

Underlying Representations and Bantu Segmental Phonology

Larry M. Hyman
University of California, Berkeley

1. Introduction¹

Within recent phonological work, there has been a recurrent move away from underlying representations (URs) as being distinct from what one encounters on the “surface”, sometimes quite dramatic:

... the notion of UR is neither conceptually necessary nor empirically supported, and should be dispensed with. (Burzio 1996: 118)

... we will argue against the postulation of “a single underlying representation per morpheme”, arguing instead for the postulation of a set of interconnected surface-based representations. (Archangeli & Pulleyblank 2015)

For decades the assumption in traditional phonology has been that URs had the two functions of (i) capturing generalizations (“what’s in the language”) and (ii) capturing the speaker’s knowledge (“what’s in the head”). Bantu languages have been among those providing evidence of robust morphophonemic alternations of the sort captured by URs in generative phonology. In this paper I take a new look at some Bantu consonant alternations to ask whether URs are doing the effective job we have assumed. As I enumerated in Hyman (2015), various phoneticians and phonologists have expressed skepticism towards URs for one or more of the following reasons:

- (1) a. URs are wrong : speakers don’t know them; they are not “psychologically real”
- b. URs are redundant : alternations can be handled by other mechanisms, e.g. allomorphy
- c. URs are indeterminate : in many cases it is not clear what the UR should be
- d. URs are insufficient : lexical entries contain much more information than the UR
- e. URs are uninteresting : the study of URs has reached a dead-end with little new to discover

My interest in the changing views on URs all started with a provocative article by Bruce Hayes, who writes:

... *all* phonology might ultimately be redistributed between the theory of phonetic rules and the theory of lexical organization.... insofar as rules apply postlexically, they are phonetic and gradient, and insofar as they treat discrete categories, they are part of the lexicon rather than applying to the output of syntax.

Of the Ilokano rules [I] studied... either they seemed phonetic in character, so that my conventional phonetic transcription represented an over idealized categorization of continuous data, or they struck me as not fully productive, lexicalized rules. At the time I occasionally wondered, “Where is the normal phonology that I was trained to study?” (Hayes 1995: 67-8)

According to Hayes we should expect word-level phonology to be “lexicalized”, not fully productive, maybe just listed allomorphs, e.g. the English related words *eléctric* [k] vs. *electricity* [s], whose segmental and stress differences can simply be stored in the two separate entries. On the other hand, we should expect phrase-level phonology to be

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“idealized” broad phonetics, e.g. the labial co-articulation of [n] as [m] in *phone book*. In short, word-level phonology is allomorphy, while phrase-level phonology is phonetics. If correct, there would be little, if anything, left of phonology proper.

Of Hayes’ two observations, it is easier to show that there are cases of discrete phrasal phonology if we turn to tone, which provides many more cases of “post-lexical” alternations than segmental phonology. Thus consider the following examples from the Bantu language Giryama [E72a] (Volk 2011: 17), where designations such as [E72a] the Guthrie language reference, as updated by Maho (2009):

- | | | | | |
|--------|-----------------------------|----|-----------------------------------|----------------------|
| (2) a. | <i>All L tone</i> | b. | <i>H tone on penultimate mora</i> | |
| | ‘I want ...’ | | ‘he/she wants ...’ | |
| | ni-na-maal-a | | a-na-maál-a | |
| | ni-na-mal-a ku-guul-a | | a-na-mal-a ku-guúl-a | ‘... to buy’ |
| | ni-na-mal-a ku-gul-a ŋguuwo | | a-na-mal-a ku-gul-a ŋguúwo | ‘... to buy clothes’ |
| | | | ⚭ | |
| | | | H | |

In these examples, L(ow) tone is unmarked, while H(igh) tone is indicated by an acute accent. As seen, all of the morphemes in (11a) are underlyingly toneless, each vowel being realized with default L tone. In contrast, the forms in (11b) have a H tone on the penultimate mora. (All forms show phrase-penultimate lengthening, indicated by doubling the vowel.) The only difference between the two is the subject prefix /ni-/ ‘I’ vs. /á-/ ‘s/he’, whose underlying /H/ shifts onto the phrase-penultimate mora, as indicated. The two infinitive phrases in (3) show that it’s not only grammatical tone but also lexical tone that shifts:

- | | | | |
|--------|-----------------------|----|-----------------------------------|
| (3) a. | <i>All L tone</i> | b. | <i>H tone on penultimate mora</i> |
| | ‘to buy wooden bowls’ | | ‘to break wooden bowls’ |
| | ku-gula mi-vuure | | ku-banda mi-vuúre |
| | | | ⚭ |
| | | | H |

While all of the morphemes are underlyingly toneless in (3a), the root /-bánd-/ ‘break’ has an underlying /H/ which undergoes the shift. It is clear that this is not idealized phonetics, nor is it intonation. That it is phonology can be further observed in (4).

- | | | |
|--------|---------------------|--|
| (4) a. | ni-na-gumbuhiziík-a | ‘I am wiped out by utter destruction’ |
| | ⚭ | |
| | H | |
| b. | a-ná-gumbuhiziík-a | ‘s/he is wiped out by utter destruction’ (Volk 2007: 17) |
| | ⚭ | |
| | H | |

In (4a), the verb root /-gúmbuhizik-/ has an underlying /H/, which shifts to the penult. In (4b), there are two input /H/ tones, one on the subject prefix /á-/. one on the verb root. As seen, the H of /á-/ shifts onto on the pre-stem tense prefix *-na-*). There are many such cases of totally productive phrasal tonology which cannot be reduced to phonetic implementation—both in Bantu and in tone languages throughout the world. In such cases one can test URs and rules by putting words together in new utterances.

Although this takes care of half of Hayes’ concern, the other still stands: Is there productive, across-the-board word-level (“lexical”) phonology? Here we run into significant analytic problems as languages conspire against us. To show this, in the following two sections I will consider two problems in Bantu segmental phonology which raise both synchronic and diachronic questions: distributions and alternations deriving from Proto-Bantu *d (§2) and from Proto-Bantu *p (§3).

2. Bantu [d] ~ [l] alternations

In the absence of other complications, the most general expectation is that Proto-Bantu **d* will be realized as a liquid [l] or [r] unless it is preceded by a homorganic nasal.² Thus, [l] and [d] are in complete complementary distribution in the following (ki-)Yaka [H31] noun class 9 deverbal nominalizations (Ruttenberg 1971 [2000]).

(5)	<i>verb</i>		<i>noun</i>	
	lákáná	‘agonize’	n-dákáná	‘agony’
	léfá	‘borrow’	n-défi	‘a loan’
	léngá	‘go on vacation’	n-dénga	‘vacation’
	lólá	‘punish’	n-dóla	‘punishment’
	lúúká	‘be prudent’	n-dúúká	‘prudence’
	lúúndza	‘bite, sting’	n-dúundza	‘a bite, sting’

A second source of [d] in Yaka is before [i], a process which although as omnipresent in Bantu, is still common:

(6)	/e/	:	léká	‘listen’	lééká	‘sleep’
	/u/	:	lúká	‘vomit’	lúúká	‘be clever, wise’
	/o/	:	lóká	‘bewitch’	lóóká	‘become dry’
	/a/	:	lábá	‘swear’	lááká	‘scream loudly’
vs.	/i/	:	dímá	‘cultivate’	díimbúká	‘jump over’

Here too there are lots of alternations, e.g. deverbal nominalizations with the suffix /-i/:

(7)	<i>verb</i>		<i>noun</i>	
	hál-á	‘sculpt’	n-hád-í	‘sculptor’
	fúúl-á	‘be in mourning’	yi-fúud-i	‘mourning’
	tál-á	‘watch’	n-tád-í	‘spectator’
	lál-á	‘get lost’	yi-lád-í	‘distraction’
	sóól-á	‘choose’	n-sóód-í	‘elector’
	yékúl-á	‘betray’	n-yékúd-í	‘traitor’

The realization is [d] even before epenthetic [i] in borrowings:

(8)	<i>French</i>		<i>Yaka</i>	
	bière	>	by-éédi3	‘beer’ (cl.8)
	l’hôpital	>	lu-pítáádi	‘mourning’ (cl.11)
	mesure	>	mi-síidi	‘measure’ (cl.4)
	tribunal	>	tímíláádi	‘tribunal’ (cl.5)

We thus see that in Yaka the [l] ~ [d] relation is completely general, allophonic, without complication. In fact, there is only one exception in the ca. 4000-entry Ruttenberg dictionary: *ma-déésó* ‘beans’.

A quite different story is seen in most other Bantu languages where this perfect complementarity gradually becomes undone. Consider first Ciyao [P21] which, like Yaka, prohibits [li] sequences:

² Since there is no contrast, an alternate reconstruction is **l*.

³ Note with respect to *bière* > *by-éédi* that *by-ééle* would have been well-formed.

- (9)
- | | | | | |
|-----------|------|--------------------------|--------|-------------------------|
| /e/ : | lela | ‘nurse, take care of’ | lééndá | ‘be sticky’ |
| /u/ : | lala | ‘be worn out, be hoarse’ | lúúndá | ‘add to, lengthen’ |
| /o/ : | lula | ‘froth up, effervesce’ | lóóndá | ‘follow after, succeed’ |
| /a/ : | lola | ‘look at, see’ | láándá | ‘be like, resemble’ |
| vs. /i/ : | dila | ‘cry’ | dííndá | ‘wait’ |

Ciyao also exhibits extensive [l] ~ [d] alternations, e.g. in verb forms (Ngunga 2000: 56):

- (10)
- | | | | | | |
|----|-------|------------|-----------|-------------------|---------------|
| a. | mil-a | ‘swallow’ | mid-isy-a | ‘swallow a lot’ | (intensive) |
| | | | mid-il-a | ‘swallow for/at’ | (applicative) |
| | | | mid-ile | ‘swallow’ | (perfective) |
| b. | kul-a | ‘grow big’ | kud-isy-a | ‘grow very big’ | (intensive) |
| | | | kud-il-a | ‘grow big for/at’ | (applicative) |
| | | | kud-ile | ‘grow big’ | (perfective) |

Only one exceptional case exists of [li] occurs out of 7740 records in Armino Neunga’s Comparative Bantu On-Line Dictionary (CBOLD) version of Sanderson (1954), *pwítíí* ‘scattering in all directions’ (an ideophone).

While the complementarity is exact in Yaka, Ciyao is like many Bantu languages which have an active /l/ → [d] rule, but also have words with [d] not preceded by [n] or followed by [i]. Ciyao thus differs from Yaka in having a small number of words with [de, da, du, do] sequences (cf. Ngunga 2000: 55-56).

- (11)
- | | | | | |
|-------|--------|--------------------|-------------|-----------------------------|
| /e/ : | delela | ‘be avaricious’ | googodecela | ‘inform against, disparage’ |
| /u/ : | duuma | ‘shout angrily’ | ci-dúulo | ‘salty acid’ |
| /o/ : | dodoma | ‘hesitate’ | kodola | ‘beckon, snap fingers’ |
| /a/ : | daal-a | ‘take for granted’ | ci-dawáati | ‘box’ |

The following table provides the numbers of lV and dV sequences in the CBOLD lexicon:

(12)	i(i)	e(e)	a(a)	u(u)	o(o)	w	y	Totals (minus i(i))
l _	1	162	1141	184	126	37	---	1650
d _	338	26	110	92	21	1	7	275 (= 13.4%)

As seen, there are many more cases of lV than dV. At one extreme there are 338 instances of [di] vs. one instance of [li]. At the other, there are 184 instances of [lu] vs. 92 of [du]. There can be no question of the minority status of dV which, however, destroys the complementarity of [d] vs. [l].

The logical analysis is to assume two contrasting underlying segments, /l/ (which alternates with [d]) and /d/, which is always realized [d]. This, however, raises two problems. First, how should we analyze tautomorphic [nd], e.g. *leend-* ‘be sticky’: as /nd/, /nɫ/, or perhaps underspecified /nD/? Second, should we analyze tautomorphic [di], e.g. *dim-* ‘cultivate’ and *dil-* ‘cry’, as /d/, /l/, or /D/?

The last case I will consider is Ruwund [L53], which adds another dimension to the [l] ~ [d] alternation. At first glance it appears to resemble Yaka and Ciyao (Nash 1992; Hyman & Inkelas 2000 [2012]). Thus note the alternations in (13).

- (13)
- | | | | | | |
|----|-------|------------|---------|-------------------|---------------|
| a. | dil-a | ‘cry’ | did-ish | ‘make cry’ | (causative) |
| | | | did-in | ‘cry for/at/over’ | (applicative) |
| | | | did-in | ‘cried’ | (recent past) |
| b. | sal-a | ‘work, do’ | sad-ish | ‘make work, do’ | (causative) |

Ndebele [S44] (5000 entries in Galen Sibanda's CBOLD lexicon)

	C1	C2	C3	C4	Totals
l	210	631	696	323	1860
d	166	107	28	5	306
% d	44.1%	14.5%	3.9%	1.5%	14.1%

At the same time there do not seem to be any generalizations concerning the following vowel. As seen in (19), the most common sequence is [di] in Chichewa, while [da] is the most common sequence in Ndebele.⁵

(19)	Chichewa (/lw, ly/ → dw, dy)	Ndebele (no prevocalic restriction on /l/)
	di de da do du Total	di de da do du Total
	75 35 66 49 59 284	48 35 93 24 69 269

In terms of word class, nouns and verbs are fairly even. Of 284 Chichewa words with non-derived [d], 124 are nouns, 113 are verbs. However, there are 47 adverbs, ideophones, or interjections, e.g. *bede bede* 'being afraid', *kwédi kwédi* 'truly', *bubudu* 'gnawing', *dala* 'intentionally', *dodolilido* 'upside down', *kodí* 'is it so?' The diachronic issue, then, is where these dV sequences come from. Why do these languages have d's not preceded by a nasal or followed by [i]?

The potential contrast between [l] and [d] is reminiscent of the "double reflex" problem addressed in the 1990s: Proto-Bantu reconstructed consonants appear to have two different reflexes in many Bantu languages. Fewer cases of non-derived [d] can be related to Proto-Bantu than the regular reflex [l]. For example, none of the following eight Lusoga [JE16] CV(V)d- verb roots have PB sources as far as I have been able to determine:

(20)	-god-	'fold'	-guud-	'disgust'
	-gud-	'drink producing gulping sound'	-gudy-	'affect, bite severely'
	-dud-	'become rotten, have pus in a wound'	-bheed-	'lift' (bb = [b])
	-dèèd-	'hackle'	-wad-	'accuse falsely'

While Bastin et al (2002) provide a regional zone J reconstruction **-pád-* 'vex, persecute', which has the reflex *-wad-* 'accuse falsely' in Lusoga, there is a more general Proto-Bantu form **-nád-* 'scrape' [zones B, C, E, G-S] which has the regular Lusoga reflex *-wâl-* 'scrape'. A historical splitting of **d* into [d] and [l] is not likely here. This is consistent with Botne (1992: 46): "none of the [Eastern and Southern Bantu] languages manifested double reflexes of **d*."

So why do the above and other Bantu languages have [d] where they should have [l] such that the perfect phonology is messed up? Possible sources of [d] may be one or more of the following: (i) an earlier [nd] that got simplified to [d] (cf. Blanchon 1991, Janssens 1993 for Northwest Bantu); (ii) ideophones and other expressive vocabulary; (iii) borrowings; (iv) morphological processes. While (iv) has not been yet been illustrated, I turn now to a case where morphological processes quite clearly complicate an earlier complementary distribution.

4. Lusoga [p] ~ [ɣ] alternations

A second common alternation in Bantu concerns the debuccalization of Proto-Bantu **p*. As documented in the reflexes reported by Guthrie (1967-1971), **p* is realized [h] in widespread areas throughout the Bantu zone. Other Bantu languages show alternate reflexes such as [ɸ], [f], [β], [v], [w] and [ɣ]. The last two are found, respectively, in

⁵ In Chichewa /lw/ and /ly/ are realized [dw] and [dy].

Luganda [JE15] (with [y] realizations before front vowels) and Lusoga [JE16], the subject of this section. Since many Lusoga speakers are bilingual in closely related Luganda, they are often influenced to pronounce their indigenous [y] as [w], developing a marginal contrast in certain words. Whichever the case, [p] is found after [m] to the exclusion of both [w] and [y]. Table 1 presents the Lusoga consonant system (cf. van der Wal 2004: 4):

		labial	dental	alveolar	palatal	velar
stops	voiceless	p	t̪	t	č	k
	voiced	b	d̪	d	ǰ	g
prenasalized	voiceless	mp	ɱt̪	nt	ɲč	ŋk
	voiced	mb	ɱd̪	nd	ɲǰ	ŋg
fricatives	voiceless	f		s		
	voiced	v		z		
prenasalized	voiceless	mf		ns		
	voiced	mv		nz		
sonorants	nasal	m	ɱ	n		ŋ
	oral			l		
approximants		w			y	ɣ

Table 1. The Lusoga Consonant System

In what follows, the Lusoga orthography will be followed in which dentals are written *th*, *dh*, *nh*, while [ɣ] is written *gh*.

The issue of concern is the alternation between [ɣ] and [p], the latter occurring after a nasal, e.g. the first person subject/object prefix and the noun class 9/10 prefix (cf. Brown 1972: 81-5, Byarushengo 1977 and Schadeberg 1989 re related alternations in Lumasaaba, Luhaya, and Lunyole). Although these prefixes are realized homorganic to a following consonant, the data in (21) provide evidence that the first person singular prefix is underlyingly /n-/:

		‘we ...’		‘I ...’		‘I ...’	
(21)	/p/	: tù-pìm-á	‘measure’	ɱ̀-ɱ̀m-á	‘measure’	n-á-ɱ̀m-á	‘measured’
	/t/	: tù-tù̀ng-á	‘sew’	ɱ̀-̀tù̀ng-á	‘sew’	n-á-tù̀ng-á	‘sewed’
	/k/	: tù-kòl-á	‘work’	ɱ̀-̀kòl-á	‘work’	n-á-kòl-á	‘worked’

Thus, in the last column the prefix is realized [n] when followed by a vowel prefix, here the past tense marker /-a-/. With this established, consider the data in (22), which show the alternation in question:

(22)	[ɣ]	: tù-gh-á	‘give’	ɱ̀-̀p-à	‘give’	n-á-gh-à	‘gave’
		tù-ghèt-á	‘bend’	ɱ̀-̀pét-á	‘bend’	n-á-ghèt-á	‘bent’
		tù-ghùlír-á	‘hear’	ɱ̀-̀pùlír-á	‘hear’	n-á-ghùlír-á	‘heard’

When stems which are realized with [ɣ] after a vowel occur after /n-/, the initial consonant is realized [p], to which the nasal becomes homorganic [m]. It is clear that the Proto-Bantu consonant was *p, and indeed the above three roots are reconstructed as *pá- ‘give’, *pèt- ‘bend, fold’, *pùlír- ‘hear’ (Meeussen 1969 [1980]; Bastin et al 2002). The historical derivation had therefore to be something like in (23), where the third stage may have been either [w] or [h], both of which are attested in the area:

(23) Proto-Bantu *p > ɸ > (w? h?) > y

The alternation between [ɣ] and [p] is quite robust, occurring also in class 11/10 singular/plural pairs:

- (24) a. ò-lú-ghàghá ‘feather’ plural: é-ím-pàghá
 b. ò-lú-gháádhó ‘piece, slice’ plural: è-ìm-páádhó
 c. ò-lú-ghúúmbú ‘young banana leaf’ plural: è-ìm-púúmbú

The same alternation between [ɣ] and [p] also occurs in reduplication both of nouns and verbs:

- (25) a. é-ím-pàghá ‘feathers’ → é-ím-pághá + ghàghá
 è-ìm-páádhó ‘pieces, slices’ → è-ìm-páádhó + gháádhó
 è-ìm-púúmbú ‘banana leaves’ → è-ìm-púúmbú + ghúúmbú
 b. ím-p-à ‘I give’ → ím-p-à + gh-á
 ìm-pét-á ‘I bend’ → ìm-pét-á + ghét-á
 ìm-pùlir-á ‘I hear’ → ìm-pùlir-á + ghúlir-á

In (25a) the reduplicated nouns have a derogatory effect (‘lousy feathers’ etc.), while in (25b) the reduplicated verbs refer to doing the action a bit here and there (and typically badly). As a final context, the alternation between [ɣ] and [p] also occurs when class 9 or 10 nouns are diminutivized or augmented:

- (26) 9/10 noun diminutive augmentative
- a. é-ím-pùbé ‘rat’ → à-ká-ghùbé ò-gú-ghùbé ‘small/big rat’
 é-ím-pàghá ‘wing’ → à-ká-ghàghá ò-gú-ghàghá ‘small/big wing’
 é-ím-pèghó ‘wind’ → à-ká-ghèghó ò-gú-ghèghó ‘small/big wind’
- b. é-ím-pùbé ‘rats’ → ò-bú-ghùbé ò-gá-ghùbé ‘small/big rats’
 é-ím-pàghá ‘wing’ → ò-bú-ghàghá ò-gá-ghàghá ‘small/big wings’
 é-ím-pèghó ‘winds’ → ò-bú-ghèghó ò-gá-ghèghó ‘small/big winds’

To summarize, the [p] ~ [ɣ] alternation, although not phonetically motivated, is quite robust in Lusoga. Let us then consider possible analyses. First, note the following problems that would arise if we assumed underlying /p/ with a /p/ → [ɣ] rule applying whenever it is not preceded by a nasal: (i) [p] occurs in a more restricted environment (after [m]), while [ɣ] occurs more generally. It would therefore seem more reasonable to start with /ɣ/. (ii) It would seem odd to posit /p/ in the many words with morpheme-internal [ɣ] which never occurs after a nasal: ò-mú-sàghó ‘doctor’, ò-kú-yúgh-á ‘to pour’ etc. (iii) There are cases of contrast between [ɣ] and [p], e.g. the following words which are the result of borrowing: è-cí-sàghó ‘bag’ vs. è-cí-kópò ‘cup’ (< Swahili *ki-kopo*), é-ń-dhìghó ‘thirst’ vs. é-ń-thúpà ‘bottle’ (< Swahili *chupa*). Other words with [p] may be sound symbolic, e.g. è-pícípíci ‘motorbike’, ò-kú-pápál-á ‘to flap the wings, flutter’. (iv) Contrastive [p] also occurs in the diminutive and augments forms of the following two exceptional nouns: é-m-pítí ‘hyena’ → à-ká-pítí ‘small hyena’, ò-gú-pítí ‘big hyena’; è-m-pálá ‘leopard’ → à-ká-pálá ‘small leopard’, ò-gú-pálá, ‘big leopard’.

At the same time there are problems for an analysis with underlying /ɣ/ which would become [p] after /n/: (i) Where does the labiality of [p] come from if the nasal is underlyingly alveolar (or unspecified for place)? (ii) Where does the devoicing come from? Why should /ɣ/ be realized as [p] rather than [b] (or [g])? The change of voicing is less surprising if we posit /p/ → [ɣ]: While we would expect debuccalization to produce [h], as in Haya [JE22] (Byarushengo 1977), voicing can result from a constraint that rules out [x] or [h].(iii) Should /nɣ/ be considered for non-alternating morpheme-internal [mp], e.g. è-cí-ghùùmpú ‘clod’? Other not-so-attractive possibilities for deriving the labiality of [p] by rule include setting up a prefixal allomorph /m-/ that occurs before /ɣ/ which would then trigger the rule /ɣ/ → [p] / m __. Or, we could posit /w/ instead of /ɣ/, which would be more likely to become [p]. Most of these problems derive from the synchronically unnatural

word-level phonology tends to be not fully general. In fact, the Bantu [l] ~ [d], and [p] ~ [ɣ] situations illustrate one of the senses of “marginal” or “quasi-” phonemes surveyed by Currie Hall (2013), which seems to be “par for the course”: Few lexical alternations occur without complications or exceptions. Although Yaka has perfect [l] ~ [d] complementary distribution (/l/ → [d] after a nasal and before /i/), this is a rarity in Bantu. What we traditionally have taken as the model is that a perfect or “canonical” underlying/surface relation /X/ → Y in the context of Z would have three properties. First, we would expect the process to be phonetically natural. While this is the case of /l/ → [d] after [n], a case of consonant “hardening” after the [-cont] nasal, the [p] ~ [ɣ] alternation is not phonetically motivated.⁶ Second, we would expect the alternation to be analytically deterministic. In this case [mp] alternates with both [ɣ] and [p]. Finally, we should expect the alternation to be completely regular. In this case, there are instances of non-alternating [p]. In short, in the canonical situation the X, Y relation should be “biunique”: Every time one finds X in the right environment it becomes Y. Every time we find Y in that environment, we know it came from X. As seen in the following tables, where C1-C4 refers to the onset of the first to the fourth syllable of a stem, the [p] ~ [ɣ, w] relation fails to be biunique in Lusoga:

(29)	2358 verbs (Minah Nabirye)		My lexicon of 1276 entries																																				
	<table border="1" style="border-collapse: collapse; margin: auto;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 10%;">C1</th> <th style="width: 10%;">C2</th> <th style="width: 10%;">C3</th> <th style="width: 10%;">C4</th> <th style="width: 15%;">Totals</th> </tr> </thead> <tbody> <tr> <td style="text-align: right;">p</td> <td style="text-align: center;">25</td> <td style="text-align: center;">9</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">34</td> </tr> <tr> <td style="text-align: right;">w, ɣ</td> <td style="text-align: center;">201</td> <td style="text-align: center;">27</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">228</td> </tr> </tbody> </table>		C1	C2	C3	C4	Totals	p	25	9	0	0	34	w, ɣ	201	27	0	0	228		<table border="1" style="border-collapse: collapse; margin: auto;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 10%;">C1</th> <th style="width: 10%;">C2</th> <th style="width: 10%;">C3</th> <th style="width: 10%;">C4</th> <th style="width: 15%;">Totals</th> </tr> </thead> <tbody> <tr> <td style="text-align: right;">p</td> <td style="text-align: center;">13</td> <td style="text-align: center;">17</td> <td style="text-align: center;">1</td> <td style="text-align: center;">3</td> <td style="text-align: center;">34</td> </tr> <tr> <td style="text-align: right;">w, ɣ</td> <td style="text-align: center;">83</td> <td style="text-align: center;">33</td> <td style="text-align: center;">10</td> <td style="text-align: center;">0</td> <td style="text-align: center;">126</td> </tr> </tbody> </table>		C1	C2	C3	C4	Totals	p	13	17	1	3	34	w, ɣ	83	33	10	0	126
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This of course ignores interaction with other rules (processes) that might interact and render the X, Y relation opaque. Rule or constraint interaction would be of little concern to a traditional phonologist—which is not the case here. The question then is how to resolve the apparent conflict between URs, which are useful in many cases, vs. the problems which have been addressed in this study.

I started by considering the phrasal tone alternations in Giryama in (2)-(4). Recall from the data in (2b) that a verb prefix assigned a H tone to the phrase-penultimate mora two words to the right. Since it would seem vast overkill to say that every word or morpheme has multiple tonal allomorphs, starting with the underlying /H/ on the subject prefix /á-/ ‘s/he’ clearly establishes that something more like URs is motivated, at least by phrase-level alternations. It seems also reasonable to assume that speakers have internalized the relation between this H tone prefix and what happens at the end of the phrase. Word-level phonology is however subject to the pressures of lexicalization, as Hayes pointed out, which is enabled by the tremendous memory capacity that speakers have. One result of this study, therefore, is that we should not conflate all phonology in such a way as to deny URs across-the-board. At the same time, we need not reject URs for all word phonology. As I suggested in Hyman (2015), whether URs are “real” or not, they are still useful:

... the categories traditionally applied to the description of phonological representation... still have an important heuristic value as descriptors to be used in the building and experimental testing of models of phonological grammar. (Harris 2007:137)

They are particularly useful if one recognizes the two separate goals that I pointed out at in the first paragraph of this paper, which I designated as “heads” vs. “languages”, two

⁶ It is less clear why we should obtain [di] vs. [l] before other vowels and its variants: hardening occurs before both [w] and [ɣ] in Chichewa and before [i] and [u] in Setswana. There is dialectal evidence in both the Kongo [H10] and Sotho-Tswana [S30] groups that the [d] was originally pronounced as retroflex [ɖ] before high vowels (cf. also much of Caga [E60], where *d is realized [r ~ ɖ] before *i, *u, elsewhere as [l] or Ø (Gérard Philippson, pers.comm.)).

independent goals of linguistics, aptly encapsulated in the following rather different statements by two generative linguists:

The central object of inquiry in linguistics... is the nature and structure of the cognitive faculty that supports Language. ... the central task for a “scientific study of language” is to arrive at an understanding of an aspect of human cognitive organization. (Anderson 2008: 796)

The goal of linguistics is to formulate the most elegant hypotheses about how language works, consistent with the data. (Newmeyer 1983: 41)

Although they may inform each other, capturing generalizations and speaker knowledge are not the same thing. I personally doubt whether one can talk about what is in the head without doing a morphophonemic analysis in terms of URs, if only to show that speakers have internalized the data somewhat differently. In fact, even doubters of traditional phonology appear to recognize this, as can be seen from current “retro” textbooks, e.g. Hayes (2009). On the other hand, URs should not be confused with what they aren't. Specifically, URs are not full records of stored knowledge of lexical items:

The strong version of exemplar theory proposes that lexical entries are directly encoded in memory on the basis of acoustic traces, thereby bypassing the need for any representation in terms of phonological categories. (Ladd 2014: 52)

By recognizing the “heads” vs. “languages” dichotomy, I believe that we will be able to appreciate the value of phonological representations.

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