound (but not the first compound) may be a simple nasal. We will return to this point when we analyze application of Meinhof's Rule in certain first singular present forms of Luganda.

3. Two phonological problems in eastern Bantu

In the preceding section, we have briefly shown that the above five phonological processes indeed occur in Bantu languages. Equipped with this knowledge on universal phonological processes, we turn in this section to explaining two phonological problems. The first concerns the problem of the complex reflexes of the first singular present forms in Luganda and the second, syllabification of nasals and stop implosion in Swahili. These problems whose explanation would be required in any theoretical framework are resolved by referring to the above universal phonological processes.

3.1. The first singular present in Luganda

The first singular present forms of Luganda present particularly interesting phonological problems that can be resolved by referring to the above universal phonological processes introduced in the preceding

section. Consider

<u>infinitive</u>	<u>1 sg. present</u>	<u>gloss</u>
(o)kubala	(e)mbala	"count"
(o)kulya	(e)ndya	"eat"
(o)kugaba	(e)ŋgaba	"divide"

It is clear from the data given above that a nasal assimilation rule by which a nasal agrees in the place of articulation with the following plosive is at work in Luganda. By looking at the data, we can easily isolate *ku-* as the class prefix marking infinitive, while the 1 singular present prefix at least includes a nasal consonant. The vowel in parenthesis is what is so called 'initial vowel', which is optional and comes before the class prefix. For the first three verbs we may thus write nasal assimilation rules of the sort

N-b ---> mb	(mbala <*N-bala)
N-d ---> nd	(ndya <*N-dya)
N-g ---> ŋg	(ŋgaba <* N-gaba)

For the pair *kulya-ndya* I assume that the underlying stem is **dya* rather than **lya* because there is no rule converting *l* to *d* after a nasal, while *d* often changes to *l* as in Lt. *lingua* < **dingua*, cf. English *tongue*. This rule is blocked when the plosive forms a nasal compound with the preceding homorganic nasal:

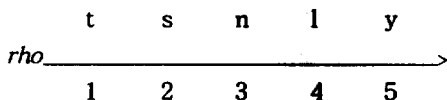
ku-dya	N-dya	
"	ndya	nasal assimilation
kulya	"	d ---> l

There is nothing complicated in the analysis made so far. The rules seem straightforward enough. The main problems however lie with the reflexes of the nasal prefix in the verbs of the following types:

<u>infinitive</u>	<u>1 sg. present</u>	<u>gloss</u>
kuyigga	njigga [ndʒigga]	"hunt"
kwagala	njagala [ndʒagala]	"love"

It is clear that in addition to the same assimilation of $N-\text{ɕ} \rightarrow n\text{ɕ}$, there are other phonological rules at work in these verbs. If we assume, for the nonce, that the 1 sg. pres. *njigga* [ndʒigga] is from **N-yigga* (cf. infinitive *kuyigga*), the problem is deriving ɕ from y . Of course we could just write a rule such as $N-y \rightarrow n\text{ɕ}$, but this would not explain by what processes y converts to ɕ . The problem is even more complicated in *njagala* [ndʒagala], because the stem of this verb begins with a vowel: infinitive *kwagala* < **ku-agala*. Naturally we are curious of where and by what process the assibilated reflex has come about.

Resolution of problems of this sort requires knowledge about universal processes. For example, to understand why we have a reflex such as ɕ from y in *njigga* [ndʒigga] < **N-yigga*, it would be necessary to learn about the process of assibilation, particularly its mechanical routine such as that presented in the preceding section. Recall that in that routine, **assibilation**, which is the addition of a sibilant release to an occlusive, is preceded by glide strengthening of $y \rightarrow dy$. Recall also that in our discussion of glide strengthening we mentioned that the process occurs preferentially after a sufficiently strong resonants such as a glide. We now expand the environment for such glide strengthening to nasals by noting that nasals are also strong on the *rho* phonological parameter



These two universal processes combine to produce the assibilation reflex in *njigga* [ndʒigga] < **N-yigga*:

N-yigga	
Ndyigga	glide strengthening: y --> dy/N__
Ndzyigga	assibilation: dy --> dzy
Nɔ̃gigga	contraction of <i>dz</i> and <i>y</i> into <i>dʒ</i>
nɔ̃gigga	nasal assimilation

The explanation given here is well motivated because all the rules used are from universal processes, processes that have been shown to occur in Bantu languages. We now turn to the explanation of *njagala* [nɔ̃ʒaga].

So far we have been assuming that the 1 sg. prefix is a nasal *N*. It is however necessary to reconsider this assumption in light of the alternation observed in examples such as (o)*kwagala*-(e)*njagala* "love". If we assume that the first singular prefix is a simple nasal, then it is difficult to explain the emergence of the assibilated reflex in *njagala*, because there is no reason why a nasal should simply change to *nj*[nɔ̃ʒ] before a nonfront vowel. Although a rule such as *N* --> *nj* / __V may be assumed in a descriptive grammar, it would really be an odd rule to posit. If, however, we assume that the first singular prefix is not a simple nasal *N* but rather *ni*-, the assibilated reflex can be made more accountable because we know that high vowels such as *i* or *u* often undergoes glide formation before another vowel. (Recall our discussion on glide formation) The glide formed by such a rule can issue an assibilated reflex in line with the assibilation observed in stems with initial *y*:

e-ni-yigga	e-ni-agala	
enyigga	"	syncope
"	enyagala	glide formation
endyigga	endyagala	glide strengthening (N__)
endzyigga	endzyagala	assibilation: dy --> dzy
endʒigga	endʒagala	contraction of <i>dz</i> and <i>y</i> into <i>dʒ</i>
enɔ̃gigga	enɔ̃gagala	nasal assimilation

There are independent evidences pointing to the underlying **ni-* as the 1 sg. prefix. The first argument concerns the vowels in parenthesis in the above data, which are what Bantuists call initial vowels. These optional vowels, which come before the class prefix in Bantu, typically agrees with the vowel of the next syllable (i.e. the vowel of the class prefix). Consider the following examples in Luganda:

o-mu-ntu	"person"	(class 1)
a-ba-ntu	"people"	(class 2)
e-ki-tabo	"book"	(class 7)

Since the first singular forms in the above data all have *e* as the optional initial vowel, we could expect that the following prefix will have the vowel *i*, as in the reconstruction **e-ni-agala*.

Our second argument concerns the application of Meinhof's Rule in certain first singular forms in Luganda with stems of the type CVNC. Consider

<u>infinitive</u>	<u>1 sg. present</u>	
(o)kwanika	(e)nnyanika	"put out to dry"
(o)kuyimba	(e)nnyimba	"sing"

Like the above pairs of verbs *(o)kuyigga-(e)njigga* "hunt" and *(o)kwagala-(e)njagala* "love" the stems in these verbs also begin with either a vowel or *y*, but their first singular forms do not exhibit assibilation reflexes. This is because they contain a nasal in the stem which triggers Meinhof's Rule. If we assume that the first singular prefix is a simple nasal, there is no reason why Meinhof's Rule should occur in forms such as ~~*nnyanika*~~ <**eN-anika* (cf. inf. *kwanika* <**ku-anika*) because there is no nasal compound to be converted into a geminate nasal. Recall that the essence of Meinhof's Rule is that it is a dissimilation between two compounds of nasal plus a voiced stop. Although the plosive of the second nasal compound may be optional as

in Bemba, the first plosive is obligatory because as mentioned earlier the effect of applying Meinhof's Rule is a geminate nasal produced by assimilation between the nasal and the plosive, i.e. NCVN(C) --> NNVN(C). The assumption of simple nasal as the underlying 1 sg. prefix cannot explain the above changes properly. On the other hand, if we assume that the first singular prefix is **ni-* as we have done in the above, *ennyanika* receives a coherent explanation, for the high front vowel in **ni-* will then become a glide before another vowel by glide formation, and the glide could strengthen in contact with the preceding nasal by acquiring a stop onset as in

e-ni-anika	e-ni-yimba	
"	enyimba	syncope
enyanika	"	glide formation
endyanika	endyimba	glide strengthening: y --> dy (n_)

Meinhof's Rule can now be applied to these outputs because the plosive acquired by glide strengthening forms a nasal compound with the preceding nasal. The rest of the rules occurring after this stage are straightforward:

ennyanika	ennyimba	Meinhof's Rule: NCVN(C) --> NNVN(C)
enjanika	enjimba	contraction: ny --> ɲ
eɲjanika	eɲjimba	assimilation

The crucial point about this derivation is that a series of phonological rules based on universal processes provide a well motivated solution to a seemingly intractable phonological problem. Application of Meinhof's Rule typically requires a nasal compound, because it is essentially a dissimilation between nasal compounds as Meinhof himself has defined. Although the assumption that the first singular prefix is a simple archiphonemic nasal *N* (an assumption typically made in synchronic analysis) may provide a nasal, it still lacks the plosive to go with it to

form a nasal compound. It thus does not meet the condition on Meinhof's Rule in Luganda. The assumption that the first singular prefix is **ni-* (an assumption often enjoyed by Bantu historical linguists), on the other hand, though it does not directly supply the plosive required in the nasal compound, sets the stage for application of glide formation, which by way of glide strengthening provides with a nasal compound.

Positing these intermediate stages are crucial, for otherwise we won't be able to explain the reflexes of Meinhof's Rule in the first singular forms of these verbs. The best we could do without them would perhaps be to posit ad hoc rules of the following type

N+VN -->	nɲVN	for (e)nnyanika <*eN-anika
N+yVN -->	nɲVN	for (e)nnyimba <*eN-yimba

which do nothing to explain the peculiar palatal reflex arising out of a simple nasal, nor the reason why Meinhof's Rule should occur in these stems that do not even begin with a plosive. As long as these intermediate stages are required for a coherent explanation of the reflexes of Meinhof's Rule and assibilation in the first singular forms in Luganda, any approach that denies such stages (e.g. constraint-based approaches which recognize no intermediate stages between the input and the output) is thus doomed to be a failure.

3.2. Swahili stop implosion

In this section we consider the reflexes of the adjectival stem *bovu* "rotten" in Swahili when it is combined with nasal prefixes. According to Kwon(1993, p 1084), the initial stop consonant of this stem shows the following variation in plosion:

mbovu[mbɔːvu]	(with nouns with <i>n</i> prefix, i.e. <*n-bovu)
mbovu[ɱbɔːvu]	(with nouns with <i>m</i> prefix, i.e. <*m-bovu)

From what appears to be almost identical etyma, we have quite different reflexes in voiced stop *b*: when the stem is combined with the nasal prefix *n*, the reflex of the initial consonant is exploded, but combined with the prefix *m*, it is imploded. The general rule for implosion in Swahili is that voiced stops are imploded unless preceded by a homorganic nasal, as in Swah. *beba* [b̥é:b̥a] "carry on back" but the above *mbovu* [mb̥ó:v̥u]. It is therefore difficult to explain why such variation in pronunciation occurs in what appears to be the same consonant cluster *mb* in the above data. Noticing that in *mbovu* [ɱb̥ó:v̥u] the nasal prefix is syllabic, one could of course say that this syllabic nasal is the reason why the following voiced stop is imploded. But there are difficulties with such explanation: The first difficulty is the question why a syllabic nasal provides a favorable environment for implosion despite the fact that a preceding nasal usually blocks implosion. The second difficulty is that judging from the reconstructed etymological forms, there is no particular reason why the nasal only in **m-bovu* but not in **n-bovu* should become syllabic. We may of course avoid the first difficulty by saying that the preceding syllabic nasal puts the *b* in *mbovu* [ɱb̥ó:v̥u] in the onset position, subjecting it to implosion, but such an explanation would only be effective if we resolve the second difficulty, which asks why a syllabic nasal arises in *mbovu* [ɱb̥ó:v̥u] but not in *mbovu* [mb̥ó:v̥u], though both are from almost the same etyma.

To understand why there is such variation in pronunciation of voiced stop in the above Swahili forms, it is necessary to compare them with the following forms in Luganda³⁾ that contain the same stem and prefixes:

- | | |
|-----------|--------------------------------------|
| (e)mbovu | corresponds to Swah. mbovu[mb̥ó:v̥u] |
| (o)mubovu | corresponds to Swah. mbovu[ɱb̥ó:v̥u] |

3. The stem *bovu* in Luganda means 'overripe'.

The first thing we can infer from the Luganda data is that the prefix in Swah. *mbovu* [ɱbɔ́:vu] is not a simple nasal *m* but *mu-*, whose loss of the vowel in Swahili is compensated by syllabification of the preceding nasal. Since the plosive *b* was not originally preceded by a nasal in Swah. *mbovu* [ɱbɔ́:vu] < **mu-bovu*, it is imploded by the general rule of implosion of voiced consonants in Swahili. The second point we infer is that the prefix in Swah. *mbovu* [mbɔ́:vu] is not a simple nasal *n* but *ni-*, as suggested by the corresponding Luganda (*e*)*mbovu* < **e-ni-bovu*. As in the first singular present forms of Luganda, e.g. (*e*)*mbala* < **e-ni-bala* "I count", the presence of the initial vowel *e* in (*e*)*mbovu* evinces **ni-* as the underlying prefix. The underlying forms of the above adjectives are thus:

Luganda: (<i>e</i>) <i>mbovu</i>	< * <i>e-ni-bovu</i>	(<i>o</i>) <i>mubovu</i>	< * <i>o-mu-bovu</i>
Swahili: <i>mbovu</i> [mbɔ́:vu]	< * <i>ni-bovu</i>	<i>mbovu</i> [ɱbɔ́:vu]	< * <i>mu-bovu</i>

In Luganda, *i* of *ni-* has dropped by syncope in preference to *u* of *mu-* because, as mentioned earlier, *i* is weaker than *u* (Recall also Bemba sg. *igguni* < **i-ni-yuni* but pl. *uluuni* < **u-lu-yuni* "honey-guide bird") as in

<i>e-ni-bovu</i>	<i>o-mu-bovu</i>	
<i>enbovu</i>	"	preferential syncope
<i>embovu</i>	"	assimilation
<i>mbovu</i>	<i>mubovu</i>	loss of initial vowel (optional)

In Swahili this vowel elision rule has generalized so that both of the prefixal vowels *i* and *u* drop as in

<i>ni-bovu</i>	<i>mu-bovu</i>	
<i>nbovu</i>	"	preferential elision of weaker <i>i</i>
"	<i>mbovu</i>	generalized elision of stronger <i>u</i>

The reason why we have different reflexes of voiced stop in these forms of Swahili is because the implosion of *b* occurred between these two vowel elision rules. Consider the following derivation:

ni-bovu	mu-bovu	beba	
nbovu	"	"	elision of <i>i</i>
mbovu	"	"	assimilation
"	muβovu	βeba	implosion of <i>b</i>
"	ɱbovu	"	elision of <i>u</i> and syllabification

Syllabification occurs only when the prefix *mu-* (but not the prefix *ni-*) loses its vowel because being a recent innovation in Swahili, the rule applies only to the nasal prefix which lost its vowel recently. That elision of *i* occurred long before elision of *u* can be seen by the number of rules interrupting in between. It would generally require longer time span for a greater number of rules to occur in a language. That there are at least two rules preceding the elision of *u* would mean that a considerable time has elapsed since the elision of *i*. Note also that loss of *i* in the prefix *ni-* is a wide spread common Bantu phenomenon occurring in both Luganda and Swahili, and most Bantu languages, while the loss of *u* in the prefix *mu-* is rather restricted to Swahili and a few other Bantu languages, which also indicates the recentness of the latter rule.

4. Summary and conclusion

In this paper, I have introduced five phonological processes that are common in eastern Bantu languages: glide formation, syncope, glide strengthening, assibilation, and dissimilation. These are members of universal processes, which by definition are limited in number and therefore instances of which are found repeatedly in languages. We have seen in this paper that these processes indeed occur not only in Bantu but also in Korean, even though genetically speaking the two languages

are as remotely related as they can possibly be.

Although there are many other processes that could be properly regarded as universal in eastern Bantu, the above five have been specifically chosen because their knowledge is required to solve two important phonological problems: the first singular present forms in Luganda and the Swahili stop implosion. The problem in Luganda was that the juxtaposition of the first singular nasal prefix and the vowel initial stem results in assibilation, while the same combination yields a geminate nasal reflex if the stem contains a nasal or a nasal compound. The problem in Swahili, on the other hand, is that from what looks almost like the same cluster of prefixal nasal plus a stem-initial voiced stop arise different reflexes: one with a syllabic nasal plus an implosive stop, and the other without any syllabification nor implosion. The common difficulty with these problems is that much of what could be clues is hidden from the surface, making any rules based on surface alternations look unusually awkward and unnatural. On the other hand, since these morphophonemic alternations are a result of long historical changes incurred by several phonological processes, any approach that just looks at the input-output relation is bound to run into difficulties. In this paper solutions to these problems have therefore been sought first by carefully reconstructing the underlying prefixes and then by seeking explanation in a series of universal phonological processes that relate the underlying form to the surface form. As much as these solutions are justified, so are the intermediate stages set up in the derivation, and so is the universal, processual approach that the paper has maintained despite the popularity of constraint-based approach.

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