# Logoori Grammatical Tone: A Distributed Morphology Analysis[*]

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**Abstract:** Like many Bantu languages, Logoori has a rich system of TAM-marking on verbs via segmental affixes as well as tones. Odden 2018 identifies several 'tonal melodies' that are assigned to verbs depending on TAM specification (e.g. *-kárààng-* 'to fry'/*-kàrááng-* 'and then fried'). Exactly how these melodies are analyzed—as tonal affixes, morphophonological tweaks, or a combination of these—remains an open theoretical question. This paper offers an analysis based in Distributed Morphology, a piece-based theory that allows for limited morphophonological readjustment. I argue that the Logoori infinitive/consecutive alternation can be derived via the same PF operations as e.g. English *keep/kept*—affixation, morphophonology, and general phonology—underscoring a more general claim that tonal and segmental morphology can be handled with the same theoretical tools.

## 1. Grammatical Tone

Grammatical tone is the realization of tense, number, case or other morphosyntactic features through tone. Some examples:

(1) a. bwě ~ bwé 'dog.SG/PL' (Noni; Hyman & Leben 2008:590)
dʒɔ̌n ~ dʒɔ́n 'star.SG/PL'
b. aqan ~ w-áqan 'leg/my leg' (Uspanteko; Bennett & Henderson 2013)
ixk'eq ~ w-íxk'eq 'fingernail/my fingernail'

Both examples in (1) can be treated as simple *tonal affixation*—e.g., the Noni singular morpheme in (1)a could be analyzed as a L-tone prefix that attaches to a H-tone root, yielding a LH contour tone (L + bwé → bwě). But not all grammatical tone yields easily to this kind of analysis. In the Logoori verbs in (2), for example, the first syllable of the root (underlined) is H in the infinitive vs. L in the consecutive, while the following vowels are L in the infinitive vs. H in the consecutive:

(2) kú-kárààngà ~ vá-kàrááńgá 'to fry / and then they fried'
kú-hááńdììka ~ vá-hààndííká 'to write / and then they wrote'

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The alternation in (2) appears to involve something more than (or different from) the addition of a single tonal affix. As such, it raises a familiar, much-debated question in morphological theory: Does some morphology involve *morphophonological processes* rather than (or in addition to) *piece-based affixation*? More generally, what are the respective roles of piece-based and process-based operations in morphology?

This paper offers an analysis of (2) and other tonal TAM-inflection in Logoori, based in the Distributed Morphology (DM) architecture described by Halle & Marantz 1993, Embick 2010, etc. In this model, piece-based morphology is basic, but limited process-based morphology is allowed in the form of morphophonological *readjustment*. The 'tonal melodies' characteristic of Logoori and other Bantu verb paradigms can thus be derived in the same three steps as, say, the English past-tense verb *meant*: affixation, readjustment, and general phonology. A preview:

| | | |
|---|---|---|
| (3) | Step 1: tone affixation (*vocabulary insertion*) | káraang + a(**H**) |
| | Step 2: H-lowering (*readjustment*) | k**à**raanga + a(H) |
| | Step 3: leftward H-spread (*general phonology*) | kàr**áá**ng**á** |
| (4) | Step 1: T[PAST] suffix (*vocabulary insertion*) | [min]+**t** |
| | Step 2: vowel lowering (*readjustment*) | [m**ɛ**n]+t |
| | Step 3: flapping (*general phonology*) | I [mɛ**ɾ̃**] it |

The parallelism between (3) and (4) underscores the larger proposal underlying this work (see Pak 2019)—that tonal and segmental morphology can be approached with the same theoretical tools. Whether or not readjustment is a necessary step in the Logoori analysis is considered in §4; I show that an alternative 'no-readjustment' treatment introduces theoretical complications of its own.

## 2. Background on Distributed Morphology

In DM the syntax is the starting point for all complex linguistic structures. Morphemes are assembled into complex words by head-movement and/or morphological merger; these structures are then spelled out phase-cyclically (at each category-defining head (*n, a, v*), working from the bottom up) and subjected to an ordered set of postsyntactic PF operations. To illustrate, English *meant* is derived as follows:

*Step 1:* Relatively early in PF, after the complex head [[[√MEAN ] *v*] T] has been formed and its component morphemes have been concatenated, Vocabulary Insertion (VI) applies, supplying phonological content to morphemes by rules like (5). In the case of English T[PAST], several exponents compete for insertion—a situation we recognize as *contextual allomorphy*. √MEAN is one of several roots that triggers insertion of an irregular -*t* allomorph ('irregular' in that it does not assimilate in voicing to the root-final consonant).

(5) T[PAST] ↔ -**t**/ X ⁀ __, where X = √**MEAN**, √FEEL, √SPILL …
-Ø/ X ⁀ __, where X = √HIT, √PUT, √DIG, √MEET …
-(ə)d *(elsewhere)*

Notice that the morpheme undergoing VI, T[PAST], is *linearly adjacent* to the roots that condition its allomorphy. This demonstrates a general locality constraint on allomorphy proposed by Embick 2010 et seq.: because VI applies just after morphemes have been concatenated, allomorphy can only 'see' linearly adjacent material in the same spellout domain (phonologically null heads like *v* here are transparent, possibly because they have been 'pruned'). We will return to this point in §4.

*Step 2:* English T[PAST] then triggers a set of morphophonological *readjustment rules* (RRs), typically manifested as irregular vowel changes. Each of these rules is specified to apply to a list of roots; √MEAN is one of several roots that undergoes /i → ε/ readjustment:

(6) i → ε / ___$_{X}$ ⁀T[PAST], where X = √**MEAN**, √FEEL, √READ, √MEET …

Notice that the trigger of the RR, T[PAST], is linearly adjacent to its target root. While certain kinds of RRs are locally constrained in this way, others have somewhat looser locality constraints, allowing limited 'morpheme-skipping' (Shwayder 2015). Again, we will return to this point in §4.

*Step 3:* Near the end of the PF derivation, the general phonology renders additional changes. For example, if *meant* /mɛn-t/ is phrase-final, its final segment can be glottalized [mɛnˀ]; if prevocalic, it might be flapped (*I* [mɛ̃ɾ̃] *it*). *General phonology* is a cover term for a wide range of phonological rules (or constraint rankings) with varying locality restrictions—word-internal, phrasal, etc.— that are all 'general' in the sense that they are not morphologically restricted. The tier-association rules that link floating tones to segments are also part of the general phonology.

To review, DM is primarily a piece-based theory: VI (insertion of pieces) applies automatically at the spellout of every morpheme, even when it inserts nothing (Ø), while readjustment (a phonological process) is triggered only by a restricted subset of morphemes. We therefore invoke RRs only when necessary: 'All other things being equal, a piece-based analysis is preferred to a [RR] analysis when the morpho-syntactic decomposition justifies [it]' (Embick & Halle 2005:29). I now apply this principle to the analysis of four Logoori tone melodies.

## 3. Analysis of Four Logoori Tonal Melodies

Logoori (Lulogooli, Llogoori) is a Bantu language spoken in western Kenya. The data reported here are drawn primarily from Odden 2018 and Goldsmith 1991 and supplemented by first-hand data from a speaker from Kakamega, Kenya, now living in Atlanta.

Like many Bantu languages (Odden & Bickmore 2014, Nurse 2008), Logoori has a rich system of TAM-marking on verbs through segmental prefixes and suffixes as well as tones. Odden 2018 identifies 10 'tonal melodies' that are assigned to verbs depending on TAM specification and verb class. (7) shows four of these melodies with a sample verb root from each class.

| (7) | | <u>'fly'</u> | <u>'fry'</u> | *designation in Odden 2018* |
|---|---|---|---|---|
| | a. | -bùrùk-à | -kárààng-à | Basic (72ff) |
| | b. | -búrúk-à | -kàrááng-á | M2, main variant (77ff) |
| | c. | bùrùk-à | kàrááng-á | M5 (90-91) |
| | d. | -búrúk-à | -kàrààng-à | M2, variant 3 (83ff) |

Many of these melodies are shared by multiple TAM forms that do not appear to form a coherent syntactico-semantic class; e.g., the ‘basic’ melody in (7)a is used in the infinitive, remote future, hodiernal future, distant past and immediate past (with distinct segmental TAM-marking affixes):

| | | | |
|---|---|---|---|
| (8) | *Infinitive* | kò-**ròr**-à ‘to see’ | kó-**réèt**-à ‘to bring’ |
| | *Remote future* | n-dà-kà-**ròr**-è ‘I will see’ | va-rá-ká-**réèt**-è ‘they will bring’ |
| | *Recent past* | w-aa-kà-**ròr**-à ‘you saw’ | w-aa-ká-**réèt**-à ‘you brought’ |

There is no semantic coherence to the two verb classes either; the distinction is relevant only for the phonology. There is apparently some variation in verb-class assignment—our consultant has -*zaazam*- ‘taste’ and -*haandiik*- ‘write’ in the opposite classes from those given in Odden 2018—but once a given verb’s class is known, its tones in every TAM form are entirely predictable.

Returning to (7), we can see that while the overall pattern is certainly complex—there is no single tonal-affix exponent that could be responsible for the difference between (7)c and (7)d, for example—it is also not entirely arbitrary. Verbs like -*buruk*- can be all L, or have H on the first two moras, but don’t seem to permit e.g. HLH. Meanwhile, -*karaang*-class roots allow the first syllable to have a different tone from the rest of the root (HLL or LHH), but do not seem to permit e.g. HHL or LLH. Our analysis will ideally account for such patterns systematically.

### 3.1. The Basic Melody

The analysis presented here preserves two key assumptions from Odden 2018:

(9) a. -*buruk*-class verbs are underlyingly toneless, while -*karaang*-class verbs have underlying H on the first syllable (-*káraang*-)—a common Bantu pattern.

b. The melody in (7)a is ‘basic’ in the sense that these underlying verb tones have not been altered. The melodies in (7)b-d, on the other hand, show effects of various combinations of tonal affixation (VI) and/or morphophonology (RR).

The basic melody (7)a is derived entirely in the general phonology, with no tonal affixation or readjustment. General phonological rules in Logoori include:

(10) a. *H-spread:* H spreads leftward ‘unboundedly and variably’ onto toneless syllables.
e.g. kugura macúunga → kúgúrá mácúunga ‘to buy oranges’ (Odden 2018:73)

b. *Downstep:* If two Hs are adjacent on the tonal tier, $H_2$ is downstepped.
e.g. kuvúgura macúunga → kúvúꜜgúrá mácúunga ‘to receive oranges’

c. *Default L:* Toneless vowels are assigned L at the end of the derivation.

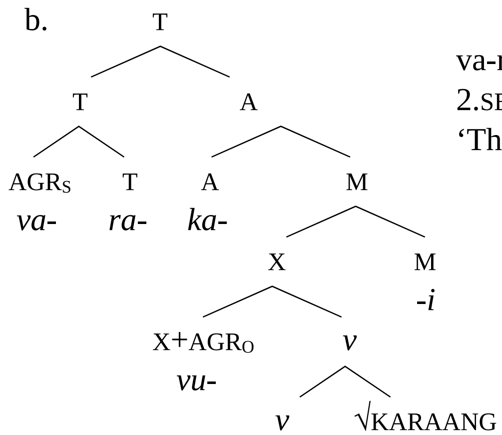
In the infinitive, one of the TAM forms with the basic melody, we see the effects of (10)a and (10)c. Toneless verbs get Default L throughout (11)c, while the underlying H of e.g. *karaang*- spreads leftward onto the infinitive prefix *ku-/ko-* (11)a:

(11) a. kù-vàrìzà ‘to count’ b. kú-kárààngà ‘to fry’
kù-bùrùkà ‘to fly’ kú-súgùmà ‘to push’
kù-zààzàmà ‘to taste’ kú-háándììkà ‘to write’

The rest of the melodies in (7)b-d deviate from this basic pattern to varying degrees. In §§3.2-3.4 I show that these melodies can be derived in three steps: (i) insertion of a H-tone TAM suffix, which in some cases alternates with a toneless allomorph; (ii) a RR triggered by certain TAM suffixes, which lowers the lexical H; and (iii) general phonological rules, including (10).

(12)a is a proposed partial syntactic structure for a Logoori verb. The verb root in this structure raises progressively to T and the resulting complex head is shipped to PF, where morphemes undergo linearization and VI (12)b. The suffix of interest here is M, which can be provisionally identified with Mood pending further work on Logoori TAM morphosyntax. I also assume that AGR nodes are added postsyntactically.[1]

(12) a. *Syntax:* [$_{TP}$ T [$_{AP}$ Asp [$_{MP}$ Mood [$_{XP}$ *pro*$_i$ X [$_{vP}$ *v* √ROOT ~~*pro*~~$_i$ ]]]]]
b.




va-ra-ka-vu-karaang-i *(tones not indicated)*
2.SBJ-T-A-14.OBJ-fry-M
‘They will fry them [mushrooms].’

## 3.2. The Consecutive Melody

Consider the melody in (7)b, which is found in the consecutive (below) as well as the indefinite future and persistive (Odden 2018:79-80). Notice that the verb roots on the left, which were toneless in the infinitive (11)a, now have H on their first two moras. Meanwhile, the verb roots on the right, which were H-initial in the infinitive (11)b, are now LH(H). (The subject-AGR prefix *va-* has its own underlying H, which triggers downstep in (13)a per (10)b.)

(13) a. vá-$^{!}$váríz-à ‘and then they counted’ b. vá-kàrááng-á ‘and then they fried’
vá-$^{!}$búrúk-à ‘and then they flew’ vá-sùgúm-á ‘and then they pushed’
vá-$^{!}$záázàm-à ‘and then they tasted’ vá-hààndíík-á ‘and then they wrote’

[1] The object-agreement marker in ‘X’ could be analyzed instead as an incorporated pronoun; see Henderson 2006, Zeller 2013, among others. As far as I am aware, this change would have no effect on the current proposal.

We can assume, following Odden 2018 and Goldsmith 1991, that the 'extra' H on the verb roots in (13) is a TAM suffix. Specifically, I propose that this H, together with the final vowel *-a*, is the exponent of the M suffix from (12). A VI rule is given in (14); *con* is shorthand for the specific syntactico-semantic features that correspond to the consecutive.

(14) M[*con*] ↔ a(H)

Importantly, (H) here is a *floating* tone; it is not underlyingly linked to the /a/ on the segmental tier. See Pak 2019 for more examples of exponents of this type.

Like all floating tones, this (H) eventually gets linked to a vowel by tier-association rules in the general phonology. Logoori has three active tiers: tonal, segmental and metrical. As suggested by Goldsmith 1991, tone-association in Logoori is determined by metrical principles: a floating tone docks on the most metrically prominent available vowel. (Something similar happens in Uspanteko (1)b, where genitive (H) docks on the penult; see Bennett & Henderson 2013.) Grid-construction and floating-tone association rules are given in (15); a more complete derivation of *vá-$^{!}$búrúk-à* 'and then they flew' is given in (16):

(15)
- i. A single binary foot is created at the left edge of a verb root by inserting a right bracket ) on line 0. (H-initial verbs are underlyingly specified with a right bracket after the first syllable, which prevents this rule from applying.)
- ii. The rightmost x in each foot projects a gridmark onto line 1.
- iii. A floating tone (T) docks on the vowel with the highest level of accent that does not already have tone. If there is no such unique vowel (e.g. if there are multiple vowels with the same level of accent), (T) docks on the nearest vowel.

(16)

| | | | | |
|---|---|---|---|---|
| a. | VI at M (14): | buruk-**a**(**H**) | | |
| b. | Grid-construction (15)i: | buru**)**k-a(H) | | (**H**) |
| c. | Insertion of subject-AGR: | **vá**-buru)k-a(H) | | buruk-**a** |
| d. | Floating-(T) assoc. (15)iii: | vá-bur**ú**)k-a | *line 0* | x x) x |
| e. | H-spread (10)a: | vá-b**ú**rúk-a | *line 1* | x |
| f. | Downstep (10)b: | vá-**$^{!}$**búrúk-a | | |
| g. | Default L (10)c: | vá-$^{!}$búrúk-**à** | | |

For H-initial verbs like *-karaanga*, an important question remains: why does the first vowel surface with L? I propose that Logoori has a *morphophonological* H-lowering rule (a RR) triggered by specific TAM morphemes, including M[*con*].

(17) H → L iff target (H) immediately precedes trigger (M[*con*]) on the tonal tier

The fact that this rule lowers H instead of deleting it explains why the H-suffix spreads leftward up to, but not onto, first syllable of the root (kà̠ráángá, *ká̠ráángá). The first syllable retains its underlying tone, but in a tweaked form (see Hyman & Katamba 1993:45, Odden 2018:74).

A more complete derivation of *vá-kàrááng-á* ‘and then they fried’ is given below:

| | | | | | |
|---|---|---|---|---|---|
| (18) | a. | Vocab. insertion at M (14): | káraang-**a**(**H**) | | H(→L) (**H**) |
| | b. | Readjustment at M (17): | k**à**raang-a(H) | | karaang-**a** |
| | c. | Insertion of subject-AGR: | **vá**-kàraang-a(H) | *line 0* | x)xx x |
| | d. | Floating-(T) assoc. (15)iii: | vá-kàraang-**á** | *line 1* | x |
| | e. | H-spread (10)a: | vá- kàr**áá**ng-á | | |

## 3.3. The Imperative Melody

Moving on: the melody in (7)c is found only in the Imperative, which is also distinguished by the absence of segmental prefixes. This melody appears to be a blend of the two previous ones: toneless verbs are all L (as in the infinitive) while H-initial verbs are LH(H) (as in the consecutive).

| | | | | |
|---|---|---|---|---|
| (19) | a. | vàrìzà ‘count!’ | b. | kàráángá ‘fry (it)!’ |
| | | zààzàmà ‘taste!’ | | hààndííká ‘write!’ |

In the current model, the mixed pattern seen here can be derived by postulating *contextual allomorphy* at the M suffix, similar to what we saw in the English T[PAST]: ‘Insert -**a**(**H**) if the preceding morpheme has H as its rightmost tone, else -**a**’ (20). The derivation then proceeds as in (21). (Metrical-grid construction has no noticeable effect here and therefore is not shown.)

(20) M[*imp*] ↔ -**a**(**H**) / X⁀__, where X has H as its rightmost tone
↔ -**a**

| | | | | |
|---|---|---|---|---|
| (21) | a. | Vocab. insertion at M (20): | variz-**a** | káraang-**a**(**H**) |
| | b. | Readjustment at M (17): | ----- | k**à**raang-a(H) |
| | c. | Floating-(T) assoc. (15)iii: | ----- | kàraang-**á** |
| | d. | H-spread (10)a: | ----- | kàr**áá**ng-á |
| | e. | Default L (10)c: | v**à**r**ì**z-**à** | ----- |

Notice that at step (b), essentially the same RR (H → L) applies in the imperative as we saw in the consecutive. I take this to mean that both morphemes M[*con*] and M[*imp*] are diacritically specified to activate the same H → L rule—roughly parallel to how several distinct morphemes can activate the same /a → ɛ/ rule in German (*Ma̠nn~Mä̠nn-er~Mä̠nn-lein*, etc.) (Shwayder 2015).

## 3.4. The Negative Subjunctive Melody

The melody in (7)d—used in the negative subjunctive and the recent perfective—is another mixed pattern, essentially the inverse of the imperative pattern. Underlyingly toneless verb roots get the same tones as in the consecutive (see §3.2), while H-initial verbs surface with L throughout:

(22) a. ù-tà[2]-váríz-à 'you shouldn't count' b. ù-tà-kàrààng-à 'you shouldn't fry (it)'
ù-tà-búrúk-à 'you shouldn't fly' ù-tà-hààndììk-à 'you shouldn't write'

The analysis involves the same ingredients as in the imperative (§3.3), but with a VI rule that is the inverse of (20): 'Insert **-a** if the preceding morpheme has H as its rightmost tone, else **-a**(**H**).'

(23) M[*subj*] ↔ **-a** / X⌒__, where X has H as its rightmost tone
↔ **-a**(**H**)

The derivation proceeds as follows:

| | | | | |
|---|---|---|---|---|
| (24) | a. | Vocab. insertion at M (23): | variz **-a**(**H**) | káraang-**a** |
| | b. | Readjustment at M (17): | ----- | k**à**raang-a |
| | c. | Grid-construction (15)i: | vari**)**z-a(**H**) | ----- |
| | d. | Floating-(T) assoc. (15)iii: | var**í**)z-a | ----- |
| | e. | H-spread (10)a: | v**á**rí)z-a | ----- |
| | f. | Default L (10)c: | várí)z-**à** | kàr**àà**ng-**à** |

It is worth noting that the H-lowering RR in (24)b is triggered by M[*subj*] even though the exponent for M[*subj*] does not itself have H tone. In other words, even though H-lowering may look like a hiatus/OCP-repair strategy in the consecutive and imperative (HH → LH), we can see now that this not a consistent effect and therefore does not need to be explained by the analysis.

I have shown how four Logoori tone melodies can be analyzed by appealing to the same three principal (stages of) PF operations as are involved in segmental morphology: VI, RR, and general phonology (GP). Some contexts require just two steps (VI+GP); others include Readjustment as an intermediate third step. Tables 1-2 summarize the analysis and underscore the similarity between tonal and segmental morphology that I have emphasized here.

Table 1: Summary of the Logoori TAM alternations analyzed in §3

| | *Infinitive* | | *Consecutive* | | *Imperative* | | *Neg. Subjunctive* | |
|---|---|---|---|---|---|---|---|---|
| | *toneless* | *H-initial* | *toneless* | *H-initial* | *toneless* | *H-initial* | *toneless* | *H-initial* |
| VI | buruk-a | súg̲um-a | buruk-a(H) | súg̲um-a(H) | buruk-a | súg̲um-a(H) | buruk-a(H) | súg̲um-a |
| RR | | | | sùg̲um-a(H) | | sùg̲um-a(H) | | sùg̲um-a |
| GP | bùrùkà | súg̲ùm-à | búrúk-à | sùg̲úm-á | bùrùkà | sùg̲úm-á | búrúk-à | sùg̲ùm-à |

[2] Negative-subjunctive verbs are obligatorily followed by the sentential-negation adverb *daave*, not shown here. The prefixes *u-ta-* (2SG-NEG.CONCORD) are consistently L in our consultant's speech and also indicated as L in Odden 2018; it is not yet clear to me why H-spread is blocked by *ta-* but not by the infinitive prefix *ku-* (cf. (11)b).

Table 2: Derivation of past-tense of several English verb roots

| | *-t* | | *-Ø* | | *-d (default)* | |
|---|---|---|---|---|---|---|
| | *spill* (%) | *mean* | *hit* | *Meet* | *beep, clean* | *keep* |
| VI | spɪl + t | min + t | hɪt + Ø | mit + Ø | bip+d, klin+d | kip + d |
| RR | | mɛn + t | | mɛt + Ø | | kɛp + d |
| GP | [spɪɫʔ] milk | [mɛ̃ʔ] more | [hɪʔ] me | [mɛʔ] me | bipt, klind | kɛpt |

There are many more aspects of the Logoori pattern that space constraints prevent me from discussing here. The next section demonstrates how at least some of these additional facts can be covered by minor extensions to the current analysis.

## 4. Analyzing the Pattern without Readjustment

Because Readjustment represents an extra step, and extra morpheme-specific information that must be memorized and stored, it is always worth asking if it is essential to a given analysis. Could the Logoori facts here be handled with just two steps, VI and general phonology?

Up to a point, they can. The reanalysis would involve treating *all* verb tones, including those in the 'basic' pattern, as exponents of the M suffix. Verbs like *-karaang-*, instead of having underlying H, would be distinguished by an abstract accent (formalized in §3.2 as a prespecified boundary mark on a metrical grid, e.g. *ka)raang*), which would cause the first syllable to attract a floating-tone exponent of M. Tones would be linked to vowels by the tier-association rules in (15).

Sample vocabulary items for M[*inf*] and M[*con*] are given in (25); (26) shows how the tones on *karaang*-class verbs would be derived. (The derivation for *buruk*-class verbs would proceed as in the original analysis in §3.1-3.2 and thus is not shown here.)

(25) a. M[*inf*] ↔ -**a**(H) / x)… ___ 'Insert -**a**(H) if preceding morpheme has x) on the
↔ -a metrical tier, otherwise -**a**.'

b. M[*con*] ↔ -**a**(L)(H) / x)… ___ 'Insert -**a**(L)(H) if preceding morpheme has x) on the
↔ -a(H) metrical tier, otherwise -**a**(H).'

(26)

| | | *Infinitive* | *Consecutive* |
|---|---|---|---|
| a. | Vocab. insertion at M: | ka)raang-a(**H**) | ka)raang-**a**(**L**)(**H**) |
| b. | Floating-tone association: | k**á**)raang-a | k**à**-raang-**á** |
| c. | H-spread: | ----- | kàr**áá**ng-á |
| d. | Default L: | kár**àà**ng-**à** | ----- |

| | *Infinitive* | *Consecutive* |
|---|---|---|
| | (**H**) | (**L**)(**H**) |
| | karaang-**a** | karaang-**a** |
| *line 0* | x)xx x | x)xx x |
| *line 1* | x | x |

This reanalysis resembles Kastner's 2019 treatment of Hebrew templatic morphology, where roots are consonantal, vowels are exponents of a function morpheme, and the general phonology determines how vowels and consonants are aligned. Everything is done in two steps, without RRs.

One potential problem with this reanalysis of Logoori is that it abandons the idea, implicit in the original analysis in §3, that Logoori has a basic phonemic contrast between H and Ø and that L is always derived (Marlo 2008:155). In (25)b, L is underlyingly specified on an exponent; i.e. it is a *phonemic* tone on par with H. This opens up a number of questions about the distribution of L and H in Logoori that would demand explanation: Why are tonal exponents never L-only (or L-final)? Why don't we find *nouns* with underlying L (that blocks H-spread)? And so on.

Another potential problem becomes evident when we consider verbs with object markers (OMs). Typical of Bantu, Logoori transitive verbs may have a prefix directly before the verb root that agrees in noun class with the understood object. These OMs interact with verb tones in virtually every TAM form, including the infinitive:

(27) a. i. kù-vàrìz-à 'to count'
ii. kú-**gá**-vàrìz-à 'to count them.6'

b. i. kú-kárààng-à 'to fry'
ii. kú-**vú**-kàrààng-à 'to fry them.14'

The (boldfaced) OMs here are H, which Odden 2018 takes to be their underlying tone. (27)a shows that toneless roots like *variz-* are unaffected by the presence of an OM, while (27)b shows that *karaang*-class verbs *are* affected: L instead of H on the (underlined) first syllable of the root.

In the analysis from §3, the change from H to L in *karaang* (27)b can be attributed to a new RR, identified by Odden 2018 as Meeussen's rule, which lowers the second of two adjacent H's.

(28) $H_2 \rightarrow L / H_1$ __ iff target ($H_2$) immediately precedes trigger (M[*inf*]) on the tonal tier

We can tell that this RR lowers rather than deletes $H_2$ because the first syllable of the root retains its ability to block a left-spreading H-tone. The H from *garáha* 'slowly' spreads leftward through the first syllable of the toneless verb root in (a), but stops short of the first syllable of the (*karaang*-class) verb root in (b) (Odden 2018:74).

(29) a. kó-ké-ꜝs**óó**m**á** g**á**r**á**ha 'to read it slowly'
b. kú-vá-vègg**á** g**á**r**á**ha 'to shave them slowly

In our alternative analysis without RRs, a potential problem arises. Since verb-root tones are exponents of M, M[*inf*] would now need to have three allomorphs: one L, one H, one toneless.

(30) M[*inf*] ↔ -**a**(L) if preceded by x) on the metrical tier *and* an OM, e.g. vú-ka)raang-**a(L)**
-**a**(**H**) if preceded by x) on the metrical tier, e.g. ka)raang-**a**(**H**)
-**a** elsewhere

The trouble has to do with the context for **-a**(**L**): it is by no means clear that allomorphy can be conditioned in this way. In order to insert the correct allomorph, VI at M[*inf*] has to 'see' the verb root itself (whether it has x)) while also seeing *through* the verb root (whether or not there is an OM). But as noted in §2, much recent work (see Embick 2010 et seq.) has argued that VI operates under strict *linear adjacency* and cannot see through phonologically overt morphemes in this way. This idea, which is also maintained in Kastner 2019, is supported by linear-intervention effects in other languages—Latin, for example, where special AGR allomorphs are selected in the perfect only if they are linearly adjacent to Asp[PERF] and not if an overt Tense morpheme intervenes (Embick 2010:51ff). If the conditions on allomorphy were relaxed to admit the condition for **-a**(**L**) in (29), such linear-intervention effects would have to be explained some other way.[3]

RRs, in contrast—plausibly because they apply later in the derivation—have been shown to have somewhat looser locality constraints. In particular, a RR whose target is defined purely phonologically (without reference to particular morphemes) may apply to larger chained structures that allow for limited 'morpheme-skipping' (Embick & Shwayder 2018). Correspondingly, the RR in (28) has a morphological trigger (M[*inf*]) but its target is defined phonologically as the H that immediately precedes the trigger and follows another H, with no stipulation about what morpheme either H belongs to as long as both are cyclically active.

A third potential problem for the 'no-RR' analysis concerns tone alternations on the OM itself. The OM is H-toned in the infinitive, as seen in (26), but L-toned in many other TAM forms:

(31) kú-**gá**-vàrìz-à 'to count them.6' ~ vá-**gà**-váríz-à 'and then they counted them.6'

Under my analysis in §3, the H~L alternation on OMs could be attributed to the H-lowering RR from (17) (repeated below). The target H here is not stipulated to belong to a particular morpheme, so the RR applies to both the verb-root H in (i) and the OM H in (ii).

(32) H → L iff target (H) immediately precedes trigger (M[*con*]) on the tonal tier
i. -k<u>**á**</u>raang-a → -k<u>**à**</u>raang-a 'and then fried' (see (18))
ii. -g<u>**á**</u>-variz-a → -g<u>**à**</u>-variz-a 'and then counted them.6'

In our no-RR analysis, the tone alternations on the OM would need to be treated allomorphically: each OM would have two allomorphs, one H and one L, with identical segmental content (*kí~kì*, *vá~và*, *vú~vù*, etc.). The phonetic similarity between these two forms would thus be purely accidental, since allomorphs are by definition stored independently. The question of whether we want this kind of redundancy across 15-20 noun-classes and personal pronouns is a serious one, raised as early as Welmers 1973:132 and still actively debated; see Pak 2019:§4.

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[3] The only way for the Logoori tone-contributing morpheme to be linearly adjacent to both the OM and the root is to be between them. This would mean positing an additional TAM prefix 'Y': [[ vu- [ **Y** [karaang]]] -a]; this 'Y' prefix would have the peculiar property of having only tonal exponents (never segments). To my knowledge, there is no precedent in Bantu for a TAM prefix in this position.

## 5. Conclusion

The Logoori tone melodies examined here are too complex to be analyzed as the affixation of a single grammatical tone. On the other hand, the pattern is not altogether chaotic. I view the complexity of the Logoori pattern as comparable to the complexity of the English past tense, and argued for a parallel treatment. In §3 I provided a DM-based analysis of Logoori tone that adopts key features from Odden 2018 and Goldsmith 1991: a TAM suffix contributes a H-tone whose placement is guided by metrical principles. I further argued that certain irregular H-lowering effects can be attributed to *readjustment*, or morphologically constrained phonological rules that are also seen in English *sing~sang*, *keep~kept*, etc. Readjustment allows for limited process-based morphology in a primarily piece-based theory; as such, its inclusion in a given analysis must be carefully evaluated. In §4 I considered an alternative 'no-RR' analysis and found that the Logoori facts do not yield easily to it; rather, it introduces theoretical problems of its own.

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