Consonant gemination and glide strengthening in Luganda: A theoretical analysis of two universal phonological processes and their interaction*

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Hyung-Soo Kim(1993), **Consonant gemination and glide strengthening in Luganda: A theoretical analysis of two universal phonological processes and their interaction** *Linguistics,* vol 1. Theoretical Phonology maintains that rules used in description and explanation of language must be universal, belonging to the set of universal phonological processes. This conception of phonological explanation is applied to the analysis of geminate consonants in West Germanic, Italian, and Luganda (Eastern Bantu). Analysis of West Germanic and Italian data illustrates the relative phonological strength on parameters, the Inertial Development Principle, and a universal condition that stipulates preferential application of consonant gemination in sufficiently strong environment. Analysis of Luganda data reveals how the universal processes of consonant gemination and glide strengthening interact to produce previously unexplained consonant-cum-geminate clusters. In addition, it shows that consonant gemination in Luganda occurs essentially under the same condition as in West Germanic and Italian, thus refuting the previous claim by Clements (1986) that Luganda gemination occurs as a result of compensatory lengthening of consonant. It is concluded that Luganda gemination is not an isolated case of compensatory 'consonant' lengthening but its application is governed by the universal conditions on consonant gemination, occurring, as in West Germanic and Italian consonant gemination, in contiguity with a sufficiently strong resonant consonant.

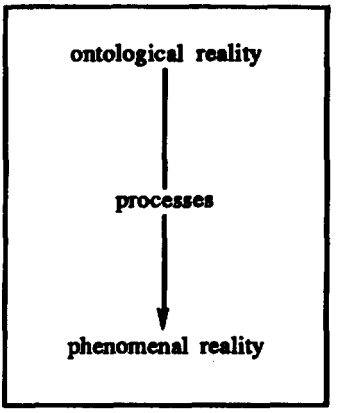
0. Introduction

In the phonological theory being developed by Prof. James Foley (Theoretical Phonology: Foley 1977, 1981, 1991), it is maintained that

phonological rules used in description and explanation of language must be universal, belonging to the set of universal phonological processes. The underlying thesis is that there exist a limited number of processes occurring as part of the definition of Language, to which all of the phonological rules in languages of the world must belong. In this paper, this concept of universal phonological process is applied to analysis of consonant gemination and glide strengthening in Luganda, an Eastern Bantu language spoken in the African country of Uganda.

The idea that there are universal processes underlying observable phenomena is not new, which in fact has been the backbone of theoretical science since its inception. In the development of physics, for example, processes have been an important topic of investigation, where major discoveries, often called laws of nature, are made concerning certain processes or the principles governing their operation. They had also been the subject of much discussion once before in the history of linguistics, namely during the nineteenth century when Neogrammarians formulated their linguistic laws; We know this because these so-called laws are in fact universal processes: Grassmann's law is of dissimilation, Verner's law of (preferential) lenition, and Grimm's law of consonantal strengthening.[1] Indeed, the two phonological processes that are to be analyzed in this paper also have the traditional origin: Consonant gemination has long been known by the example of West Germanic consonant lengthening, though no specific name has been given to this traditional 'law', while glide strengthening in Gothic and Old Norse is traditionally appellated Holtzmann's Law.

Why do processes take such an important place in the minds of scientists as well as linguists? It is because as scientists we are typically interested in the underlying realities that can be discovered by a systematic investigation, and believe that processes are the link, perhaps the only link available, to the abstract reality that underlies the phenomenal world we live in;[2]



To give an example in linguistics, linking the words such as *illegal, immoral, irregular* with their underlying representation,**in-legal, *in-moral, *in-regular*, are the rules such as *nl*→ *ll*, *nm*→ *mm*, and *nr*→ *rr*, which all belong to the phonological process of assimilation. This linkage provides an understanding not only of the relationship between the two representations but also of the abstract morphological structure in which the common underlying negative prefix **in-* (as occurring in, e.g. *in-accurate*) is reconstructed from observation of the various allomorphs of the prefix.

In current approaches to linguistics, however, this important tradition in scientific investigation is often superseded by the practice of writing rules in the grammar, on the belief that such a description of language reflects the native speakers' linguistic knowledge. In phonological analysis, this has meant largely that rules may be written as long as there is no counterexample to them in the language described, or in some cases, as long as the exceptions are 'listed'. Characteristic of these language-particular approaches is the great attention paid not to the processes but to the description and representation of grammar. Thus a phonological rule would be written on the basis of its descriptive simplicity (arguing that simple rules reflect the linguistic knowledge of native speakers), or its formal conformity to the

overall representation of grammar rather than its universal validity.

Theoretical Phonology denies such descriptive-parochial approaches to linguistics, wherein the goal is not to describe language but to understand Language, the system that underlies all languages of the world. And achieving this goal in part means knowing not only how languages are alike but also how and in what respects they differ. Theoretical Phonology maintains that such a goal is best achieved by studying universal phonological processes: While all languages share the same set of universal processes, they may differ in manifestation of these processes. Thus a phonological process may occur in a number of languages under the same universal condition, but the rule configurations belonging to that process in each language may not necessarily be the same, due to the diverse parochial manifestation of the universal condition.

This concept of universal phonological process plays an essential role in Theoretical Phonology in defining the set of natural rules, providing principled phonological explanation, and understanding coherent linguistic change. As an illustration of what is actually meant by this concept, and to introduce other theoretical concepts and principles that interact with it in the explanatory system of Theoretical Phonology, we therefore consider below the universal phonological process of apocope, particularly its conditions on application in Romance languages.

0.1 Romance apocope

It is well known in Romance languages that vowels often drop in word final position, as in[3]

Romance	Italian	Spanish	Sursilvan	French
amica	amica	amiga	amitga	amie
amico	amico	amigo	amitg	ami
mare	mare	mar	mar	mer

But not so well known is the fact that languages differ with regard to the type of vowels that drop by apocope. In the above data, for example, though the

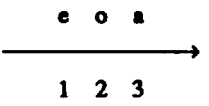
same universal process of apocope occurs in Spanish, Sursilvan, and French, the vowels that drop in word final position differ from language to language. By examining the rule configurations of apocope in the above languages, we can therefore establish preferential relations in application of apocope with regard to the three vowels, (*e*, *o*, *a*). For example, since word final *e* drops but word final *a* and *o* remain in Spanish, we can say that apocope occurs to *e* in preference to *a* and *o*. Similarly, since *e* and *o* drop but *a* remains in the same word final position in Sursilvan, we can say that apocope occurs to *e* and *o* in preference to *a*. Finally, combining these two preferential relations, we can conclude that apocope occurs to *e* in preference to *o* in preference to *a*.

There are a couple of questions that naturally arise from the above observation. One is: why would such preferential relations in apocope obtain in natural languages? Another question concerns the extent of apocope that these languages have undergone. Including Italian and French into the set of languages compared, since in Italian none of the three vowels in word final position drops but in French all of the three vowels drop (Note that the final vowel in Fr *amie* is not pronounced: [ami]), we can make a generalization that apocope has occurred least extensively in Italian but most extensively in French, while in between these two extremes are Spanish and Sursilvan (in that order). An obvious question is thus: how can we explain, in a coherent fashion, such variation among a group of languages in application of apocope?

Answers to these questions are sought in Theoretical Phonology under an explanatory system that comprises three theoretical constructs: a set of abstract phonological elements, a set of universal phonological rules, and a set of principles governing application of these rules. Phonological elements are defined on parameters according to their relative phonological strength, which in turn is determined by their participation in phonological rules. Universal rules are those phonological rules that are instantiations of universal phonological processes, the set of processes that underly all languages of the world. Application of universal rules in languages is subject to a small number of principles, the most important of which is the *Inertial Development Principle*. This principle states that weak elements weaken first

and preferentially in weak environment and strong elements strengthen first and preferentially in strong environment.

In the above data, for example, since a vowel drops by apocope in word final position, we can say that apocope is a weakening process, and the word final position in which such a change occurs is a weak environment. With reference to the relative strength of the three vowels,[4]



it is thus predicted by the *IDP* that if apocope occurs in a language, it will occur first and preferentially to the weakest *e*, as in Spanish where $e \rightarrow \emptyset$ / __# but *o*, *a* → *idem*.[5] This is the primordial rule in apocope of the three vowels. This rule then generalizes to occur to the next weaker element on the parameter, resulting in Sursilvan as $e, o \rightarrow \emptyset$ / __# but *a* → *idem*. In French where all three vowels drop by apocope, the rule has further generalized to include the strongest *a*. The Italian configuration where none of the three vowels drop, simply indicates that the language does not possess the rule.

The above generalizations are often written in Theoretical Phonology in a form such as

universal process: $V \rightarrow \emptyset$ / __#
universal condition: $|V| \leq \delta$
parochial condition: $\delta = 0$ for Italian
$\delta = 1$ for Spanish
$\delta = 2$ for Sursilvan
$\delta = 3$ for French

The universal process states that apocope is a phonological process that drops a vowel in word final position. The universal condition stipulates that the strength value of such a vowel be sufficiently small. The parochial condition is the instantiation of this universal condition in individual languages.

The values of parochial condition clearly show the extent of apocope that each language has undergone, because the smaller the value, the lesser the number of vowels included by the condition. The universal condition, on the other hand, predicts the type of rule configurations of apocope that are expected to occur in languages, thus enabling us to distinguish between natural rules from unnatural ones. If we consider all the logically possible rule configurations of apocope with regard to the above three vowels, there are all together eight combinations:

1) e → idem	5) e → Ø
o → idem	o → idem
a → idem	a → idem
2) e → idem	6) e → Ø
o → Ø	o → Ø
a → Ø	a → idem
3) e → idem	7) e → idem
o → idem	o → Ø
a → Ø	a → idem
4) e → Ø	8) e → Ø
o → idem	o → Ø
a → Ø	a → Ø

Of these, the universal condition predicts that *1*, *5*, *6*, and *8* are linguistically possible combinations but *2*, *3*, *4*, and *7* are not. The claim here is that phonological rules occurring in the former are natural because they obey the universal condition $/V/ \leq \delta$ whereas the rules in the latter are unnatural because they violate it. In fact, though the former configurations are found to occur in natural languages, the latter are not; *1* is the configuration occurring in Italian, *5* in Spanish, *6* in Sursilvan, and *8* in French, but there is no language that has configurations such as *2*, *3*, *4*, and *7*.

A phonological analysis done under the concept of universal phonological process provides a coherent explanation of various rule configurations of apocope in Romance languages. Although in a Transformational analysis it has been customary to describe a phonological phenomenon as simple as

possible in the 'grammar' of a language, such a description in this case would only complicate the matter, for each language would have required a separate rule of apocope, despite the fact that these rules are all instantiations of the same weakening process of apocope. In contrast, the above Theoretical analysis not only subsumes these rules under one process of apocope, but also captures, coherently, the relation of change by apocope among languages. Since apocope is a weakening process that applies preferentially to weak elements in consonance with the *IDP*, weak vowels are more likely to drop by apocope than strong vowels. Stronger vowels *o* and *a* may drop in a language, but not before weaker *e* has already dropped. The difference among languages is thus how extensively the process has developed by rule generalization in each language.

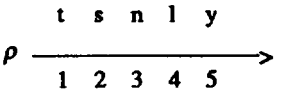
In the following, the phonological processes of consonant gemination and glide strengthening are similarly analyzed in Luganda. But as a preliminary, we first consider the universal conditions on application of these processes in some well known IndoEuropean languages in sections 1 and 2, and then examine in detail their interaction in Luganda in section 3. With the insights gained from these analyses, a new solution is proposed in section 4 concerning the origin of geminate consonants in Luganda, a phonological problem previously considered by Meeussen (1955), Mould (1974), and Clements (1986), all under compensatory lengthening of consonants. The paper concludes in section 5 with a brief summary of the proposed analysis and some remarks on its ramifications for the phonological theory in general.

1. Consonant gemination in West Germanic and Italian

Consonant gemination is a strengthening process in which a consonant doubles before (or sometimes after) another consonant. In consonance with the *IDP* that strengthening occurs preferentially in strong environments, the process often occurs in contiguity with a sufficiently strong consonant, as in, for example, West Germanic consonant lengthening (Prokosch 1939, Foley 1971) where consonants generally geminate before strong resonant consonants (i.e. glides, liquids, nasals), e.g.

Gothic	O. Saxon	Old English	OHG	
bidjan	biddian	biddan	bitten	"ask"
skapjan	------	scieppan	scepfen	"creat"
sibja	sibbia	sibb	sippa	"related"
hugjan	huggian	hycgan	huggen	"think"
(ON) eple	------	æppel	apful	"apple"
letilis	luttil	------	luzzil	"small"
baitrs	bittar	bittor	bittar	"bitter"
(ON) dapr	------	dapper	tapfar	"weighty"

For examples of gemination before *n*, note: OHG *knappo* <**knab-n* (cf. OHG *knabo* "knave"; *n* is a noun suffix) and OHG *tropfo* <**drop-n* (cf. OE *dropa* "a drop" without the *n* suffix). With reference to the *rho* phonological parameter (*t* for stops, *s* for sibilants, *n* for nasals, *l* for liquids, *y* for glides)



the universal rule is

1) gemination: C → CC /__ K where |K| ≥ Δ
Δ = 3 for West Germanic

In certain languages, after gemination of the preceding consonant, the resonant drops by a special type of consonant cluster reduction, leaving only the geminate reflex:

2) devolution: CCK → CC

This explains the lack of glide in the Old English and Old High German examples: OE *biddan*, OHG *bitten*, etc. Note also *bn* → *pp*, *pn* → *pf* in the

above OHG *knappo* < **knab-n*, OHG *tropfo* < **drop-n*. The same rule is blocked, however, in examples with liquids because the consonant cluster is broken up by anaptyxis, the phonological process that inserts a vowel between two consonants, often in cluster of consonant plus liquid, as in Latin, e.g. *ager* "field" < **agrr* < **agros* (cf. Eng *acre*). Consider

bidyan	æpl	
biddyan	æppl	gemination
"	æppel	anaptyxis
biddan	"	devolution of the resonant

In Italian, under the above condition on gemination ($/K/ \geq \Delta$), consonants geminate before the relatively stronger glides *w* and *y* in preference to the relatively weaker liquid *r* as in

	Latin	Italian	
Cw → CC:	habuit	ebbe	"he had"
	futuit	fotte	"he fornicated"
Cy → CCy:	apiu	appio	"celery"
	rabies	rabbia	"rage"
	triviu	trebbio	"corner"
Cr → idem:	quadrum	quadro	"picture"
	petra	pietra	"stone"
	supra	sopra	"over"

Thus for the above gemination rule, $\Delta = 5$ in Italian.

Since, however, the liquid on the above ρ parameter includes *l* as well as *r*, and since among the liquids *l* is relatively weaker than *r*

$$\underset{1}{l} \quad \underset{2}{r}$$

the gemination of *p* in examples such as

Cl → CCy:	duplus	doppio	"double"

appears to violate the above preferential condition, as the same rule fails before the stronger *r* in examples such as Lt *supra* It *sopra*. But this only means that the gemination in It *doppio* occurs before *y* rather than before *l*; First, *l* converts to *y* as in Lt *planus* It *piano* "flat", then the preceding consonant geminates before the sufficiently strong yod: *duplus* >**dupyo* >*doppyo*. Since *py* → *ppy* but *pr* → *idem* in this data, the rule configuration rather confirms the above preferential condition $/K/ \geq \Delta$.

Combining the rules of consonant gemination in West Germanic and Italian, we thus have

gemination: C → CC /__ K where $|K| \geq \Delta$
$\Delta = 3$ for West Germanic
$\Delta = 5$ for Italian

Note that there is a gap in this presentation. Though predicted by the universal condition $/K/ \geq \Delta$, a language that has the parochial value $\Delta = 4$ is missing in the above list. To fill this gap, we need to find a language in which consonants geminate before glides ($\Delta = 5$) and liquids ($\Delta = 4$) but not before nasals ($\Delta = 3$). Even though such a language has not been found yet, essentially the same condition obtains in Luganda, where consonant gemination occurs *after* glides and liquids in preference to nasals. This will be shown in section 3 below, after discussing glide strengthening.

2. Glide strengthening

Glide strengthening is the strengthening of a glide by acquiring a stop onset. The best known example of glide strengthening is Holtzmann's Law in Germanic languages, e.g.

Germanic	Old Norse	Gothic	OHG	
*twajje	tveggja	twaddje	zweio	"of two"
*drewwa	tryggvar	triggwa	triuwa	"faith"

where Germanic **w* and **y* respectively strengthens to g^w and d^y (or g^y in Old Norse). Note that the same rule is also observed in Romance words of

Germanic origin (Boyd-Bowman 1954, p135) where $w \rightarrow g^w$ in strong word initial position:

Germanic	Italian	Spanish	French	English
werra	guerra	guerra	guerre	war
wisa	guisa	guisa	guise	wise
warjan	guarire	guarecer	guérir	wary

On the other hand, the rule $y \rightarrow d^y$ occurs as part of the assibilation mechanism, which Foley (1977, p92) interprets as (using Lt *cera* [kera] Sp *cera*[sera] "wax" as an example):

kera	
kyera	palatalization
ktyera	Holtzmann's Law and assimilation: y → dy; kdy → kty
ktsyera	assibilation: ty → tsy
tsyera	cluster simplification: ktsy → tsy
tsera	syneresis of yod with front vowel: ye → e
sera	lenition: ts → s

Foley bases his arguments for the above interpretation on examples of assibilation in many languages, particularly Romance languages. He argues, for example, that from Lt *iuvenis*, Sp *joven* [χoβen] "young" has the following development;

1. yoven	
2. dyoven	Holtzmann's Law (i. e. glide strengthening)
3. dzyoven	assibilation proper
4. dẑoven	combination of *z* and *y* into *ẑ*
5. ẑoven	lenition, loss of stop onset
6. ŝoven	medieval Spanish sibilant devoicing
7. χoven	Spanish velarization

Step 4 corresponds to the assibilated reflex of *y* in It *giovane* [dẑovane], step 5 to Fr *jeune* [ẑæn], and step 7 to Sp *joven*.

The above rules of glide strengthening also occur in the mechanism of consonantal epenthesis, interpreted in H-S. Kim 1992 as comprising three

ordered rules of glide epenthesis, glide strengthening, and contraction between inserted glide and the stop onset. Under this interpretation, the epenthesis as occurring in Lt *camera* Fr *chambre* "room" and Lt *cinere* Fr *cendre* "ash" would have the following derivation ($\hat{d}$ indicates palatal *d*):

camera	cinere	
camra	cinre	syncope
cam^{w}ra	cin^{y}re	1) glide epenthesis
camg^{w}ra	cind^{y}re	2) glide strengthening: G → CG
cambra	cind̂re	3) contraction: $g^{w} \rightarrow b$, $d^{y} \rightarrow \hat{d}$
"	cindre	phonetic manifestation of $\hat{d}$ as *d*
chambre	cendre	MR

The fact that the glide strengthening rules occur in many languages and figure prominently in the mechanism of some well known phonological processes should not be surprising, because these are universal rules whose number is limited, and which therefore are used repeatedly in languages.

2.1. Glide strengthening in Bantu

From the above observation, we are thus not surprised to find that the same rules of glide strengthening occur in many Bantu languages, although this fact has not been generally recognized by traditional grammarians in their handbooks. Evidence supporting occurrence of the above rules of glide strengthening comes from several sources. First, there are the traditional examples of assibilation whose reflexes rather confirm the above established routine. For example, one of the noun-prefixes that often occurs with language names in Bantu is the class 7 prefix *ki-* , which occurs in Swahili, e. g. *Ki-swahili*. The same prefix, however, appears as *tʃi* in Herero, e.g. *Otji-herero*, and as *ʃi* in Ndonga, e.g. *Oshi-ndonga*. Although Meinhof (1932, p14) describes the change occurring in Herero as regressive (or in his term, *retrogressive*) assimilation noting that 'in Herero and elsewhere, *ki* frequently becomes *tji* because the *k* has approached the point of articulation of the *i* ...', this explanation fails to take into account the fact that the reflex of same "assimilation" in Ndoga is not *tʃi* but rather *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
tʃi	5) contraction of *s* and *y* into *ʃ*
ʃi	6) lenition

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

Secondly, there are examples of labial glide strengthening in post nasal position. In Tswana, according to Cole (1955, p47), when the noun class prefix *mo-* (protoBantu **mu-*) is attached to a stem commencing with a vowel, it appears as *ŋw-* :

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

Though Meinhof (1932, p14) assumes simple direct assimilation, saying that 'the velar qualities of *w* have changed nasal *m* into the velar nasal *ŋ*', we do not need such a dubious assimilation rule, for we can derive the same reflexes by using the above rule of glide strengthening and other universal phonological rules. After the glide formed by glide formation strengthens to *gw*, the preceding nasal assimilates to the velar *g* with subsequent nasal assimilation and degemination:

mu-ana	
mwana	1) glide formation: u → w/__V
mgwana	2) glide strengthening
ŋgwana	3) assimilation of place
ŋŋwana	4) nasal assimilation
ŋwana	5) degemination

A similar development also occurs in some Mijikenda dialects, in which, according to Hinnebusch (cf. Hinnebusch et al. 1981, p113-4), **mw* shifts to

labial velar nasal $\widehat{ŋm}$, e.g. $\widehat{ŋm}$aka "year" <*mu-aka. The crucial difference distinguishing these dialects from Tswana is that between rules 3) and 4) the contraction of *g* and *w* into *b* has occurred (recall the same rule in the mechanism of consonantal epenthesis where $w \rightarrow g^w \rightarrow b$):

mu-aka	
mwaka	1) glide formation: u → w/__V
mg^waka	2) glide strengthening
$ŋg^w$aka	3) assimilation of place
ŋbaka	4) contraction
ŋmaka	5) nasal assimilation
$\widehat{ŋm}$aka	6) syneresis

Finally, consider the following examples of what Mould (Hinnebusch et al. 1981, p190) calls obstruentization of glides in Logooli:

*umu-ana > umŋwaana "child"
*mi-eli > mɲeli "months"

The above data are of great importance because they evince the intermediate stages after glide strengthening of *w* and *y*. That *w* first strengthens to *gw* is shown by **umu-ana* > *umŋwaana* because otherwise we cannot explain the *w* after the velar nasal. Similarly, note that the *ñ* in **mi-eli* > *mɲeli* is palatal, i.e. [ɲ]. This also evince strengthening of *y* → *dy* because palatals often result by contraction of corresponding dental (or alveolar) consonant and the glide *y*. Note, for example, *s* and *y* contract into *ʃ* in English, e.g. *passion* [pæʃən]. Similarly, contraction of *n* and *y* would naturally give *ɲ*:

umu-ana	mi-eli	
umwana	myeli	glide formation
umgwana	mdyeli	glide strengthening
umŋwana	mnyeli	nasal assimilation
"	mɲeli	contraction
umŋwaana	"	vowel lengthening[6]

3. Consonant gemination and glide strengthening in Luganda

Having seen that the strengthening processes of consonant gemination and glide strengthening occur in many languages of the world, we now analyze the conditions on their application in Luganda, particularly their interaction to produce certain geminate clusters. Consider

infinitive	1 sg. perfect	
(o)ku-ggwa	(e)mpwedde	"be exhausted"
(o)ku-ggya	(e)mpidde	"burn"

whose geminate-cum-glide clusters, *ggw* and *ggy*, are traditionally derived from the geminate glides **ww* and *yy (cf. Meeussen 1955).

Proto-Bantu **p* normally appears as *w* in Luganda (and as *h* in Nkore) unless it forms a prenasalized stop $\widehat{mp}$ with a preceding nasal (cf. *(e)mpwedde, (e)mpidde*). Compare

Luganda	Nkore	Swahili	
wa-	ha-	pa-	class 16 (locative) prefix
(o)ku-wa	(o)ku-ha	ku-pa	"give"

Other examples with *p* in Luganda, e.g. *pima* "weigh!" are of foreign origin, mainly Swahili (cf. Swah *ku-pima* "to weigh": Tucker 1962, p130f). There is also a phonological rule in Luganda converting *w* to *y* before *i*, as witnessed by the alternation between *p* and *y* in examples such as

(e)mpiso "needle"	(a)kayiso "small needle"
(e)mpita "I pass"	(o)ku-yita "to pass" (cf. Swahili *ku-pita*)

These rules are illustrated in the following derivation:

ku-pue-a	ku-pi-a	
ku-wue-a	ku-wi-a	p → w
"	ku-yia	w → y /__ i
ku-wwea	ku-yya	glide formation: u → w, i → y / __ V
ku-ggwea	ku-ggya	ww → ggw, yy → ggy
ku-ggwaa	"	ea → aa
ku-ggwa	"	v̄ → v̆ / ___ #

Included in the conversions, **ww* → *ggw* and **yy* → *ggy*, are the following strengthening rules

1) glide strengthening: w → gw / w __ , y → gy / y __
2) gemination (with subsequent devolution of the resonant): wg → gg, yg → gg

both of which occur, in consonance with the *IDP*, after the strong glide in Luganda:

ww	yy	
wgw	ygy	glide strengthening(G__)
wggw	yggy	gemination (G__)
ggw	ggy	devolution of the resonant
(ku-ggwa)	*(ku-ggya)*	

The same processes also occur in the following class 5 nouns with glide initial stems:

class 5 (sg.)	class 6 (pl.)	
(e)ggwanga < *e-li-wanga	(a)ma-wanga	"nation"
(e)jjinja < *e-li-yinja	(a)ma-yinja	"stone"

The Luganda words are given here with the so-called 'initial vowel'. This optional vowel, which is one of the morphological characteristics of Bantu languages in general, always precedes the class prefix and agrees (i.e. is in harmony) with the prefixal vowel in the following syllable, e.g. Luganda: *o-mu-ntu* "person", *a-ba-ntu* "people", and *(e)ggwanga* < **e-li-wanga*. The underlying class 5 prefix **li-* occurs in examples such as

class 5(sg.)	class 6(pl.)	
(e)li-ggwa	(a)ma-ggwa	"thorn"

The vowel of this prefix is lost by syncope in Luganda unless it is supported by two consonants as in *(e)li-ggwa* (see below for further explanation). After this preferential syncope of *i*, *l'w* and *l'y* convert to *ggw* and *jj* [ʤʤ] by the

same processes of glide strengthening and consonant gemination, both of which occur after the sufficiently strong liquid *l*:

e-li-ggwa	e-li-wanga	e-li-yinja	
"	elwanga	elyinja	syncope
"	elgwanga	eldyinja	glide strengthening: w → gw, y → dy / l __
"	"	elʤinja	assibilation: dy → dzy → ʤ
"	elggwanga	elʤʤinja	gemination: C → CC / l __
"	eggwanga	eʤʤinja	devolution of the resonant

The above examples show that both consonant gemination and glide strengthening occur in Luganda after strong resonant consonants such as glides and liquid. After the resonant consonant of nasal, however, no consonant gemination but only glide strengthening occurs. Consider the 1. sg. present of the following verb,

infinitive	1 sg. present	
(o)ku-yigga	(e)njigga < *e-ni-yigga	"hunt"

where *y* strengthens to *dy* with subsequent assibilation to ʤ but without occurrence of the gemination routine.

The same glide strengthening rule is also observed in certain examples of Meinhof's rule, a dissimilation rule in Bantu which converts a nasal compound into a geminate nasal cluster if it is followed by another nasal compound in the next syllable (Meinhof 1932, p183; Meeussen 1963). In Luganda, a generalized version of this rule applies, where a nasal consonant in the second syllable also triggers the rule, i.e. *NCVN(C)* → *NNVN(C)*:

infinitive	1 sg. present	
kubumba	(e)mmumba	"model"
kuluma	(e)nnuma	"bite"
kugenda	(e)nnenda	"go"

These examples contrast with the following examples that do not undergo

Meinhof's rule:

infinitive	1 sg. present	
kubala	(e)mbala	"count"
kulaba	(e)ndaba	"see"
kugula	(e)ŋgula	"buy"

Forms such as 1 sg. *(e)nnuma* is from **e-ni-duma* and the infinitive *kuluma* is derived from **ku-duma* by a rule converting *d* to *l* (cf. Lt *lingua* <**dingua* Eng *tongue*).

In stems beginning with y or a vowel, however, the reflex of Meinhof's rule is a palatal nasal cluster *nny* [ɲɲ]:

infinitive	1 sg. present	
kwanika	(e)nnyanika	"put out to dry"
kuyimba	(e)nnyimba	"sing"

These examples are curious because 1) Meihof's rule is occurring even though the obligatory first nasal compound is not present in their underlying forms, e.g. *(e)nnyanika* <**e-ni-anika* and 2) operation of the rule yields not a simple geminate nasal but a palatal nasal cluster. The first point suggests that the glide *y*, either present underlyingly or formed by glide formation, has strengthened to d^y in contact with the sufficiently strong preceding nasal. The second point indicates that after operation of Meinhof's rule, contraction between the nasal and the following glide has occurred, eventually giving [ɲɲ]:

(e)ni-anika	(e)ni-yimba	
(e)nyanika	"	glide formation
"	(e)nyimba	syncope
(e)ndyanika	(e)ndyimba	glide strengthening (N__)
(e)nnyanika	(e)nnyimba	Meinhof's rule
(e)ɲɲanika	(e)ɲɲimba	contraction: ny → ɲ
(e)ɲɲanika	(e)ɲɲimba	assimilation of place

As for the reasons assuming strengthening of *y* to *dy* rather than to *gy*

in these examples, consider the following arguments:

1) One of the principles of assibilation (Foley 1977, p94) is that *dy* assibilates before *gy*. Thus the fact that the strengthened *y* assibilates in examples such as *ejjinja* <**e-li-yinja* and *enjigga* <**e-ni-yigga* in preference to examples such as *okuggya* <**o-ku-yya* strongly suggests that *y* → *dy* (→ *ʤ*) / *l*, *n* __ but *y* → *gy* / *y*__.

2) One of the principles governing the reflexes of epenthesis is that the epenthetic consonant is always homorganic with the preceding consonant, e.g. *nr* → *ndr* as in Lt *cinere* Fr *cendre* "ash", *lr* →*ldr* as in Lt *molere* Fr *moudre* "to grind" but *mr* → *mbr* as in Lt *camera* Fr *chambre* "room". The insertion of a homorganic dental stop after *l* and *n* by yod strengthening in Luganda reveals the same pattern: the insertion of *g* after *y* by the same process may be due to the palatal nature of the first yod in the rule **yy* → *ggy*.

3) It is not unusual for the yod strengthened by glide strengthening to fluctuate its reflex between *dy* and *gy*, as in the examples of Holtzmann's law,

Germanic	Old Norse	Gothic	OHG	
**twajje*	tveggja	twaddje	zweio	" two"
**drewwa*	tryggvar	triggwa	triuwa	"faith"

where the reflex of strengthened *y* is *gy* in Old Norse but *dy* in Gothic, presumably because *y* is palatal in Old Norse but dental in Gothic.

3.1 Summary of rules

The above glide strengthening rules in Luganda may be summarized as

replacement	environment	examples
w → gw	[w __]	(o)ku-ggwa < *o-ku-wwa
y → gy	[y __]	(o)ku-ggya < *o-ku-yya
w → gw	[l __]	(e)ggwanga < *e-li-wanga
y → dy	[l __]	(e)jjinja < *e-li-yinja
y → dy	[n __]	(e)njigga < *e-ni-yigga

This table clearly shows that in consonance with the *IDP*, the glide strengthening in Luganda generally occurs after sufficiently strong resonants. With reference to the above ρ parameter, the universal rule is thus

glide strengthening: $G \rightarrow CG / K \_\_$ where $|K| \geq \Delta$
$\Delta = 3$ in Luganda

Similarly, the gemination rules (with subsequent devolution of the resonant) used in the above analysis of Luganda may be summarized as

replacement	environment	examples
g → gg	[w __]	(o)ku-ggwa < *o-ku-wwa
"	[y __]	(o)ku-ggya < *o-ku-yya
"	[l __]	(e)ggwanga < *e-li-wanga
j → jj	[l __]	(e)jjinja < *e-li-yinja
j → idem	[n __]	(e)njigga < *e-ni-yigga

This table clearly shows that in consonance with the *IDP*, the strengthening process of consonant gemination in Luganda applies preferentially after sufficiently strong resonants such as glides and liquid, though not after relatively weaker resonant nasal. With reference to the above ρ parameter, the universal rule is thus

gemination: $C \rightarrow CC / K \_\_$ where $|K| \geq \Delta$
$\Delta = 4$ in Luganda

Since we are concerned here with the conditions on consonant gemination rather than the direction of its application, we can combine the above condition on consonant gemination in Luganda with those given in section 1 in a form such as

gemination: $C \rightarrow CC / \ldots K$ where $|K| \geq \Delta$ (... K = in contiguity with K)
$\Delta = 3$ in West Germanic
$\Delta = 4$ in Luganda
$\Delta = 5$ in Italian

4. Origin of geminate consonants in Luganda

Aside from the above examples of consonant gemination and glide strengthening, geminate consonants also appear in Luganda where closely related neighboring languages show the reflex of the Proto-Bantu extra high front vowel **î* followed by the corresponding consonant. For this reason, this gemination has traditionally been considered an example of compensatory lengthening (Ashton et al. 1954, p10):

> "The double consonant in Luganda in some cases probably compensates for the loss of "I" in kindred languages. *Ku-bba*, to steal, cf. Runyoro: *kw-iba*"

Recently, in a nonlinear metrical account entitled "Compensatory lengthening and consonant gemination in Luganda", Clements(1986) gives a similar explanation, characterising the phenomenon as 'a type of compensatory lengthening process in which a consonant "spreads" backward to occupy the position of the disassociated (hence, deleted) vowel...' (p65).

Part of Clements' argument concerns analysis of the following comparative data for class 5 nouns given by Mould (1974);

Luyia	Lusoga	Luganda	
ligumba	eigumba	eggumba	"bone"
libeere	eibeere	ebbeere	"breast"
lifumu	eifumu	effumu	"spear"
likumi	eikumi	ekkumi	"ten"

The words in Luganda and Lusoga are given here with the 'initial vowel'. Noting that of the above three closely related languages, the *l* of the class 5 noun prefix **li-* is absent in both Luganda and Lusoga, Clements assumes that in these languages *l* has dropped giving rise to the intermediate vowel sequence **Vî*. Clements then claims that the geminate consonants in the above class 5 nouns of Luganda arise by the same processes that have caused gemination in the infinitives such as the above *ku-bba*: loss of PB **î* with subsequent compensatory consonant lengthening.

This analysis, however, fails to note that the same rule dropping the

prefixal *l* does not occur in examples such as[7]

Lusoga	Luganda	
eliiso	eliiso	"eye"
eliino	elinnyo	"tooth"

Nor does it give any independent evidence that consonants indeed lengthen by compensatory lengthening, despite that the explanation crucially depends on existence of such a rule. This is not to say that compensatory lengthening of consonant is phonologically an implausible rule but rather that it must be justified on phonological grounds, by showing that the putative rule occurs independently in other languages, and, if possible at all, by subsuming it under the general process of compensatory lengthening. This is especially so because 1) in the well-known cases of compensatory lengthening surveyed, for example, by Anderson and de Chene (1979), not consonants but vowels typically lengthen by the process, e.g. Lt *nīdus* < **nĭ-sd-os* (cf. Lt *sedeo* "sit"), 2) geminate consonants most often arise in languages not by compensatory consonant lengthening but rather by assimilation or gemination, as in Italian, e.g. Lt *septem* It *sette* "seven" where *pt* → *tt* and Lt *apiu* It *appio* "celery" where *py* → *ppy*, and 3) as illustrated above, in the examples such as, e.g. *ku-ggwa* and *ku-ggya* whose geminate-cum-glide clusters are traditionally derived from geminate glides, consonant gemination occurs without any vowel loss, although this important data for alternative source of geminate consonants in Luganda have largely been ignored in both traditional and Clements' analyses.

The crucial observation in the above comparative data is that it is not the consonant *l* but the vowel *i* of the prefix **e-li-* that drops in both Luganda and Lusoga. After this syncope of *i*, the stem initial consonant in Luganda which is now after the sufficiently strong liquid of the prefix undergoes the gemination routine as in the above derivation of class 5 nouns such as *eggwanga* < **e-li-wanga*;

e-li-iso	e-li-gumba	e-li-wanga	
"	elgumba	elwanga	syncope
"	"	elgwanga	glide strengthening

"	elggumba	elggwanga	gemination
"	eggumba	eggwanga	devolution

Note also the same combination of rules occurring in examples such as Luganda *(o)ku-bba*, derived, according to Guthrie(1967)'s reconstruction of common Bantu stems, from **o-ku-yîb-a*.

o-ku-yîb-a	
okuyba	syncope
okuybba	gemination
okubba	devolution

In Lusoga, on the other hand, after the same syncope of *i*, the *l* of the prefix **e-li*, instead of causing gemination of the following consonant, rather vocalizes before another consonant, giving *eigumba*, etc. For examples of vocalization of *l* in other languages, note: Lt *vulture* Sp *buitre* "vulture".[8] For an evidence that the *i* of *eigumba*, *eifumu*, etc. in Lusoga cannot be the original vowel *i* of the prefix **li-* but rather the secondary reflex of the prefixal *l* by vocalization, consider the following class 5 nouns with glide initial stems in Lusoga

class 5(sg.)	class 6(pl.)	
eigwanga < *e-li-wanga	amawanga	"tribe"
eijala < *e-li-yala	amayala	"big hungry person"

which, according to Mould (1974), correspond to the above examples of class 5/6 nouns in Luganda: sg. *eggwanga* pl. *amawanga* "nation" and sg. *ejjala* pl. *amayala* "big hungry person". These examples show that as in Luganda, stem initial glides also strengthen in Lusoga class 5 nouns. In Clements' analysis which assumes that the *l* of the prefix **e-li-* has dropped in Lusoga leaving *ei-* in *eigwanga*, etc, this glide strengthening cannot be explained coherently, for there is no theoretical reason why the glide should strengthen after the vowel *i* but not after the vowel *a* (cf. *eigwanga* but *amawanga*). In the alternative analysis presented here, however, this preferential glide strengthening is easily explained, as it occurs in the same post-liquid

environment as the glide strengthening in the corresponding examples of Luganda:

e-li-iso	e-li-gumba	e-li-wanga	
"	elgumba	elwanga	syncope
"	"	elgwanga	glide strengthening
"	eigumba	eigwanga	vocalization: l → i / __C

Note that unlike the rule eliding the prefixal *l* in Clements' analysis, the rule eliding the medial vowel *i* is posited in the above analysis not only because it feeds the later application of phonological rules such as consonant gemination and vocalization, but also because it meets the preferential conditions on the universal process of syncope. The previous Theoretical study (Foley 1987) has shown that application of this process in languages is subject to the following conditions: 1) in consonance with the *IDP* that weakening occurs preferentially to weak elements, weak vowels drop by syncope in preference to strong vowels; under this condition, for example, syncope in Luganda drops weaker *i* in preference to the stronger *u*, e.g. *eggumba* < **e-li-gumba* but *oluganda* "language of Buganda, brotherhood" where *i* → *Ø* but *u* → *idem*; Recall also the Romance apocope, which occurs preferentially when the word final vowel is sufficiently weak: V → Ø / __# where |V| ≤ δ. 2) syncope often occurs preferentially after sufficiently strong consonants, as in Lt *carnis* <**caronis* (cf. nom.*caro* <**caron*) where the medial *o* drops after the strong liquid but Lt *hominis* < **homonis* (cf. nom. *homo* < **homon*) where the same vowel remains (as *i*) after the weaker nasal;

caron	caronis	homonis	
"	carnis	"	preferential syncope
"	"	hominis	medial vowel weakening
caro	"	"	n → Ø / __ #

or in Luganda where syncope of *i* applies after the strong resonants in general in preference to the weaker nonresonants, e.g. *ebbeere* <**e-li-beere* "breast"(cf. pl. *ama-beere*) and *embala* <**e-ni-bala* "I count" (cf.*oku-bala* "to

count") where $i \rightarrow \emptyset$ after the resonants *l* and *n* but *ekibeere* <**e-ki-beere* "udder" and its plural *ebibeere* <**e-bi-beere* where $i \rightarrow idem$ after the nonresonants; With reference to the above ρ parameter, the universal rule is thus

$$V \rightarrow \emptyset / VC\_\_CV \qquad \text{where } |Cl| \geq \Delta$$
$$\Delta = 4 \text{ for Latin}$$
$$\Delta = 3 \text{ for Luganda}$$

3) application of syncope sometimes depends on the number of consonants surrounding the medial vowel, as it often applies after (or sometimes before) one consonant in preference to two or more consonants, as in Luganda, e.g. *eggumba* <**e-li-gumba* (cf. pl. *ama-gumba*) but *eliggwa* <**e-li-ggwa* (cf. pl. *ama-ggwa*) where $i \rightarrow \emptyset$ / *VC__CV* but $i \rightarrow idem$ / *VC__CCV*.

A phonological analysis done under the concept of universal phonological processes provides a coherent explanation of the above comparative data for class 5 nouns in Eastern Bantu, revealing in the process the origin of geminate consonants in Luganda. Since in phonological analysis incorrect rules lead to erroneous arguments, and eventually to incorrect conclusion, it is essential that correct rules are formulated. And since universal processes manifest into rules in individual languages, this means not only that the rules should have no exceptions but also that the processes involved must be correctly interpreted. For example, in the following data of Luganda

(e)bbeere < *e-li-beere "breast' (cf. pl. (a)ma-beere)
(e)mbala < *e-ni-bala " I count" (cf. inf. (o)ku-bala)

an analysis that posits simple elision of the prefixal *l* in *(e)bbeere* <**e-li-beere* would run into theoretical difficulties (in addition to the counterexamples such as *eliiso* mentioned above) because the weaker prefixal *n* remains in the same environment: *(e)mbala* <**e-ni-bala*. Such an analysis would thus contradict the *IDP* that in weakening processes such as elision weak consonants weaken (or drop) in preference to strong consonants. As this

interpretation violates the *IDP*, elision cannot be the correct process.

Alternatively, we could assume that the prefixal vowel *i* drops by syncope in both words, and then the stem initial consonant undergoes preferential gemination (with subsequent devolution of the resonant) after the strong resonant *l* in preference to the weaker *n*, as in

e-li-beere	e-ni-bala	
elbeere	enbala	syncope
elbbeere	"	preferential gemination
ebbeere	"	devolution
"	embala	assimilation

This interpretation avoids the above theoretical difficulties as well as use of the incorrect rule eliding the prefixal *l*. We consider it to be the correct interpretation of the processes involved, for the following arguments:

1) It reveals that consonant gemination in Luganda applies after the strong liquid *l* in preference to the weaker nasal *n*, in consonance with the *IDP* that a strengthening process such as consonant gemination occurs preferentially in strong environment.

2) The rule configuration for gemination used in the above derivation,

$$C \rightarrow CC / l\_\_$$
$$\text{but} \quad C \rightarrow \text{idem} / n\_\_$$

is in fact a manifestation of the universal process of gemination

$$C \rightarrow CC / K\_\_ \qquad \text{where } |K| \geq \Delta$$
$$\Delta = 4 \text{ in Luganda}$$

3) There are independent evidences, internal as well as external, supporting the consonant gemination posited in the above analysis; Internally, the same process not only explains the geminate consonants in, e.g. *o-ku-bba* <**o-ku-yîb-a* but also collaborates with glide strengthening to produce the geminate-cum-glide clusters in, e.g. *ku-ggwa* <**ku-wwa* and *ku-ggya* <**ku-yya*, while externally the same process occurs in, for example,

West Germanic languages and Italian, though in reversed direction.

4) The rule strengthening the stem initial consonant in the above analysis is related to the glide strengthening rules occurring elsewhere, under the general strengthening of the stem initial consonants in sufficiently strong environment; In Luganda, for example, in consonance with the *IDP*, the strong glides after the liquid in, e.g. *eggwanga* <**e-li-wanga* generally undergo double strengthening of glide strengthening and consonant gemination, but the weaker consonants in, e.g. *ebbeere* <**e-li-beere*, single strengthening of gemination; In Lusoga, on the other hand, the strong glides strengthen in preference to the weaker consonants after the liquid with subsequent vocalization of *l*, as in *eigwanga* <**e-li-wanga* but *eibeere* <**e-li-beere*.

5) Other interpretations are possible but not plausible. For example, although it is possible to interpret the change of *lb* → *bb* in *ebbeere* <**e-li-beere* as simple assimilation rather than the more complex subrules of gemination and subsequent devolution, such an interpretation is not plausible because it violates the universal condition on assimilation that assimilation typically occurs to sufficiently similar consonants: since n and b are more similar to each other than *l* and *b* on the above ρ parameter, we should expect either a preferential assimilation, i.e. *nb* → *bb* but *lb* → *idem* or its generalization, *nb* → *bb* and *lb* → *bb*, but not *nb* → *mb* but *lb* → *bb* as in the above examples of *embala* < **e-ni-bala* but *ebbeere* < **e-li-beere*.

5. Conclusion

Previous analyses have all contended that geminate consonants in Luganda arise due to loss of PB **î* with subsequent compensatory lengthening of the following consonant. There are however several problems with this explanation: 1) there is no independent evidence that consonants indeed lengthen by compensatory lengthening; In other languages, not consonants but vowels typically lengthen by the process. 2) Long (geminate) consonants typically arise in languages either by assimilation (*CK* → *KK*) or by gemination (*CK*→ *CCK*); Indeed the geminate-cum-glide clusters in Luganda, *ggw* and *ggy*, are traditionally derived from geminate glides **ww*

and *yy, but this alternative source for consonant gemination has not been considered in previous analyses. 3) Since these geminate-cum-glide clusters arise without any vowel loss, they contradict the traditional claim that geminate consonants originate in Luganda to compensate for the loss of PB*$\hat{\imath}$.

In Theoretical Phonology, it is maintained that

> "The rules of a language must belong to the set of universal phonological rules. They cannot be created ad hocally and justified by workability or simplicity." (Foley 1975, p37)

If a rule does not belong to the set of universal rules, it is therefore not only unacceptable as a phonological rule but the data must be reinterpreted so that a correct rule could be formulated. It is for this reason that consonant gemination in Luganda is reanalyzed under the universal processes of consonant gemination and glide strengthening, two strengthening processes whose application in languages is governed by the *Inertial Development Principle* that strengthening occurs preferentially in strong environment.

There are several reasons why among the various phonological processes consonant gemination and glide strengthening have specifically been chosen as an alternative to compensatory lengthening. Firstly, unlike compensatory lengthening of consonant posited by Clements, these processes do occur in a number of well known languages; consonant gemination is the process underlying Germanic consonant lengthening and Italian gemination, while glide strengthening occurs as Holtzmann's Law in certain Germanic languages as well as in a number of Bantu languages. Secondly, the conditions on these processes are derived from the *IDP*, the Theoretical principle that governs application of other universal phonological processes, such as, for example, apocope in Romance languages. Thirdly, and most importantly, these processes crucially interact to produce previously unexplained geminate-cum-glide clusters in Luganda: *ku-ggwa* < **ku-wwa*, and *ku-ggya* <**ku-yya*.

Since these consonantal changes in Luganda have puzzled Bantu phonologists for years, their explanation in terms of the universal processes

of consonant gemination and glide strengthening is an achievement by itself. But its real value lies in the crucial examples it has furnished to determine the precise condition on consonant gemination in Luganda, ultimately leading to an alternative explanation of the origin of geminate consonants.

By combining the conditions on gemination thus discovered in Luganda with those established earlier in West Germanic and Italian, the analysis has shown that the diverse rule configurations of consonant gemination in these languages are a coherent consequence of the universal condition that consonant gemination occurs preferentially in contiguity with a sufficiently strong resonants:

gemination: $C \rightarrow CC / \ldots K$ where $|K| \geq \Delta$
$\Delta = 3$ in West Germanic
$\Delta = 4$ in Luganda
$\Delta = 5$ in Italian

The upshot of this analysis is that languages share the same universal process and its preferential condition, but may differ in its manifestation depending upon the extent of rule generalization each language has undergone. And this is exactly what is meant by understanding Language, which in part means knowing not only how languages are alike but also how and in what respects they differ.

As for glide strengthening, two arguments have been provided to establish it as a universal phonological process: 1) although traditionally limited to examples of Holtzmann's Law, the process actually occurs in a variety of languages including a number of Bantu languages as well as in the mechanism of certain universal processes such as assibilation and epenthesis. 2) Like consonant gemination in Luganda, the rule also applies after sufficiently strong resonants, in consonance with the *IDP* that strengthening occurs preferentially in strong environments:

glide strengthening: $G \rightarrow CG / K \_\_$ where $|K| \geq \Delta$
$\Delta = 3$ in Luganda

In addition, the discovery of this glide strengthening rule in Luganda also has repercussions regarding the questions that have persistently been raised against Holtzmann's Law. One of the questions frequently raised, for example, is whether Holtzmann's Law is a genuine law. Although this question is no longer valid since what traditional grammarians call laws are in fact phonological processes, it is nevertheless instructive to consider the reasons behind the dispute. According to Collinge (1985: 93-98) who presents an historical overview of the law, two common sources of disagreement lie at the heart of the controversy. First is the precise domain of the law, whose conditions for application in Germanic have never been clearly defined. Second is the problem of the law's reflexes: Why do we have *ddy* in Gothic but *ggy* in Old Norse as in Got *twaddje* ON *tveggja* OHG *zweiio* "of two"? Although these are certainly difficult questions and much work needs to be done to answer them, they are however no longer potent arguments against the law because existence of the law, or more precisely, existence of glide strengthening as a universal phonological process, can be inferred from its examples in Luganda where preferential application of the process in consonance with the *IDP* leaves no room for doubt. Moreover, based on the insights gained from previous analysis of epenthesis, a novel solution has been proposed for the second question: the different reflexes of *yy is due to the different nature of the yod in each language. Being palatal, the yod in Old Norse strengthens to *gy* whereas being dental, the yod strengthens to *dy* in Gothic.

One ramification that naturally emerges from the above discussion, I believe, is the importance of universal phonological processes as the subject of inquiry in phonological analysis. This is not only because universal processes underlie superficially complex phenomenal changes, but also because study of these processes helps us solve phonologically more difficult problems, providing, in the process, understanding of the systematic nature of Language. And this is why the concept of universal phonological process plays such an essential role in the explanatory scheme of Theoretical Phonology.

In the above explanation of varied reflexes of Holtzmann's Law, for

example, two observations based on the concept of universal phonological process have been crucial: 1) to realize that a similar variation also occurs in Luganda glide strengthening where you have *y* strengthening to *gy* after *y* but to *dy* after *l* and *n* as in *(o)ku-ggya* <**o-ku-yya* but *(e)jjinja* <**e-li-yinja* and *(e)njigga* <**e-ni-gga* and 2) that in the universal process of epenthesis the reflexes are often homorganic with the preceding consonant: *nr* → *ndr* as in Lt *cinere* Fr *cendre* "ash", *lr* → *ldr* as in Lt *molere* Fr *moudre* "to grind" but *mr* → *mbr* as in Lt *camera* Fr *chambre* "room".

Similarly, our knowledge gained from previous Theoretical analysis of universal processes such as assibilation, assimilation, vocalization, and syncope has proven to be essential in providing the basis for coherent explanation of consonant gemination in Luganda, helping us make difficult decisions on correct rules at crucial stages of the derivation. For example, the knowledge that glide strengthening as a universal process occurs after sufficiently strong consonants in consonance with the *IDP*, has been essential in interpreting the processes occurring in examples such as Luganda *ku-ggya* <**ku-yya*. Likewise, without knowledge of the universal conditions on gemination, acquired by previous Theoretical analysis of West Germanic consonant lengthening, the claim that the geminate consonants in Luganda arise by compensatory consonant lengthening would have remained unchallenged. As we study more processes, our knowledge of universal processes will increase, and so will our ability to solve phonologically difficult problems, and the result will be a deeper understanding of Language, its coherent structure behind the superficial manifestation in languages of the world.

NOTES

*This is a revised version of chapter one of my doctoral dissertation, entitled *Universal Phonological Processes: A theoretical analysis of dissimilation, cluster simplification, and their synergy for consonant cluster reduction in Romance and IndoEuropean languages* (Simon Fraser University, Vancouver, Canada 1991). I am again grateful to Prof. James Foley, my senior supervisor and teacher, from whom I learned Theoretical Phonology. Errors, if any, are however my own responsibility.

[1]The law has been interpreted as a series of strengthening rules by Foley (1970

and 1977, p40).

[2]This figure for ontological assumption is from Foley 1990, p17.

[3]The following illustration is based on Foley 1983. Sursilvan is a dialect of RaetoRomansh, spoken in Switzerland. Orthographic *tg* is [ʧ].

[4]Note that this parameter was not established arbitrarily, nor to solve the problem of apocope alone, but rather by examining participation of these vowels in other phonological processes as well, such as, for example, medial vowel weakening in Latin. For the arguments for this and other parameters used in this paper, see Foley 1977, chapter three.

[5]Idem means 'the same'; $A \rightarrow idem$ thus indicates that no change has occurred to *A*.

[6]Note that vowels are often long after glides in Bantu languages, e.g. Luganda *omwaana*, Logooli *umʧwaana* "child" (cf. Chesswas 1967, p 201) For explanation of this vowel length by compensatory lengthening, see Clements 1986, p47. The vowel *e* in *mʧeli*, however, is not long presumably because its lengthening is blocked by prior application of contraction:$ny \rightarrow ɲ$.

[7]Data adapted from Tucker & Bryan 1957, p18. Note that $l \rightarrow r / e\_\_$ in both Luganda and Lusoga, e.g. *eliiso* [eriiso].

[8]Menendez Pidal 1940, p140. See also Foley 1977, p56 for vocalization of *l* in Latin.

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