SOAS Working Papers in Linguistics Vol.15 (2007): 33-48

On Recent Trends in Phonology: Vowel Sequences in Bantu Languages

Al Mtenje
University of Malawi, amtenje@sdnp.org.mw

1. Introduction

The study of vowel sequences and their interaction with syllable structure in the phonology of Bantu languages has been a subject of considerable theoretical discussion. There are cross-linguistic variations on when and how such sequences are separated in order to yield preferred syllable patterns but the most common repair strategies are through epenthesis, glide formation, coalescence and deletion. One of the most challenging cases to explain is when, within one and the same language, vowel sequences are tolerated in one domain but disallowed in another.

There have been various theoretical positions over the decades in the analysis of this kind of phenomenon but the articulation of Optimality Theory (OT) (cf. Prince & Smolensky 1993, McCarthy 2004, Kager 1999, Archangeli & Langendoen 1997 among others) has provided new theoretical insights into how complex facts involving vowel sequences can be accounted for.

This paper discusses data from three Malawian Bantu languages namely, Cindali, Citonga and Cinyika in relation to syllabification, vowel deletion and consonant insertion and observes that while in the majority of cases, vowel sequences are eliminated through vowel deletion and consonant epenthesis to ensure that syllables generally begin with full onsets, there are instances when contiguous vowels are tolerated within the same language, which is paradoxical. It is then argued that these facts can easily be accounted for in OT by exploiting the notion of Cophonologies and variations in constraint rankings in the spirit of Downing (2003), Inkelas (1998), Orgun (1997), Inkelas & Zoll (2005) and others. The paper thus provides further supporting evidence from Bantu languages for the explanatory power of Cophonologies in Optimality Theory.

2. Reduplication in Cindali and Cinyika

Cindali and Cinyika are very closely related Bantu languages which are spoken in Chitipa district in northern Malawi and have been classified by Guthrie as M20. Due to their similarity, they have sometimes been regarded as dialects of the same language. Verbal reduplication in these languages, like in many other Bantu languages, indicates repetition and intensity of action. Reduplicated verb stems therefore carry the additional meaning of reflecting action which is repeated, frequent or intensive. Mtenje (2006) has shown that verbal reduplication in these languages essentially involves suffixing a copy of the verb stem (i.e. a verb root and its derivational suffixes, if they are available, and the final vowel) to the Base as shown in (1) below.

(1) Verb stem reduplication (identical forms are used in both Cindali and Cinyika).

Cindali and Cinyika

send-a	→	senda-senda	'take'
pan-a	→	pana-pana	'kick'
dumul-a	→	dumula-dumula	'cut'
womb-a	→	womba-womba	'do'

The evidence for treating reduplication as suffixation and not prefixation comes form the data in (2).

(2) Unreduplicated subjunctive monosyllabic verb forms

a.	n-dy-e	< /n-ly-e/	'I should eat'
b.	m-fw-e	< /n-fw-e/	'I should die'
c.	m-by-e	< /n-py-e/	'I should burn'

When the stems given above are reduplicated they appear as in (3) below.

(3)
a. n-dy-e-ilye
b. m-fw-e-ifwe
c. m-by-e-ipy-e

As it may be noted, there is an epenthetic vowel **/i/** which appears in the second portion of the reduplication construction. If RED was a prefix, there would be no easy way of accounting for this epenthetic **/i/** in the Base. A similar argument has been made by Hyman & Mtenje (1999) for Chichewa.

2.1 Onsets in Cindali and Cinyika

Like in the majority of Bantu languages, when vowel-initial verbs are reduplicated in Cindali and Cinyika, the reduplicants either copy prefix material (e.g. consonants) or change high vowels into glides in order to create full onsets in their initial syllables as shown in (4).

(4) **Cindali:** Distant Past Tense (tense marked by prefix -ka)

	unreduplicated		Reduplicated	Gloss
a.	ukota	< / u-ka-ot-a /	ukota-kota	'you basked'
b.	mukenga	< /mu-ka-eng-a /	mukenga-kenga	'you brewed'
c.	wakuma	< /wa-ka-um-a /	wakuma-kuma	'they dried'
d.	tukima	< /tu-ka-im-a /	tukima-kima	'we stood'

Cinyika (tense marked by prefix –ha)

e.	uhota	< /u-ha-ot-a/	uhota-hota	'you basked'
f.	muhenga	< /mu-ha-eng-a /	muhenga-henga	'you brewed'
g.	wahuma	< /wa-ha-um-a /	wahuma-huma	'they dried'

(5) **Cinyika and Cindali:** Infinitive tense (same forms in both languages; infinitive marked by prefix -uku)

a.	ukwaka	< /uku-ak-a/	ukwaka-kwaka	'to burn'
b.	ukwenga	< /uku-eng-a/	ukwenga-kwenga	'to brew'
c.	ukwima	< /uku-im-a /	ukwima-kwima	'to stand'

In the forms above, the reduplicated portions, which are suffixed to the verb stems, include prefix consonants to satisfy the regular condition in Bantu languages that reduplicants should ordinarily begin with full onsets.

2.2 Violations of Onset in Cindali and Cinyika

Although the examples above show that initial syllables of reduplicants generally begin with full onsets, there are instances in Cindali and Cinyika where this condition is violated and reduplicants have initial onsetless syllables. Consider the examples below.

Subjunctive constructions (marked by final vowel -e; Reduplicant in bold)

(6)	unreduplicated		Reduplicated	Gloss
a.	ndye	< /n-ly-e /	ndye-**ily-e**	‘I should eat’
b.	mfwe	< /n-fw-e/	mfwe-**imfw-e**	‘I should die’
c.	mbye	< /n-py-e/	mbye-**impy-e**	‘I should burn’

Near future tense (data taken from Chiona 2005 and through personal communication)

Cinyika (tense marked by –andi- plus final vowel –e; subject prefix repeated)

(7)	unreduplicated		Reduplicated	Gloss
a.	a:ndume	< /a-andi-a-um-e/	a:ndume-**ume** **(*a:ndumendume)**	‘s/he will dry’
b.	a:ndime	< /a-andi-a-im-e/	a:ndime-**ime** **(*a:ndimendime)**	‘s/he will stand’
c.	a:ndalye	< /a-andi-a-ly-e/	a:ndalye-**alye** **(*a:ndalyendalye)**	‘s/he will eat’
d.	wandiulye	< /u-andi-uly-e/	wandiulye-**ulye** (*wa**ndiulyendiulye)**	‘you will eat’

Cindali: Near future tense (marked by prefix -ti- plus final vowel -e; subject prefix not repeated)

(8)	unreduplicated		Reduplicated	Gloss
a.	tume	< /ti-a-um-e /	tume-**ume** **(*tumetume)**	‘s/he will dry’
b.	time	< /ti-a-im-e /	time-**ime** **(*timetime)**	‘s/he will stand’
c.	talye	< /ti-a-ly-e /	talye-**alye** **(*talyetalye)**	‘s/he will eat
d.	tulye	< /ti-u-ly-e/	tulye-**ulye** **(*tulyetulye)**	‘you will eat’

Unlike in the infinitive and distant past tenses above where RED was required to begin with a full onset and thus included material from prefixes in order to fulfil this condition, in the reduplicated subjunctive and near future tenses above, the initial syllable of RED is onsetless. The same is true of the reduplicated perfective tense forms given below.

Perfective tense (marked by prefix –a)

(9) Cindali and Cinyika

a.	mota	< /mu-a-ot-a /	mota-**ota** **(*mota-mota)**	'you (plur.) have basked'
b.	muma	< /mu-a-um-a/	muma-**uma** **(*muma-muma)**	'you (plur.) have dried'
c.	wuma	< /u-a-um-a /	wuma-**uma** **(*wuma-wuma)**	'you (sing.) have dried'
d.	talya	< /ti-a-ly-a /	talya-**alya** **(*talya-talya)**	'we have eaten'

We wish to propose that Cophonology theory straightforwardly accounts for why the phonological pattern of the Base appears to be different from that of its reduplicant with regard to onsets. We start by a giving a brief account of the theory of cophonologies.

3. On Cophonology Theory

3.1 The theoretical Claim

Since the development of generative grammar in the early sixties, there have been different approaches to the analysis of morphologically conditioned phonological processes and the many instances where regular phonological rules either fail to apply or over-apply. Some of the devices which have been employed include the appeal to morpho-lexical diacritics, minor versus major rules and the stipulation of morphological conditions governing the application of specific phonological rules (cf. Kenstowicz & Kisseberth 1977, 1979 for detailed examples of some of these devices).

The shift from cyclic phonology to Lexical Phonology and Morphology (LPM) in the mid eighties (cf. Kiparsky 1982a, b, Mohanan 1986, Kaisse & Shaw 1985, Pulleyblank 1986 among others) provided new insights into how morphologically sensitive phonological processes could be handled. The approach, which basically allowed phonological rules of a language to be interspaced with morphological operations in a specific lexical stratum, accounted for how morphology interacted with phonological processes in ordered lexical levels in languages.

However, starting from the early nineties, the original approach to LPM was criticized as being both too strong and too weak on the grounds that its claims about the strict ordering of levels was not always correct and that it also failed to consider some instances of phonological changes or effects which were too morphologically specific to be allocated to a separate lexical level (cf. Inkelas 1998, Orgun 1997, Inkelas & Ogun 1998 and others for details). These and other works argued for a new approach called *Cophonologies* as a better way of accounting for morphologically conditioned phonological processes.

The appeal to Cophonologies was originally proposed and motivated in work by Orgun (1994, 1996, 1997) and Inkelas, Orgun & Zoll (1997) and later elaborated in Inkelas (1998), Orgun (1999), Inkelas & Orgun (1998), Yu (2003), Inkelas & Zoll (2005), Downing (2003) and others.

The main claim of Cophonology theory (cf. Inkelas and Zoll 2005) is that there are sets of phonological patterns (or phonological grammars) which are associated with specific morphological constructions and that within one and the same language, a given set of rules or constraints may show a particular ranking or precedence relation in one morphological construction and a reverse ranking in another.

Individual rules or constraints are not themselves indexed to particular morphological environments. Rather, the entire bundle of rules or the specific ranking of constraints constituting the Cophonology is the one which is itself morphologically indexed. It is this kind of indexing of constraint rankings to specific morphological constructions which accounts for the numerous instances of exceptions (or counterexamples) to the application of phonological rules in various morphological contexts.

Inkelas & Zoll (2005:76) present a detailed illustration of how reduplication constructions can also be accounted for in terms of Cophonology theory. They argue that since reduplication usually involves the compounding of two morphological constituents, the Base (B) and the Reduplicant (R), the two can be considered as daughters of the mother node, the reduplication construction itself. Each of these three constituents in the construction is in turn associated with its own separate Cophonology (cf. Inkelas & Zoll (2005: 76).

Given the independence of cophonologies, the theory predicts that the three cophonologies can, in principle, differ from one another - resulting in phonological differences (non-identity) between the Base and the Reduplicant - just as each one of them (and indeed all of them) may potentially differ from the cophonologies of other morphological constructions in the same language. The latter situation would yield phonological effects which are specific to reduplication constructions in the relevant language.

Since daughters in reduplication constructions have their own cophonologies which are independent of each other, they may also have different constraint rankings. This, in fact, is what brings about the numerous cases of attested mismatches (non-correspondence) between the Base and the Reduplicant in most languages.

Inkelas & Zoll (2005:76) present a classic example of a Base-Reduplicant phonological mismatch in intensive reduplication in Sanskrit. This is shown in (10) below.

(10) Sanskrit Intensive Reduplication

kan-i-krand	'cry out'
tai-tvais	'stir'
dau-dyaut	'shine'
sa:-svap	'sleep'
ga:-grabh	'seize'

In the forms above, there are two phonological processes which accompany reduplication (copying). First, there is a rule which truncates the first portion of the reduplicated construction into a single syllable. Second, if that syllable contains an initial consonant cluster, then it is truncated further into its least sonorant consonant (thus kr → k, sv → s, tv → t, dy → d, gr → g).

Inkelas & Zoll (2005) argue that there are two cophonologies (X and Y) corresponding to each input half or portion of the reduplication construction. In cophonology X, which is associated with the first daughter, the markedness constraint barring complex onsets (*Complex), ranks higher than the faithfulness constraints requiring that input vowels and consonants should not be altered by either deletion or insertion (Dep-V and Max-C). This explains why that portion (with truncated segments) is not a full copy of the second daughter where the ranking of the constraints is reversed (i.e. the faithfulness constraints are ranked above *Complex). The two cophonologies are shown below.

(11) Cophonology X: *Complex, Dep-V » Max-C

Cophonolgy Y: Dep- V, Max-C » *Complex

The use of cophonologies in the Sanskrit data above thus accounts for the differences in the phonological patterns observed in the Base and the Reduplicant. We now proceed to show how the theory of cophonologies can easily account for the otherwise puzzling facts about onsets in Cindali and Cinyika.

3.2 Cophonologies and Onsets in Cindali and Cinyika

As shown in (4) and (5) above, the usual pattern for syllables in the initial position of RED in both Cindali and Cinyika reduplication is for them to have a full onset as required by the regular condition in Bantu which bars onsetless syllables at the beginning of RED. However, in some morphological constructions, like the subjunctive, near future and perfective tenses, only the Base begins with a full onset. The reduplicant begins with a vowel and thus violates the onset condition. The relevant data are repeated below for convenience.

(12) **Cindali and Cinyika:** Subjunctive constructions (same forms in both languages; subjunctive marked by the final vowel -e; Reduplicant in bold)

	unreduplicated		Reduplicated	Gloss
a.	ndye	< /n-ly-e/	ndye-**ily-e**	‘I should eat’
b.	mfwe	< /n-fw-e/	mfwe-**imfw-e**	‘I should die’
c.	m-by-e	< /n-py-e/	mbye-**imby-e**	‘I should burn’

(13) **Cinyika**: Near future tense (marked by -andi- and final vowel -e; subject prefix repeated)

	unreduplicated		Reduplicated	Gloss
a.	a:ndume	< /a-andi-a-um-e/	a:ndume-**ume** **(*a:ndumendume)**	‘s/he will dry’
b.	a:ndime	< /a-andi-a-im-e/	a:ndime-**ime** **(*a:ndimendime)**	‘s/he will stand’
c.	a:ndalye	< /a-andi-a-ly-e/	a:ndalye-**alye** **(*a:ndalyendalye)**	‘s/he will eat’
d.	wandiulye	< /u-andi-uly-e/	wandiulye-**ulye** (*wa**ndiulyendiulye)**	‘you will eat’

(14) **Cindali:** Near future tense (marked by -ti- and final vowel -e; subject prefix not repeated)

a.	tume	< /ti-a-um-e /	tume-**ume (*tumetume)**	‘s/he will dry’
b.	time	< /ti-a-im-e /	time-**ime (*timetime)**	‘s/he will stand’
c.	talye	< /ti-a-ly-e /	talye-**alye (*talyetalye)**	‘s/he will eat’
d.	tulye	< /ti-u-ly-e/	tulye-**ulye (*tulyetulye)**	‘you will eat’

(15) **Cindali and Cinyika:** Perfective tense (marked by prefix –a)

a.	mota	< /mu-a-ot-a/	mota-**ota** (***mota-mota**)	'you (plur) have basked'
b.	muma	< /mu-a-um-a/	muma-**uma** (***muma-muma**)	'you (plur) have dried'
c.	wuma	< /u-a-um-a/	wuma-**uma** (***wuma-wuma**)	'you (sing.) have dried'
d.	talya	< /ti-a-ly-a/	talya-**alya** (***talya-talya**)	'we have eaten'

In order to account for the forms above we need both syllable structure constraints, like *Onset, and faithfulness constraints such as DEP-IO and Max-BR. We will assume that all these constraints are motivated by a more general markedness constraint which disallows vowel sequences (*COMPLEX). Since *COMPLEX is general to all the cases to be discussed, we will not show it. Instead, we will just present the other constraints. These are given below.

(16) DEP-IO
Output segments must have input correspondents
(no epenthesis)

(17) Max- BR
Every element of the Base has a correspondent in the Reduplicant
(no deletion)

(18) *Onset (Ito 1989)
*[σ V
Syllables must have onsets

For purposes of this discussion, we will interpret *Onset as meaning that the Base and the RED must begin with full onsets.

We will assume the common conditions on reduplication namely, CONTIUIGTY (RED corresponds to a contiguous sub-string of a Base); ANCHOR (the initial element in RED is identical to the initial element in the Base) and ALIGN RED (the Base sub-categorizes for a following reduplicant). Since these constraints do not have a crucial bearing on the arguments to be made in the paper, we will only show them where it is absolutely necessary to do so.

In order to account for the forms in (4) and (5) where RED is faithful to *ONSET, this constraint must be ranked above the faithfulness constraints DEP-IO and Max-BR which penalize segment insertion and deletion respectively, so as to maximize the identity between the Base and RED.

However, the phonological pattern in the data in (12)-(15) above where RED begins with onsetless syllables and thus violates *Onset, shows that the ranking of these constraints must be reversed. *Onset must be ranked below both faithfulness constraints, DEP-IO and Max-BR since there is a mismatch between the Base and the reduplicant. This position is inconsistent with the standard requirements in OT that constraints should have a fixed ranking in one language and that given constraints X and Y, X cannot be ranked both below and above Y in the same language.

Cophonology theory has a straightforward way of handling this type of ranking paradox. Following the analysis of Sanskrit reduplication adopted by Inkelas & Zoll

(2005) above, we can propose that in Cindali and Cinyika reduplication, there are two cophonologies which are associated with the Base and the Reduplicant respectively, in the morphological constructions of these tenses. We will conveniently refer to these cophonologies as Base Cophonology and Reduplicant Cophonology. In the former, where onset requirements are met, *Onset ranks above the faithfulness constraints DEP-IO and Max-BR. This means that while the Base may violate these faithfulness constraints through the loss of segments (e.g. by vowel deletion), *Onset has to be respected by ensuring that the initial syllable of the Base begins with a full onset. This constraint is therefore not violated, thus accounting for Base forms like **ndume** (a:**ndume**-ume < /a-andi-a-um-e /), 'she will dry', **mota** (**mota**-ota < /mu-a-ot-a /), 'you have basked', **time** (**time**-ime), 'she will stand' etc. The ranking of the constraints is given below (the ranking between Max-BR and DEP-IO is not crucial to the present argument).

(19) Base Cophonology: *Onset » Max-BR, DEP-IO

In the Reduplicant Cophonology where RED begins without a full onset, there is segmental identity between RED and the stem, a clear indication that the forms violate *Onset in order to guarantee segmental faithfulness to the input. The faithfulness constraints MAX-BR and DEP-IO are therefore ranked above *Onset, a reversal of the ranking in the Base Cophonology. This is shown below.

(20) Reduplicant Cophonology: Max- BR, DEP-IO » *Onset

The ranking above explains why the reduplicant **ume** in *a:ndume-**ume***; **ota** in *mota-**ota*** and **ime** in *time-**ime*** are segmentally identical to their input verb stems (the Base) and have no onsets. Thus cophonology theory, which regards the input daughter constituents (the Base and the RED) to reduplication constructions in these languages as two separate phonological grammars with independent constraint rankings, easily explains the apparent ranking paradoxes observed between a syllable structure related constraint like ***Onset** and faithfulness (identity) constraints such as DEP-IO and Max-BR.

The tableau for the Base forms *ndume* (in a:ndume-ume < a-andi-a-um-e) and *mota* (in mota-ota < mu-a-ot-a) are given below (only the relevant morphological portions are shown in the input hence some prefix vowels are left out; the verb stem is shown by a square bracket and the Base is in bold).

Tableau (21): Base Cophonology

input: /-ndi-a-[um-e/	*Onset	Max-BR	DEP- IO
a. **ndi-[um-e**	*!	*	
b. **nda-[um-e**	*!	*	
☞c. **nd-[um-e**		**	

Tableau (22)

input: /mu-a-[ot-a	*Onset	Max-BR	DEP- IO
a. **mu-a-[t-a**	*!	*	
b. **mu-[ot-a**	*!	*	
c. **ma-[ot-a**	*!	*	
☞d. **m-ot-a**		**	

In tableau (21) above, the fist two candidates are not optimal because they violate the high-ranking constraint *Onset since the initial syllable in the verb stems begins with a vowel. (In fact, these forms would also violate the more general constraint *COMPLEX which disallows vowel sequences and is ranked above *Onset). The third candidate is the most optimal in this cophonology because it respects the high-ranking constraint *Onset since the verb stem includes prefix consonants to ensure that it begins with a full onset i.e. **-ndu**.

The same observations hold for the candidates in (22). The first three in this set are not optimal because they all have vowel sequences in front of the verb stems and thus do not respect *Onset. The optimal candidate is the last one because despite the deletion of two of its input vowels, its Base begins with a full onset as required by the high-ranking constraint *Onset.

The constraint ranking in these forms crucially shows that the Base cophonology prefers the Base to begin with a full onset even if they may lose some of their original vowels through deletion, thereby violating faithfulness constraints. The reverse ranking is true for the Reduplicant Cophonology in which the *Onset constraint is not highly ranked and RED can begin with syllables without a full onset.

The tableau for the reduplicants **ume** in *a:ndume-ume* and **ota** in *mota-ota* is given below (again, only the relevant morphological portions and crucial candidates are shown).

Reduplicant Cophonology: (the left edge of the verb stem is indicated by a square bracket and RED is in bold)

Tableau (23)

input: /-ndi-a-[um-e/	ANCHOR	Max-BR	DEP- IO	*Onset
a. **–nd-[um-e**	*!	**		
☞b. **[um-e**		****		*

Tableau (24)

input: /mu-a-[ot-a/	ANCHOR	Max-BR	DEP- IO	*Onset
a. **m-[ot-a**	*!	**		
☞b. **[ot-a**		***		*

In the tableaus above, the first candidate in each set is not optimal because it fails to be faithful to the verb stems (the Base) although it satisfies *Onset. By incorporating prefixial material in order to satisfy *Onset, the reduplicant is misaligned with the Base and thus violates the general alignment constraint ANCHOR. The preferred candidates are therefore the ones which totally reduplicate the verb stem (violating *Onset) and in which RED is identical to the Base.

In this cophonology, the ranking of *Onset in relation to the faithfulness constraints is thus reversed (it is lower than that of the faithfulness constraints). By resorting to cophonology theory, we are therefore able to account for what initially appears to be a ranking paradox between *Onset and the faithfulness constraints.

Below, we show that Malawian Citonga presents another case of constraint ranking paradoxes which can also be easily accounted for by Cophonology theory. We now turn to this issue.

4. Cophonologies and Constraint Ranking Paradoxes in Citonga

Mkochi (2004) shows that in Malawian Citonga, just like in Cindali and Cinyika, vowel sequences are disallowed. In order to break up such VV patterns, vowels may be deleted or consonants can be inserted. An instance of vowel deletion occurs when verb roots with mid vowels are followed by the final vowel [a]. Here, the final vowel is deleted and the verbs end with long mid vowels (the length compensating for the lost final vowel). The relevant examples are given below (data from Mkochi 2004:8)

(25) Final vowel deletion (/-i/ and /-e/ = applicative suffixes; /y/ inserted to break up vowel sequences)

a.	jal-a	'close'	jal-i-ya	'close for'
b.	bik-a	'cook'	bik-i-ya	'cook for'
c.	wonj-a	'catch'	wonj-e: < /wonj-e-a/	'catch for'
d.	woch-a	'roast'	woch-e: < /woch-e-a/	'roast for'
e.	sem-a	'carve'	sem-e: < /sem-e-a /	'carve for'

A similar phenomenon of final vowel deletion occurs with verb roots which underlyingly end in mid vowels. This is shown below (data from Mkochi 2004: 11)

(26) Deletion of final vowel in verb roots ending in vowels

a.	ndele:	< /ndele-a/	'move'
b.	pende:	< / pende-a/	'be lame'
c.	to:	< / to-a/	'take'
d.	domo:	< / domo-a/	'cut'
e.	sotopo:	< /sotopo-a/	'snatch'
f.	longolo:	< /longolo-a/	'speak very much'

Now, when vowel-initial extensions are added to verb roots ending in vowels, like those in (26) above, the vowel sequences created are corrected by inserting the consonant /l/ and not by vowel deletion. Consider the examples below.

(27) /l/ insertion to break up V-V clusters (dative marked by suffixes /i/ and /e/; -esy = causative marker)

a.	saniya	< /sani-a/	'find'	saniliya	< /sani-i-a/	'find for'
b.	mbatiya	< /mbati-a/	'stagger'	mbatiliya	< /mbati-i-a/	'stagger for'
c.	ndele:	< /ndele-a/	'move'	ndelele:	< /ndele-e-a/	'move for'
d.	to:	< /to-a/	'take'	tolesya	< /to-esy-a/	'cause to take'
e.	domo:	< /domo-a/	'cut'	domolesy-a	< /domo-esy-a/	'cause to cut'

The following observations can be made about the data presented above: First, vowel sequences are generally not tolerated hence vowels are separated by either vowel deletion or consonant insertion (/l/ or a glide). Second, only vowel sequences involving mid vowels followed by the verb stem final /a/ trigger the deletion of the latter vowel (cf. 27c-e). That is, only the final vowel can be deleted and then only when it is preceded by a mid vowel. In all other cases, the remedy for vowel sequences is the insertion of a consonant (/l/ or a glide) as in (27a-b) above.

To account for the cases of vowel deletion and consonant insertion Mkochi (2004) proposes an optimality theoretic account in which the following constraints are used:

(28) *COMPLEX: There should be no segment clusters like CC, VV, GG

FAITH C: The output must be identical to the input in terms of consonants

FAITH V: The output must be identical to the input in terms of vowels

The constraints are ranked as follows:

*COMPLEX, FAITH V » FAITH C

To demonstrate the ranking Mkochi (2004:40) uses the tableau below

Tableau (29): Vowel clusters are disallowed in Citonga

input: to-esy-a	*COMPLEX	Faith V	Faith C
☞a. to-lesy-a			*
b. to-esy-a	*!		
c. to-sy-a/te-sy-a		*!	

In the tableau above, the first candidate is optimal because it satisfies the high-ranking constraint *COMPLEX through the insertion of the consonant /l/, although it violates the lower ranking constraint FAITH C by adding to the output a consonant which is not in the input. The second candidate, which has observed both FAITH V and FAITH C, fails because it violates the higher ranking constraint *COMPLEX by not getting rid of the vowel sequence. The crucial ranking here is that between FAITH C and FAITH V. Note that the third candidate is not optimal because it crucially violates FAITH V by deleting one of the vowels despite observing FAITH C (and of course the higher ranking constraint *COMPLEX). This shows that FAITH V must be ranked above FAITH C.

However, Mkochi (2004) goes on to observe that the ranking of FAITH V above FAITH C is contradicted by the output **sompho:** which is accounted for by crucially ranking **Faith C** above FAITH V as shown below (Mkochi 2004:41) where another constraint which requires that the featural properties of sequences of vowels be identical (Identical Consonant Cluster Constraint – ICC) is added. This constraint is intended to rule out outputs like **sompho-a** with non-identical vowel sequences (a mid vowel and a low vowel).

Tableau (30): Mid Vowel deletes low final vowel

input: sompho-a	ICC (height)	Faith C	Faith V
a. somphoa	*!		
☞b. sompho:			*
c. somphola		*!	

In the tableau above, the most optimal candidate is (30b) because it respects FAITH C by not introducing a new consonant in the output although it violates FAITH V by losing the final vowel through deletion. The crucial candidate showing that FAITH C must be ranked above FAITH V is (30c) which is not optimal because FAITH C has been violated by the insertion of the consonant /l/, although FAITH V is respected by maintaining both input vowels.

There is, therefore, a constraint ranking paradox involving FAITH V and FAITH C. That is, in order to account for outputs like **tolesya** (< to-esy-a), FAITH V must be ranked above FAITH C while a form like **sompho:** requires that the ranking be reversed. Given that OT requires a fixed constraint ranking within a given language, a constraint cannot be ranked both before and after another constraint in one language. These facts therefore pose a serious problem for the grammar of Citonga, as Mkochi himself acknowledges.

Mkochi (2004) proposes that one possible way of accounting for this raking paradox is to relax some of the theoretical claims of OT and allow constraints to refer directly to inputs in addition to outputs. Thus, ICC would be considered as a constraint which applies to inputs and bars them from containing non-identical vowel sequences like **sompho-a**, **pende-a** etc. in languages like Citonga. This proposal is largely meant to account for language-specific phonological effects like these (cf. Golston 1996, Mtenje 2000 etc. on language –specific phonological processes of this type).

While this solution sounds plausible on the surface, the problem is that the value of the constraint ICC (height) in Citonga is itself not very clear. Note that while it may rule out inputs like the vowel sequences **/o-a/** and **/e-a/** as in the cases above, it would not explain why the same vowel sequences would be allowed as inputs in cases where derivational suffixes like passives **(-ek)**, applicatives **(-e)** and causatives **(-esy)**, are involved and where /l/ insertion occurs like **/domo-e-a/ > domole:** (cut for), **/sompho-esy-e-a/ > sompholesye:** (cause to snatch for) and others.

Furthermore, the approach also fails to explain why other types of non-identical vowel sequences (other than **/o/-/a/** and **/e/-/a/**) are allowed as inputs in the same language. For example, the vowel sequence **/i/+/a/** should be allowed as a possible input to account for outputs like **sani-ya**, 'find' (**< /sani-a/** through glide insertion), **sani-li-ya,** 'find for' (**< /sani-i-a/**, through /l/ and glide epenthesis), **pu-wa,** 'pound' (**< /pu-a/** through glide epenthesis), **pu-li-ya**, 'pound for' (**< /pu-i-a/**, through /l/ and glide insertion) etc.

In other words, the constraint is just meant to rule out un-derived verb stems (i.e. verbs without suffixes) which lose their final vowel **/a/** when preceded by a mid vowel. Beyond this, it is totally incapable of explaining why in derived verbal constructions, like the ones shown above involving derivational suffixes, the same constraint does not apply to rule out inputs which have vowel sequences of non-identical height. It is obvious then that this constraint has very limited generality within the grammar of the language and this seriously undermines its desirability.

What these observations indicate is the fact that there must be some explanation beyond the constraint which Mkochi (2004) proposes which accounts for the facts more generally and satisfactorily. In order for us to capture the missed generalization, we need to look at the domain in which vowel deletion occurs in Citonga. The data presented above clearly shows that the only time when a mid vowel triggers the deletion of a following vowel is when the latter is in a verb stem final position. That is, a sequence of a mid vowel plus a final **/a/** triggers the deletion of the latter in both bare (un-derived) and derived verb stems and no consonant can be inserted between the mid vowel and the final vowel **/a/**.

In other morphological contexts, a consonant (/l/ or glide) is inserted to separate all types of vowel sequences regardless of their height. Hence bare verb forms like **/sompho-a/**, **/mete-a/**, **/longoso-a/**, **/pende-a/, /sotopo-a/** will lose the final vowel and will not permit consonant insertion (***somphola, *metela, *pendela, *longosola, *sotopola**). A consonant will, however, be inserted when a suffix is added, hence **sompho-esy-a > sompholesya, sotopo-esy-a > sotopolesya, longoso-ek-a > longosoleka** etc.

When a suffix with a mid vowel is added before the final vowel, it behaves like all other forms of mid vowel plus final vowel sequences and it triggers the deletion of the latter regardless of whether there are other suffixes preceding the last suffix. Thus, verb stems like **me:** (grow), **pe:** (get subdued), **sotopo: (**snatch) all surface with an inserted /l/ and a truncated final vowel when suffixes with mid vowels are added as shown below.

(31) me-applic-fv > me-le: (/me-e-a/) 'grow for'
pe-applic-fv > pe-le: (/pe-e-a/) 'get subdued for'
sotopo-caus-applic-fv > sotopo-l-esy-e: < (/sotopo-esy-e-a/)
'be snatched for'

What these facts show then is that it is the morphological construction ordinarily referred to in Bantu as the derivational stem (i.e. the verb root plus derivational suffixes, if available) which serves as the domain for /l/ insertion and that final vowel deletion, which is triggered by the presence of a mid vowel, is confined to the constituent comprising the derivational stem plus the final vowel, normally known as the Inflectional stem (cf. Myers 1998, Downing 2000, Hyman 1998 and others on the constituent structure of the Bantu verb stem) .

In terms of the cophonology approach, this is reminiscent of the position argued for earlier that some morphological constructions have different cophonologies with independent constraint rankings. We wish to propose that in Citonga, there are two cophonologies, one associated with the Derivational Stem and the other, the Inflectional Stem. The first, which we will refer to as the Derivational Stem Cophonology has the following ranking for FAITH V and FAITH C:

(32) Derivational Stem Cophonology

FAITH V » FAITH C

The second cophonology, the Inflectional Stem Cophonology, has the reverse ranking as shown below.

(33) Inflectional Stem Cophonology:

FAITH C » FAITH V

These two cophonologies, in which the constraint rankings are reversed, account for the apparent ranking paradox observed above. The constraint rankings for the outputs **sompho:, sotopolesy**e: and **tolesya** are shown in the tableau below.

Tableau (34): Derivational stem cophonology

Insert /l/ instead of deleting a vowel to break up vowel sequences.

input: /to-esy-/	Faith V	Faith C
☞a. to-l-esy		*
b. to-sy	*!	
c. t-esy	*!	

Tableau (35)

input: /to-esy-/	Faith V	Faith C
☞a. sotopo-l-esy-e		
b. sotopo-sy-e	*!	*
c. sotop-esy-e	*!	
d. sotop-sy-e	**!	
e. sotopo-esy-	*!	

In tableau (34) above, the outputs for **tolesya** show that candidate (34a) is the most optimal because it respects the high-ranking constraint FAITH V by preserving the vowels although it violates the lower ranking constraint FAITH C by inserting the consonant/l/. Candidates (34b) and (34c) are not optimal by virtue of the fact that they both violate FAITH V through the deletion of one input vowel although they respect the low ranking constraint FAITH C by avoiding /l/ insertion.

The output candidates for **sotopolesye** in tableau (35) show the same pattern. In that set, (35a) is the most optimal because it respects the high-ranking constraint FAITH V by preserving all the input vowels although it violates the low ranking constraint FAITH C through the insertion of /l/. Candidates (35b-e) are not optimal because they all violate the high-ranking constraint FAITH V to various degrees through vowel deletion.

Let us now consider the output candidates for **sompho:**. This is shown in the tableau below.

Tableau (36): Inflectional Stem Cophonology

Delete a vowel instead of inserting a consonant to break up vowel sequences.

input: /sompho-a/	Faith C	Faith V
☞a. sompho:		*
b. somphola	*!	

In the tableau above, candidate (36a) is optimal because it respects the high-ranking constraint FAITH C, which prohibits the insertion or deletion of input consonants, although it violates the lower ranking constraint FAITH V by deleting the inflectional stem-final vowel. Candidate (36b) is not optimal because it violates the high-ranking constraint FAITH C by inserting the consonant /l/ despite the fact that it respects the lower ranking constraint FAITH V by not deleting the vowels.

By using cophonology theory we are able to explain why the two constraints FAITH V and FAITH C appear to be in a ranking paradox. Now we know that there are two cophonologies corresponding to the morphological constructions, Derivational Stem and Inflectional Stem, each of which has a constraint set ranking indexed to it and that because the two phonologies are independent of each other, the ranking of these constraints need not be the same. Thus, facts involving vowel sequences and the strategies employed to correct them in Bantu languages like Cindali, Cinyika and Citonga offer further supporting evidence to the claims of Cophonology theory.

5. Conclusion

This paper has presented data from Cindali, Citonga and Cinyika where, like in most Bantu languages, vowel sequences are not tolerated and are separated by glide formation, vowel deletion or consonant insertion in both reduplicated and non-reduplicated constructions. However, in some morphological constructions, vowel sequences are allowed. This brings about contradictions in the ranking of faithfulness and syllable structure-related constraints. It has been shown that by appealing to Cophonology theory we can easily resolve such ranking paradoxes without weakening any of the independently motivated principles of OT.

The fact that besides cases of lexical exceptions, for which Cophonology theory was originally intended, independent data on verbal reduplication and derivation from Bantu languages can also be insightfully accounted for by the same theoretical framework, provides further supporting evidence for Cophonology theory.

References

Archangeli, Diana & Terence Langendoen. (eds.) (1997) *Optimality Theory: an Overview*. Oxford: Blackwell.

Chiona, Kephas. (2005) *Syllable Structure and Phonotactic Constraints in Cindali and Cinyika*. BA thesis, University of Malawi.

Downing, Laura J. (2000) Morphological and prosodic constraints on Kinande verbal reduplication. *Phonology* 17: 1-38.

Downing, Laura J. (2003) Compounding and tonal non-transfer in Bantu languages *Phonology* 20: 1-42.

Golston, Chris. (1986) Direct Optimality Theory: Representation as pure markedness. *Language* 72: 713-748.

Hyman, Larry M. (1998) Positional prominence and the 'Prosodic' trough in Yaka. *Phonology* 15: 41-75.

Hyman, Larry M. & Al Mtenje. (1999) Prosodic morphology and tone: the case of Chichewa. In René Kager, Harry van der Hulst & Wim Zonneveld (eds.) *The Prosody-Morphology Interface*. Cambridge: Cambridge University Press, 90-133.

Inkelas, Sharon. (1998) The theoretical status of morphologically conditioned phonology: A case study of dominance effects. *Yearbook of Morphology 1997*, 121-155.

Inkelas, Sharon & Orhan Orgun. (1998) Level (non)ordering in recursive morphology: Evidence from Turkish. In Steven Lapointe, Diane Brentari & Patrick Farrell (eds.) *Morphology and its Relation to Phonology and Syntax*. Stanford: CSLI, 360-392.

Inkelas, Sharon, Orhan Orgun & Cheryl Zoll. (1997) Implications of lexical exceptions for the nature of grammar. In Iggy Roca (ed.) *Constraints and Derivations in Phonology*. Oxford: Clarendon Press, 393-418.

Inkelas, Sharon & Cheryl Zoll. (2005) *Reduplication: Doubling in Morphology*. Cambridge: Cambridge University Press.

Itô, Junko. (1989) A prosodic theory of epenthesis. *Natural Language and Linguistic Theory*, 217-260.

Kager, René. (1999) *Optimality Theory*. Cambridge: Cambridge University Press.

Kaisse, Ellen & Patricia Shaw (1985) On the theory of Lexical Phonology. *Phonology Yearbook* 2: 1-30.

Kenstowicz, Michael & Charles Kisseberth (1979) *Generative Phonology*. New York: Academic Press.

Kenstowicz, Michael & Charles Kisseberth. (1977) *Topics in Generative Phonology: Theory and Description*. New York: Academic Press.

Kiparsky, Paul. (1982a) From Cyclic Phonology to Lexical Phonology. In Harry van der & Norval Smith (eds.) *The Structure of Phonological Reprentations*, Part 1. Dordrecht: Foris, 131-175.

Kiparsky, Paul. (1982b) Lexical morphology and phonology. In I.-S. Yang (ed.). *Linguistics in the Morning Calm*. Linguistics Society of Korea. Seoul: Hanshin, 3-91.

McCarthy, John. (ed.) (2004) *Optimality Theory in Phonology*. Oxford: Blackwell.

Mkochi, Winfred. (2004). *An Optimality Theoretic Account of Some Aspects of Citonga Phonology*. MA thesis, University of Malawi.

Mohanan, Karuvannur P. (1986) *Lexical Phonology*. Dordrecht: Kluwer.

Mtenje, Al. (2006) Tone in Cindali. *Lingua* 116: 1495-1506.

Mtenje, Al. (2000) An Optimality Theoretic account of Ciyao verbal reduplication. Paper presented at the 33rd Annual Conference on African Linguistics, Ohio University, Athens.

Myers, Scott. (1998) Aux in Bantu morphology and phonology. In Larry M. Hyman & Charles Kisseberth (eds.) *Theoretical Aspects of Bantu Tone*. Stanford: CSLI.

Myers, Scott & Troi Carleton. (1996) Tonal transfer in Chichewa. *Phonology* 13: 39-72.

Orgun, Orhan. (1999) Sign-based morphology; a declarative theory of phonology-morphology interleaving. In Ben Hermans & Marc Oostendorp (eds.) *The Derivational Residue in Phonological Optimality Theory*. Amsterdam: John Benjamins, 247-267.

Orgun, Orhan. (1997) Cyclic and non-cyclic phonological effects in a declarative grammar. *Yearbook of Morphology 1997*, 179-218.

Orgun, Orhan. (1996) *Sign-based Morphology and Phonology: with special attention to Optimality Theory*. Ph.D. dissertation, University of California, Berkeley.

Orgun, Orhan. (1994) Monotonic cyclicity and Optimality Theory. In Merce Gonzalez (ed.) *Proceedings of the Northeastern Linguistic Society* 24. Amherst: GLSA, 461-474.

Prince, Alan & Paul Smolensky (1993) Optimality Theory: Constraint Interaction in Generative Grammar. Ms. Rutgers University & University of Colorado, Boulder.

Pulleyblank. Douglas. (1996) *Tone in Lexical Phonology*. Dordrecht: D. Reidel.

Yu, Alan. (2003) *The Phonology and Morphology of Infixation*. Ph.D. dissertation, University of California, Berkeley.