Underlying Representations and Bantu Segmental Phonology
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1. Introduction

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. electrício [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):

\[(2)\]

\[\begin{align*}
&\text{a. All } L\text{ tone} & \text{b. } H\text{ tone on penultimate mora} \\
&\text{‘I want ...’} & \text{‘he/she wants ...’} \\
i\text{-na-maal-a} & \text{a-na-maál-a} \\
i\text{-na-mal-a ku-guul-a} & \text{a-na-mal-a ku-guíl-a} \quad \text{‘... to buy’} \\
i\text{-na-mal-a ku-gul-a nguwo} & \text{a-na-mal-a ku-gul-a ngúwo} \quad \text{‘... to buy clothes’} \\
\end{align*}\]

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:

\[(3)\]

\[\begin{align*}
&\text{a. All } L\text{ tone} & \text{b. } H\text{ tone on penultimate mora} \\
&\text{‘to buy wooden bowls’} & \text{‘to break wooden bowls’} \\
k\text{u-gula mi-vuure} & \text{ku-bandá mi-vúre} \\
\end{align*}\]

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).

\[(4)\]

\[\begin{align*}
&\text{a. } \text{ni-na-gumbuhiziík-a ‘I am wiped out by utter destruction’} & \\
&\text{H} \\
&\text{b. } \text{a-ná-gumbuhiziík-a ‘s/he is wiped out by utter destruction’} & (\text{Volk 2007: 17}) \\
&\text{H} & \text{H} \\
\end{align*}\]

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 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. Thus, [l] and [d] are in complete complementary distribution in the following (ki-)Yaka [H31] noun class 9 deverbal nominalizations (Ruttenberg 1971 [2000]).

(5) verb noun
- lákána ‘agonize’ n-dákána ‘agony’
- lélé ‘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-dúúndza ‘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/ : díma ‘cultivate’ díímbúká ‘jump over’

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

(7) verb noun
- hál-á ‘sculpt’ n-hád-í ‘sculptor’
- fúúl-á ‘be in mourning’ yi-fúúd-í ‘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) French Yaka
- bière > by-éédi3 ‘beer’ (cl.8)
- l’hôpital > lu-pítáádi ‘mourning’ (cl.11)
- mesure > mi-sídidi ‘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:

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2 Since there is no contrast, an alternate reconstruction is *l*.
3 Note with respect to bière > by-éédi that by-éele would have been well-formed.
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 Armindo Neunea’s Comparative Bantu On-Line Dictionary (CBOLD) version of Sanderson (1954), pwítílí ‘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).

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)) |
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
1 | 1 | 162 | 1141 | 184 | 126 | 37 | --- | 1650 |
2 | 338 | 26 | 110 | 92 | 21 | 1 | 7 | 275 ( = 13.4%) |

As seen, there are many more cases of lV than dV. At one exteme there are 338 instances of [dl] vs. one instance of [li]. At the other, there are 184 instances of [lu] or 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 tautomorphemic [nd]? e.g. leend- ‘be sticky’: as /nd/ /nl/ or perhaps underspecified /nD/? Second, should we analyze tautomorphemic [dl], 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)
Like Ciyao, Ruwund has words with [d] before vowels other than [i]:

(14) /e/: sudeen ‘end up on’
/u/: ru-dung ‘heart’
/o/: dookal ‘come out’
/a/: di-caada ‘day after tomorrow’

As seen in the above examples, Ruwund has dropped final vowels in most cases. Thus there are cases where a coda [d] can be explained by reconstructing an earlier final *i, e.g. ru-pàd ‘polveamv’ < PB *-pàdi. More remarkably, Ruwund has words with [li] which contrasts with [di]:

(15) lil ‘raise a child’
lik ‘stop, leave (alone)’
palik ‘fall from a height’
ku-lìm ‘weight’
n-kaliweñ ‘craftsman’
ci-salijook ‘deed’

The following table shows the number of each syllable type from 1348 verbs stems in Nash (1991):

<table>
<thead>
<tr>
<th></th>
<th>i(i)</th>
<th>ee</th>
<th>a(a)</th>
<th>u(u)</th>
<th>oo</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td>22</td>
<td>24</td>
<td>39</td>
<td>113</td>
<td>14</td>
<td>212</td>
</tr>
<tr>
<td>d</td>
<td>73</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>91</td>
</tr>
</tbody>
</table>

Again, the [di] sequences outnumber the [li] sequences. While other lv sequences outnumber dV. The [li] forms are explained by the fact that short *ĕ > i:4

(17) Proto-Bantu  Ruwund  
*ded- > dil ‘cry’  
*ded- > lel- > lil ‘raise (child)’  
*dim- > dim ‘cultivate’  
*dek- > lek- > lik ‘stop, leave (alone)’

Unless we recognize abstract short /e/. Ruwund will require /l/ vs. /d/. A contrast that is robust only before [l]. There still will be the problem of how to interpret tautomorpheme [nd], e.g. in the language name Ruwund itself.

From the above we reach the following two general observations: First, languages with a [l] ~ [nd] relation tend to have some cases of underived [d]. Second. stems with underived [d] are always rarer than stems with [l]. A third generalization is that [d] tends to occur earlier in the stem. This is seen in the following counts from Chichewa and Ndebele:

(18) Chichewa [N31] (5862 entries in Al Mtenje’s CBOLD lexicon)

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td>315</td>
<td>883</td>
<td>855</td>
<td>392</td>
<td>2445</td>
</tr>
<tr>
<td>d</td>
<td>147</td>
<td>94</td>
<td>55</td>
<td>7</td>
<td>303</td>
</tr>
</tbody>
</table>

% d  31.8%  9.6%  6.0%  1.8%  11.0%

4 In addition, short *ő > a, e.g. *bón- > màn ‘see’.
Ndebele [S44] (5000 entries in Galen Sibanda’s CBOLD lexicon)

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td>210</td>
<td>631</td>
<td>696</td>
<td>323</td>
<td>1860</td>
</tr>
<tr>
<td>d</td>
<td>166</td>
<td>107</td>
<td>28</td>
<td>5</td>
<td>306</td>
</tr>
<tr>
<td>% d</td>
<td>44.1%</td>
<td>14.5%</td>
<td>3.9%</td>
<td>1.5%</td>
<td>14.1%</td>
</tr>
</tbody>
</table>

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/)

<table>
<thead>
<tr>
<th></th>
<th>di</th>
<th>de</th>
<th>da</th>
<th>do</th>
<th>du</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>75</td>
<td>35</td>
<td>66</td>
<td>49</td>
<td>59</td>
<td>284</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>di</th>
<th>de</th>
<th>da</th>
<th>do</th>
<th>du</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>35</td>
<td>93</td>
<td>24</td>
<td>69</td>
<td>269</td>
<td></td>
</tr>
</tbody>
</table>

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 ‘enawine’, dala ‘intentionally’. dodolílido ‘upsidedown’. 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 [l]? 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’ -bbeed- ‘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 *ndád- ‘scrape’ (zones B, C, E, G-S) which has the regular Lusoga reflex -wàl- ‘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] ~ [y] 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 [y]. 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):

<table>
<thead>
<tr>
<th>stops</th>
<th>labial</th>
<th>dental</th>
<th>alveolar</th>
<th>palatal</th>
<th>velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>voiceless</td>
<td>p</td>
<td>t</td>
<td>t</td>
<td>č</td>
<td>k</td>
</tr>
<tr>
<td>voiced</td>
<td>b</td>
<td>d</td>
<td>d</td>
<td>ğ</td>
<td>g</td>
</tr>
<tr>
<td>prenasalized</td>
<td>voiceless</td>
<td>mp</td>
<td>ňt</td>
<td>nt</td>
<td>ňč</td>
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<td>ňd</td>
<td>nd</td>
<td>ňj</td>
<td>ňġ</td>
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<tr>
<td>fricatives</td>
<td>voiceless</td>
<td>f</td>
<td>s</td>
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<td>z</td>
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<td></td>
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<td>m</td>
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<td>nz</td>
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<tr>
<td>sonorants</td>
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<td>l</td>
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<tr>
<td>approximants</td>
<td>w</td>
<td>y</td>
<td>y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1. The Lusoga Consonant System**

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

The issue of concern is the alternation between [ŋ] 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-/:  

(21) /p/ : tū-pím-á ‘measure’ m-pím-á ‘measure’ n-á-pím-á ‘measured’
/t/ : tū-tùūng-á ‘sew’ ň-tùūng-á ‘sew’ n-á-tùūng-á ‘sewed’
/k/ : tū-kòl-á ‘work’ ň-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) [ŋ] : tū-gh-á ‘give’ m-p-á ‘give’ n-á-gh-á ‘gave’
         tū-ghêt-á ‘bend’ m-pét-á ‘bend’ n-á-ghêt-á ‘bent’
         tū-ghülír-á ‘hear’ m-púlír-á ‘hear’ n-á-ghülír-á ‘heard’

When stems which are realized with [ŋ] 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’, *-pét- ‘bend, fold’, *-pûl- ‘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 > φ > (w? h?) > y

The alternation between [ŋ] and [p] is quite robust, occurring also in class 11/10 singular/plural pairs:
(24)  a. ò-lù-ghàghá ‘feather’ plural: é-rù-pàghá
    b. ò-lù-ghàadhó ‘piece, slice’ plural: è-rù-pàadhó
    c. ò-lù-ghùúmbú ‘young banana leaf’ plural: è-rù-pùúmbú

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

(25)  a. é-m-pàghá ‘feathers’ → é-m-pàghá + ghàghá
      è-m-pàadhó ‘pieces, slices’ → è-m-pàadhó + ghàadhó
      è-m-pùúmbú ‘banana leaves’ → è-m-pùúmbú + ghùúmbú
    b. m-p-à ‘I give’ → m-p-à + gb-á
        m-pét-á ‘I bend’ → m-pét-á + ghét-á
        m-pùúlr-á ‘I hear’ → m-pùúlr-á + ghùúlr-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-m-púbè ‘rat’ → à-ká-ghubè  ò-gú-ghubè ‘small/big rat’
       é-m-pàghá ‘wing’ → à-ká-ghàghá  ò-gú-ghàghá ‘small/big wing’
       é-m-pèghó ‘wind’ → à-ká-ghèghó  ò-gú-ghèghó ‘small/big wind’
    b. é-m-púbè ‘rats’ → ò-bú-ghubè  ò-gá-ghubè ‘small/big rats’
       é-m-pàghá ‘wing’ → ò-bú-ghàghá  ò-gá-ghàghá ‘small/big wings’
       é-m-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-mù-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-cl-sàghó ‘bag’ vs. è-cl-kòpá ‘cup’ (< Swahili kl-kopo), è-n-dhùghó ‘thirst’ vs. è-n-thùpá ‘bottle’ (< Swahili chupa). Other words with [p] may be sound symbolic, e.g. è-pìcìpìcì ‘motorbike’, ò-kú-pùpùl-á ‘to flap the wings, flutter’. (iv) Contrastive [p] also occurs in the diminutive and augments forms of the following two exceptional nouns: è-m-pùlí ‘hyena’ → à-ká-pùlí ‘small hyena’, ò-gá-pùlí ‘big hyena; è-m-pàlá ‘leopard’ → à-ká-pàlá ‘small leopard’, ò-gá-pàlá, ‘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 underlingly 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 /ìny/ be considered for non-alternating morpheme-internal [mp], e.g. è-cl-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
relation between [p] and [ɣ]. Strikingly, Schadeberg (1989) reported that the alternation is between [p] and [ŋ] in nearby Lunyole [JE35], thereby requiring the rule \( p \to \eta / n \___ \).

This now brings us to the central question of whether to analyze the above facts via underlying representations and phonological rules—or in some other way. Since Lusoga [p] \~\ [ɣ] has the above problems—and is not a phonetically “natural” alternation—maybe it is best to just list both initial [p] and initial [ɣ] allomorphs, the former being subcategorized for a [+nasal] prefix, as in (27), where the underlying tonal contrast is /L/ vs. Ø (Hyman 2016):

(27)

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘hear’</td>
<td>/pùlir/ /n_</td>
<td>m-pùlir-á ‘I hear’</td>
</tr>
<tr>
<td>‘rat’</td>
<td>/pùbe/ /n_</td>
<td>é-m-pùbé ‘s/he hears’</td>
</tr>
<tr>
<td>‘flutter’</td>
<td>/papala/</td>
<td>ɗ-kú-pápálá ‘to flutter’</td>
</tr>
<tr>
<td>‘motorbike’</td>
<td>/picipici/</td>
<td>é-pícípící ‘motorbike’</td>
</tr>
</tbody>
</table>

As seen, the words ‘hear’ and ‘rat’ have two allomorphs in (27a). The p-initial allomorph is restricted to occurring after a nasal prefix, while the ɣ-initial allomorph occurs elsewhere. The phonologically identified nasal context seem preferable to referring directly to the morphosyntactic features that these prefixes realize (first persons singular subject/object, noun classes 9 and 10). Since words like ‘flutter’ and ‘motorbike’ have [p] in all environments, they have only a single allomorph with /p/.

4. Conclusion

In the preceding sections we have established the following: In §2 we saw that the inherited complementary distribution of [l] and [d] becomes undone in numerous Bantu languages. (A similar situation sometimes arises between [β] and [b].) The solution for languages like Ciyao, Chichewa and Ndebele was to set up both /l/ and /d/: /l/ undergoes a change to [d] after a nasal and in some languages before /i/. /d/ is realized [d] in all environments. In §3 we saw that in addition to being phonetically unmotivated from a synchronic point of view, the [p] ~ [ɣ] complementarity is further complicated by the occurrence of morphemes with non-alternating [p]. As in the case of /l/ and /d/, it would be possible to set up a contrast between /ɣ/ and /p/. However, as enumerated in the preceding section, there would be many problems with /ɣ/, especially as concerns how to get /n+ɣ/ to become [mŋ]. The problems become clear when we evaluate Lusoga [p] ~ [ɣ] with respect to the potential arguments presented against URs in (1), repeated in (28).

(28)

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. URs are wrong</td>
<td>/p/ \to {v} makes wrong predictions. as there are cases of /p/ that do not become [ɣ]; /ɣ/ \to [p] is “odd”</td>
</tr>
<tr>
<td>b. URs are redundant</td>
<td>the same job can be done with allomorphs, as in (27), which are independently needed in unambiguous cases</td>
</tr>
<tr>
<td>c. URs are indeterminate</td>
<td>what should the URs be of non-alternating [ɣ] and [mp]—the same as the surface representations?</td>
</tr>
<tr>
<td>d. URs are insufficient</td>
<td>URs do not encode other information, e.g. why certain morphemes can alternately be pronounced with [w] instead of [ɣ]</td>
</tr>
<tr>
<td>e. URs are uninteresting</td>
<td>is it worth arguing about URs in this case?</td>
</tr>
</tbody>
</table>

As a result, it seems not unreasonable to give up on URs and propose the allomorph solution in (27). By doing so, we provide another confirmation of Hayes’ observation that
word-level phonology tends to be not fully general. In fact, the Bantu [l] ~ [d], and [p] ~ [y] 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] ~ [y] alternation is not phonetically motivated. Second, we would expect the alternation to be analytically deterministic. In this case [mp] alternates with both [y] 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] ~ [y, w] relation fails to be biunique in Lusoga:

<table>
<thead>
<tr>
<th></th>
<th>My lexicon of 1276 entries</th>
<th>(29) 2358 verbs (Minah Nabirye)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>p</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>w, y</td>
<td>201</td>
<td>27</td>
</tr>
</tbody>
</table>

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

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6 It is less clear why we should obtain [di] vs. [l] before other vowels and its variants: hardening occurs before both [w] and [y] 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 [ɻ] before high vowels (cf. also much of Caga [E60], where the [ɻ] is realized [r ~ ɻ] before *i, *u, elsewhere as [l] or Ø (Gérard Phillipson, 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.

References

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