Syllable-counting Tone Allomorphy in Bari

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Abstract: In this paper, we show that the Eastern Nilotic language Bari exhibits extensive evidence for a pattern so far unattested in the phonological literature: suppletive allomorphy of tonal affixes which is sensitive to the number of syllables in the base word. Whereas 'syllable-counting allomorphy' (SCA) is amply attested for segmental affixes, there are no reported cases from tonal affixation (Paster 2005, 2006). A second unusual and theoretically significant property of Bari tonal allomorphy is that different allomorphs appear to be added at different stages of the morphophonological derivation, either before or after association and spreading of the lexical tone melodies of stems. We capture this in our analysis by adopting Stratal Optimality Theory (Kiparsky 2015, Bermúdez-Otero 2018) and the assumption that different allomorphs are specified to be inserted either at the Stem Level or the Word Level. Whereas it is a standard assumption in the stratal literature that different suppletive allomorphs of an inflectional category might have different stratal affiliations (see, e.g., Kiparsky 1982, Wiese 1988 on plural marking in Germanic), such a stratal split has so far not been documented for strictly phonologically sensitive allomorphy. Finally, we show that the Bari data also provide new evidence for two broader claims: the morphophonological independence of tonal morphology from segmental morphology, and the non-optimizing nature of phonologically conditioned suppletive allomorphy

1 Introduction

Bari is an Eastern Nilotic language spoken in Southern Sudan, but also in parts of Northwest Uganda and the Democratic Republic of Congo. Bari verbs have a rich morphological inventory marked independently by both segmental and tonal affixes. The complex tonal alternations of the language are documented in detail by Yokwe (1986) who also provides a comprehensive rule-based analysis. His account succeeds in explaining major tonological alternations of the language in a rule-based version of Autosegmental Phonology. The pattern of interest here is found in parts of the verbal morphotonology which remain open problems under Yokwe's analysis. Tonal affixation exhibits what we will call the 'Short-Stem Syndrome': short (monosyllabic or bisyllabic) stems show in many morphological contexts different morphological tones than polysyllabic stems. Thus the Passive is marked by a final H in polysyllabic roots, [sàpûk] 'turn over' → [sàpúk-á] 'being turned over' (pass.), but by a final Low (resulting in a HL/Fall) after a H for monosyllabic roots ([lók] 'entrap' → [lók-â] 'being entrapped' (pass.)). In other constructions, the same tonal exponent is differently aligned according to syllable number, e.g., a final Low affix in Antipassives which is 'dominant' with monosyllabic roots and claims a separate syllable, but 'recessive' as part of a falling tone with longer roots: [pé] 'shoot' → [pé-jà] 'shoot' (AP) vs. [bóró] 'smear' → [bóró-jâ] 'smear' (AP)). On the other hand, segmental affixes are insensitive to the syllable number of their base and only exhibit sandhi processes triggered by stem-final segments. Thus the palatal stop of the Antipassive suffix -[ɟa] assimilates in place to a preceding nasal no matter whether the stem is poly- or monosyllabic (e.g., [dom-ba] 'stalk', [didim-ba] 'notch', [riŋ-ga] 'punish', [bariŋ-ga] 'get a glimpse of', p.37).

Before we go into more details on the Short-Stem Syndrome, we will introduce some general background on the tone system of Bari in section 1.1. In section 1.2, we will then return to the Passive and Antipassive patterns and lay out the crucial data and our basic analysis.

1.1 Background on Bari Tone

Bari has three surface tones, H(igh), L(ow) and F(alling) with ample evidence that the Falling tone is a combination of High and Low. As in many tonal and accentual languages, tone is virtually fully contrastive on nouns, but highly restricted in verbs.[1] As Yokwe shows, there are only two tonal classes of verbs whose tone association can be deterministically predicted from tone class membership and syllable number. With Yokwe, we assume these classes to be H and LHL. This contrast is clearest in underived bisyllabic roots where verbs of the first class have H on both syllables, whereas the second class has L on the first and a Fall, hence HL on the second syllable:

(1) *Tonal verb classes in bisyllabic roots (Yokwe 1986:12+13)*

H-roots		LHL-roots	
ɓóró	'smear	kàbûr	'agitate'
ɲáɗót	'stick to'	sàpûk	'overturn'
lúsák	'melt'	dòdôŋ	'shake'
wúlák	'till with a hoe'	ɲàbûr	'grind flour'

While all monosyllabic roots have H in isolation (as we will see in section 3, another instance of the Short-Stem Syndrome), they exhibit the same tonal contrast in derived forms such as the Benefactive which provide additional TBU's:

(2) *Tonal verb classes in monosyllabic roots (Benefactive derivations, Yokwe 1986:25)*

H-roots		LHL-roots	
dér-ákín	'cook for s.o.	bàl-ákìn	'reprimand for s.o.'
dóm-ákín	'stalk for s.o.'	sùt-ákìn	'bet for s.o.'
lákákín	'untie for s.o.'	dwàɲ-ákìn	'undo for s.o.'

There are no verb roots which have four or more syllables, and only a handful of trisyllabic roots, which are all of the LHL class shown in (3) with their bare and Benefactive forms:

[1]There are two major aspects of Bari tone which we will ignore in this paper because they are orthogonal to the phenomena discussed here: dissimilation of adjacent H-tones at the Word and Phrase Level, and H-tone spreading at the Phrase Level. See Yokwe (1986) and Author (2021) for detailed discussion.

(3) *Trisyllabic verb roots, (LHL, Yokwe 1986:25)*

Bare roots		Benefactive	
kùkúɗì	‘tickle	kùkúɗì-kìn	‘tickle for s.o.’
dìlílì	‘winnow grain’	dìlílì-kìn	‘winnow grain for s.o. ’

As the longer LHL-forms show, for simple cases, Bari verbs directly instantiate the generalizations originally observed by Goldsmith (1976) for Mende: One-by one association for tone and TBU’s, spreading of the final tone for surplus TBU’s as in (4-a) and contour formation for leftover trailing tones (4-b):

		L	H	L			L	H	L			L	H	L	
(4)	a.	ka	di	ra	kin	→	ka	di	ra	kin	→	ka	di	ra	kin
		L	H	L			L	H	L			L	H	L	
	b.	sa	puk			→	sa	puk			→	sa	puk		

1.2 Basic Data and Analysis

On the introduced background on Bari tone, we can now approach the Short-Stem Syndrome more systematically. (5) shows representative data of the Passive for both tonal verb classes. All Passives with bisyllabic stems end in a syllable with a Falling tone, whereas all Passives with longer polysyllabic stems end in a H-toned syllable (the dashes indicate that there are no simple Passive forms with a single syllable or more than 4 syllables, and no quattrisyllabic forms based on H-toned roots):[2]

[2]We formulate the empirical generalizations and their formal implementation referring to stems (i.e., for the Passive the combination of the root and the segmental suffix), not with reference to roots. Since most verbal categories in Bari involve a monosyllabic segmental suffix, there is an almost equivalent way of stating Short-Stem Syndrome effects by saying that monosyllabic roots behave differently from bisyllabic and longer roots. In fact, Yokwe (1986:68) informally describes the Passive pattern as a type of allomorphy assigning different final tones to monosyllabic and polysyllabic *roots*. We will provide evidence in section 3.1 for Benefactive forms and in section 3.3 for bare roots that the stem-based characterization is empirically superior. See section 5.4 for more general criticism of a possible root-based account, and section 5.1 for a discussion of Yokwe’s treatment of Short-Stem effects.

(5) *Exponence of Passive for bisyllabic vs. polysyllabic stems*

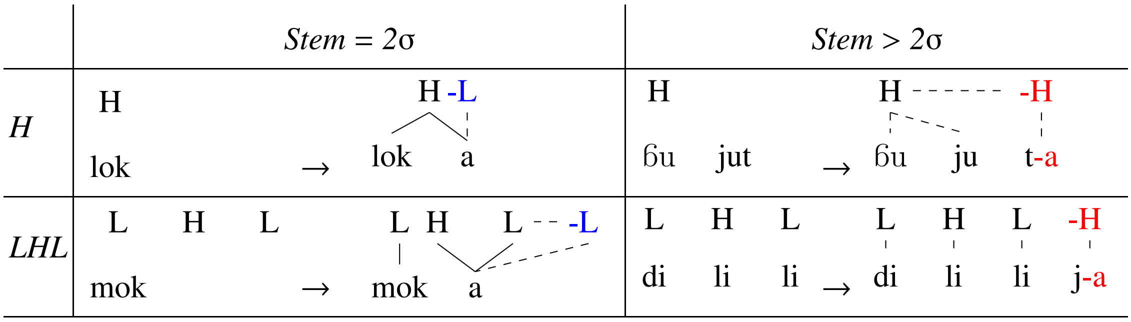
	H		LHL	
1σ	———		———	
2σ	lók-â	'entrap'	mòk-â	'catch'
3σ	bújút-á	'sharpen'	sàpúk-á	'turn over'
4σ	———		dìlílì-já	'winnow'
5σ	———		———	

Crucially, the alternation in (5) is not due to a general tonal alternation in the language, which would depend on syllable number. The final Fall restricted here to bisyllabic stems is found in Instrumental forms of all lengths (e.g., [lá-gî] 'untie', but also [ɓújúd-dî] 'sharpen', see section 2 for discussion). Conversely, final H-tones freely occur in underived bisyllabic roots (e.g., [ɓóró] 'smear) and in other derived bisyllabic verb forms such as the Ventive. In fact, in the Ventive the affixal H has the complementary distribution with respect to the Passive. It occurs in bisyllabic stems (e.g., [mò-kún] 'catch' and ['dép-ún] 'hold'), but not in longer stems (cf. [àpúk-ùn] 'overturn' and [ɗàlílì-jùn] 'float', see section 3 for more details). Consider also what kind of optimality-theoretic analysis we would have to assume if short and long Passive forms are taken to have the same underlying tonal exponent. Thus we might posit an underlying Fall (or maybe Low) which surfaces in bisyllabic forms but is simplified to H in polysyllabic forms. However, this would require a markedness constraint which penalizes contours in longer word forms. Similarly we could posit a single underlying H which emerges in longer stems, but is changed to Low at the end of a short base, possibly due to an OCP-like constraint against adjacent H-tones. But, as the putative anti-contour constraint, the OCP-constraint would have to be sensitive to syllable count in a way which is unprecedented in the phonological literature.

On the other hand, there is an extensive body of evidence that suppletive allomorphy may be sensitive to syllable number in parallel to the data in (5). Thus Paster

(2005, 2006, 2015) reports, based on a broad crosslinguistic language sample, that the standard pattern of suppletive allomorphy sensitive to prosodic structure involves cases where one allomorph is chosen for shorter (e.g. monosyllabic, bisyllabic or bimoraic) bases, and the other allomorph for longer bases. For example, the Pama-Nyungan language Kaititj uses the Ergative marker -[ŋ] with bisyllabic nouns (e.g., [akí-ŋ] 'head' or [ilt^{y}í-ŋ] 'hand-ERG'), but the allomorph -[ɭ] with trisyllabic or longer nouns (e.g., [alíki-ɭ] 'dog-ERG' and [a^{b}mu-ŋi-t̪iri-ɭ] 'snake-ERG', Paster 2005:179, based on Koch 1980). Our proposal here is that the Passive in Bari is completely analogous to the Kaititj case involving syllable-counting allomorphy with the only substantial difference that the involved affixes are tonal, not segmental. The tonal exponent of Passive with bisyllabic stems is a L-tone suffix, whereas it has a H-tone suffix with polysyllabic roots, as shown in (6) (as usual in the autosegmental literature on tone, we assume that adjacent identical tones fuse, indicated here by horizontal association lines):

(6) *Different tone allomorphs in the Passive*



In line with Paster (2005, 2006, 2015), we formalize syllable-counting allomorphy by prosodic subcategorization (selection) frames. Thus the morphological tone exponents of Passive are lexically specified as in (7). The L-allomorph (7-a) selects for bases with exactly two syllables. The H- allomorph doesn't have any selectional requirements and hence serves as the default exponent selected for longer bases:

(7) *Passive Tone Allomorphs*

a. Passive ↔ -L / [σσ]$_{\text{Base}}$ __ b. Passive ↔ -H (default)

Crucially, the allomorphy account avoids all the problems raised by the assumption of a single underlying tonal exponent. Syllable-counting allomorphy is not predicted to result in natural phonological patterns since it is not due to phonological constraints, but to idiosyncratic morphological subcategorization (selection). By the same token, the allomorphy analysis also correctly predicts that other morphological categories might show substantially different distributions. Subcategorization is a feature of single affixes, not of a grammar in its entirety. Finally, the analysis in (7) does not require to introduce any new formal device (such as OCP-constraints sensitive to syllable number) into the theory of grammar. Whereas Paster does not discuss syllable-counting allomorphy for tonal exponents, there is broad evidence that tonal morphology is affixal just in the same way as segmental affixes (see, e.g., Pulleyblank 1986, Zoll 2003, Rolle 2018, Trommer 2022 for detailed discussion). Positing SCA for tonal affixes thus fills a typological gap predicted by any theory embracing prosodic subcategorization and a concatenative autosegmental approach to tonal morphology.

Let us turn now to our second case of the Short-Stem Syndrome in the Antipassive. This emerges most clearly in H-tone roots. whose Antipassive forms end in a Low for monosyllabic stems, but in a Fall for longer stems:[3]

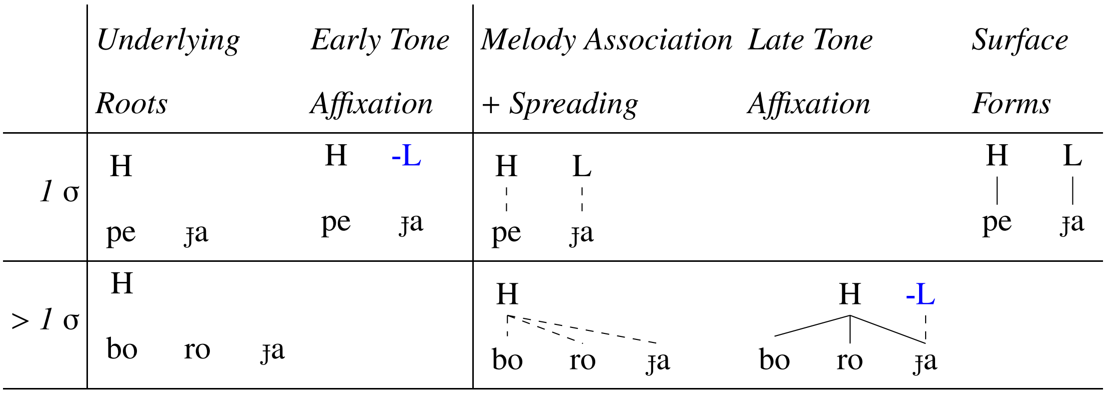
[3]The segmental Antipassive exponent -[ɟa] shows considerable, but mostly predictable allomorphy. The vowel [a] is raised in many contexts to [u] (e.g. after [+ATR] Mid vowels as in [són-dù] 'send away' AP, p. 31, and after another [a] as in as in [lá-gù] 'untie' AP, p. 31). It becomes [i] in combinations with the Imperative suffix [-ʔ] (e.g., [mòg-gí-ʔ] 'hold' IMP.AP) and in Instrumental forms (e.g., [sàpú-gì-rì] 'overturn' INS.AP). The initial consonant [ɟ] is realized as a homorganic voiced stop after other stops or nasals (e.g., [tég-gà] 'strike mildly' AP, p. 36, as in [díb-bà] 'support' AP, p. 35 and [dóm-bà] 'stalk' AP, p. 37), After alveolar stops and if the affix vowel is [a], the stop is followed by [j] preserving the palatal place of [ɟ] as in [tún-djà] 'gather' AP, p. 37 and [géd-djà] 'scratch' AP, p. 35. However the consonant is just [d] if the affix vowel is raised to high, e.g. [wád-dù] 'answer' AP, p. 35 and [kín-dù] 'shut, close' AP, p. 37. See Yokwe (1986:30ff) for some of the rarer allomorphs and a discussion of the specific phonological processes involved.

(8) *Syllable-counting effects in the Antipassive (p. 31,43,45,46)*

	H		*LHL*	
1σ	_____		_____	
2σ	ɗéb-bà	'hold'	dòg-gû	'carry'
3σ	ɓújúd-djâ	'sharpen'	kàbúr-ɟà	'agitate'
4σ	_____		dìlílì-ɟà	'winnow grain'
5σ	_____		_____	

Again, this is clearly not due to a general phonological alternation. We have already seen for Passive forms that final Falls are possible in Bari bisyllabic stems (e.g. [lòk-â] 'entrap'), and the bisyllabic Antipassive LHL-form [kàbúr-jà] points into the same direction. Antipassive LHL-roots also demonstrate that simple L-tone syllables are licit in trisyllabic and longer stems (e.g., [dìlílì-jà] 'winnow grain'). Thus, again, an interpretation of this pattern in terms of syllable-counting allomorphy seems the most viable option. Under the assumption that morphology and phonology are derivationally interleaved, we can posit two allomorphs sensitive to syllable number which are identical in their phonological content, but different in their morphophonological timing properties. The L-suffix appearing with bisyllabic stems (9-a) is concatenated before association and spreading of the lexical tone melodies, and the L-suffix found with polysyllabic stems after melody association and spreading as illustrated in (9) for a H-tone root (for LHL-roots the predictions by late and early addition are identical since in both cases we expect spreading of a final L). (9) illustrates the resulting derivations for H-tone roots:

(9) *Different timing of Antipassive tone allomorphs*



Stratal Optimality Theory is a natural formal framework for capturing this distinction between morphs added at earlier and later stages of morph concatenation, where we can equate early affixation with Stem-Level morphology, and late affixation with Word-Level morphology. Independent crosslinguistic evidence for cyclic effects in syllable-counting allomorphy from segmental affixes is already discussed by Paster (2005), and interpreted in a Stratal OT-approach in Trommer (2015). Additional evidence for a stratal organization of the morphophonology of Bari will be provided below. Thus the lexical entries for the Antipassive allomorphs would be as in (10):

(10) *Antipassive Tone Allomorphs*

a. Antipassive ↔ -L / $[\sigma\sigma]_{\text{Base}}$ __ (Stem Level)

b. Antipassive ↔ -L (Word Level)

As a consequence, the distinctive interleaving of tone affixation and spreading in (9) simply follows from the fact that association and spreading happen recursively first at the Stem Level (after Stem-Level affixation but before Word-Level affixation):

(11) *Different timing of Antipassive tone allomorphs*

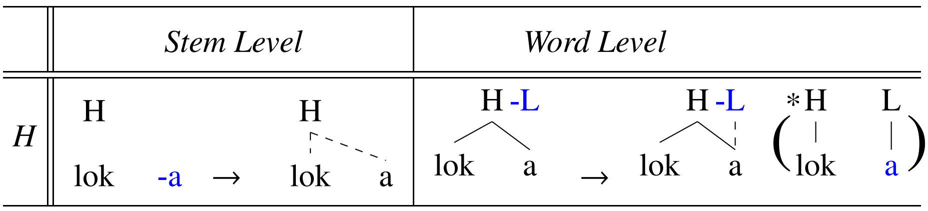
	Stem Level	*Word Level*
2 σ	H -L pe ɟa → H L pe ɟa	H L pe ɟa ——
> 2 σ	H bo ro ɟa → H bo ro ɟa	H -L bo ro ɟa → H -L bo ro ɟa

Note that the notion of allomorphs (or variants) of a given formative which are assigned to different strata is by no means new. Thus it is standardly assumed that irregular plurals in English (such as the *-en* in *oxen*) are Stem-Level whereas the regular plural-*s* is Word Level (Kiparsky 1982).Evidence for a similar stratal split in plural marking is provided by Wiese (1988) for German and by Trommer (2013) for Albanian. Paster (2007) shows that plural in Lower Jubba May is expressed either by a (Word-Level) affix, or a (Phrase Level) clitic. See Zwicky and Pullum (1983), Bresnan (2001) for arguments that a similar stral split holds for full vs. contracted negation in English. Caballero (2008) argues that allomorphs of Applicative and Causative in Raramuri are located at different lexical strata. (see also Inkelas and Caballero 2013). It is also well-established that the same (or homophonous) formatives can be attached at different strata (Giegerich 1999), resulting in 'dual-level affixes' such as English adjectivizing -[able] (Kiparsky 2005, Bermúdez-Otero 2018). Kiparsky (2020) makes the same claim for English Past Tense *-d* which is affixed as Stem-Level affix in strong verbs (such as *keep* → *kep-t*), but as a Word-Level affix in regular verbs (as in *played*). Bermúdez-Otero and Luís (2009) provide exhaustive evidence that object markers in European Portuguese are Word-Level affixes if they follow the verb (in Imperatives and infinite paradigms), but Phrase-Level clitics when they precede it.

In all these cases, isofunctional and often homophonous markers are introduced at different strata depending on morphosyntactic features and lexicalization (specific lexemes). Thus what is new in the claim that the different realizations of Antipassive tones are affiliated to different strata is only the fact that this allomorphy is based on syllable count and not on purely morphological features. However, if allomorphy triggered by phonological subcategorization in principle exists, as established by Paster's work, this is a possibility which is predicted to exist. The Bari tone data thus again fill an important typological gap.

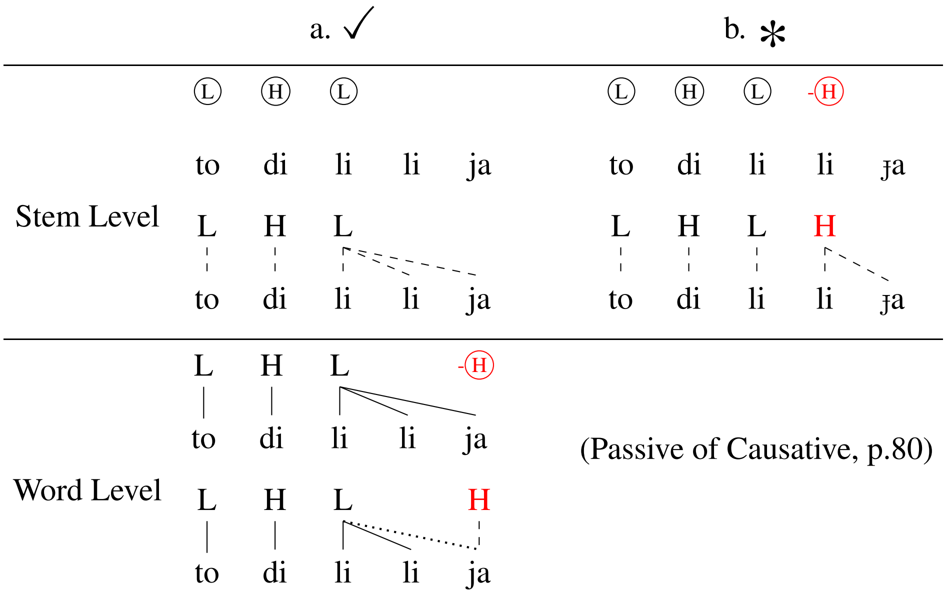
In fact, also the Passive provides evidence for a stratal structure of tonal allomorphy where tone melodies associate at the Stem Level, but Passive tonal morphology is added at the word level. The L-allomorph found in bisyllabic stems must be added after the association of the root tone melody to correctly create the final Fall contour:

(12)



Evidence that also the Passive H-allomorph found with longer stems is attached at a later stratum than root tone association can be found in the Causative which adds the segmental prefix [tu]-/[tɔ]- and thus creates longer bases than the simplex roots discussed above, for example, the Causative Passive of [dìlílì] 'winnow grain' [tò-dílìlìjá]. The tonal alignment of this form follows directly from spreading the final L of the Causative LHL at the Stem Level and subsequent replacement of the final association line by the Passive-H. If tone affixation and spreading would apply in parallel, we would expect an incorrect outcome as in (13-b), where the final H being the fourth unassociated tone associates to the fourth syllable by one-by-one mapping and then spreads:

(13) *Long Causative Passive*



Note finally that in a subcategorization account the distribution of syllable-counting allomorphs can be captured in slightly different ways with empirical consequences that are subtly different. Thus instead of restricting the Passive H-allomorph to short stems, and taking the L-allomorph as the default, the Passive allomorphs could also be captured slightly differently by assuming that the H-allomorph is restricted to bases which have three or more syllables, while the L-allomorph is the default exponent.

(14) *Passive Tone Allomorphs (alternative version)*

a. Passive ↔ -H / $[\ldots\sigma\sigma\sigma]_{\text{Base}}$ __

b. Passive ↔ -L (default)

In fact, there is evidence for assuming something like (14). Thus in forms where the Passive is combined with another derivational category such as the Benefactive or the Ventive, the final vowel never exhibits a H, but a L independently of syllable count. This is shown in (15) for cases where the Passive combines with a single second category, but the same generalization holds also in combinations with more categories:

(15) *Passive Data*

	Ø		+Benefactive		+Ventive		+Instrumental	
	H	LHL	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—	—	—
2σ	ɗép-â	mòk-â	—	—	ɗép-wè-ʔ	mòk-wê-ʔ	—	—
3σ	búјút-á	sàpúk-á	ɗép-á-kì-ʔ	mòk-á-kì-ʔ	ɓújút-wè-ʔ	sàpúk-wè-ʔ	ɗép-á-rî	mòk-á-rì
4σ	—	dìlílì-já	ɓújút-á-kì-ʔ	sàpúk-à-kì-ʔ	—	dìlílì-wè-ʔ	ɓújút-á-rî	sàpúk-à-rì
5σ	—	—	—	??	—	—	—	dìlílì-jà-rì
6σ	—	—	—	—	—	—	—	—

The distribution in (15) suggests that not -H is the default allomorph, but -L. The fact that it does only appear in simple Passive forms can then be captured by adding a further subcategorization specification to (14-a) which requires a base ending in a low vowel (. . . [a] __). Assuming that segmental exponents for derivational categories generally precede the tonal ones in the affix lexicon of Bari, this correctly predicts that -H is barred from forms ending in a glottal stop (such as Passive Benefactive [ɗép-á-kì-ʔ]) or a non-low vowel (as in Passive+Instrumental [ɓújút-á-rî])

In the following sections, we will formally spell out the analysis, first in its morphological aspects (section 1.3) and then for phonological optimization (section 1.4).

1.3 The Morphological Side: Allomorphy across levels and modality

While allomorphy across strata is a common notion in the Lexical Phonology and Stratal OT literature (see the discussion in section 1.2) it is typically not formalized in its morphological aspects. Here we adopt and adapt a recent approach proposed by Inkelas and Caballero (2013) for modelling the interaction of different exponents between lexical levels. Crucially, they assume that morphophonological computation is based on the notion of a predetermined meaning target which allows recursive optimization steps evaluating the degree of realization for specific aspects of meaning. The resulting model is hence realizational in the sense of Stump (2001).[4] Since the morphosyntactic and semantic aspects of meaning targets and their interaction with affixation are far beyond the scope of the paper, we will develop a very simplified toy model here. We will implement meaning targets simply as feature structures such as [+Antipassive + Benefactive], which are then realized via affixation at the Stem Level and the Word Level of a Stratal-OT architecture, preceding in both cases the phonological optimization cycles in these strata. A further simplifying assumption we make here is that affixation is based on ordered lists of affixes for every stratum, where matching affixes are inserted according to the order on the list in a way we will work out immediately below.

An interesting complication specific to the Bari case at hand is the interaction of allomorphy with blocking and multiple exponence. Thus tonal allomorphs in the language seem to block each other whether they appear on the same stratum or not.[5] This is what allows to formulate the tone allomorph of longer bases simply as the default case (see e.g. (14)) instantiating the Elsewhere Principle well-known from the morphological literature (Kiparsky 1973, Anderson 1992, Halle and Marantz 1993). On the other hand, as we already have observed above, tonal affixes seem to be morphologically independent from corresponding segmental affixes in Bari. Thus the Passive is realized segmentally as -[ɟa] no matter what the syllable number of the root is to which it attaches. However, if -[ɟa] and the tonal exponents of Passive are conceived as different morphemes, they obviously cooccur escaping the expected blocking effect. The solution we propose for this dilemma is to take seriously the idea that tone is independent from segments not only in phonology, but also in morphology. We achieve this by

[4] We do not exclude the possibility that the same facts can be derived in a way which is fully incremental, hence where the meaning of a word form is not the starting point of computation, but successively constructed by affixation. However, the realizational approach chosen here is closer to the intuitive notion of allomorphy as different realizations of a given category.

[5] Whereas blocking across strata is less self-evident in the Antipassive involving two L-tone suffixes, it emerges more clearly in the Imperative, where the allomorphs are more distinct phonologically. See section 4.4 for discussion.

generalizing the notion of morphological feature discharge of Noyer (1992). In its original formulation, a feature *F* is discharged by adding an affix which is specified for this feature (in Noyer's DM approach, inserting a vocabulary item). Discharge then blocks further affixation for the same morphosyntactic feature since only non-discharged features trigger affixation. Here, we assume that discharge works independently and in parallel for tones and for segments. Tonal affixes discharge morphosyntactic features tonally, segmental affixes discharge segmentally (and affixes containing both segments and tones discharge both tonally and segmentally). Affixation then follows the algorithm in (16) and (17). (17) is a fuller version integrating morphological spellout with the phonological evaluation in different lexical strata such that phonological optimization characteristic of a specific stratum is applied at the point where a matching affix specified for a higher stratum is encountered, or if the algorithm has passed through all affixes of the lexicon without encountering matching affixes of higher strata (thus a word form consisting only of a bare root would still go through all phonological strata).[6]

The relevant autosegmental tiers in (16) and (17) are the tonal tier and the tier of segmental root nodes:

(16) *Affixation algorithm for Base B, meaning target M, and affix Lexicon L*

For all affixes *A* in L:

  If *A* matches *M* and *B* satisfies the subcategorization of *A*:

    For all phonological tiers *T* specified in *A*

      Append the phonological content of *A* on tier *T* to tier *T* of *B*

      Mark all morphological features of *M* as discharged for tier *T*

[6]Although the algorithm in (17) works for any number of lexical strata, we assume here that there are only two of them, Stratum 1 (Stem Level) and Stratum 2 (Word Level). A limitation of the algorithm here is that it does not take into account compounding, whose stratal status has remained controversial in the literature, or phrasal strata. Both, strata for compounds and for phrasal constituents would require to apply optimization on the combination of units which have independently run through all earlier strata.

(17) *Affixation algorithm for Base B, meaning target M and affix Lexicon L*

Set the Stratum S to 1

For all affixes A in L:

If A matches M, $S' \geq S$, (where A is a stratum-S'affix)

and B satisfies the subcategorization of A:

If $S' > S$:

For all strata s ($S \leq s \leq S'$):

apply phonological stratum-s optimization to B

Set S to S'

For all phonological tiers T specified in A

Append the phonological content of A on tier T to tier T of B

Mark all morphological features of M as discharged for tier T

For all strata s ($S \leq s \leq S_{max}$, the maximum stratal Level) :

apply phonological stratum-s optimization to B

The definition of Matching in (18) as used in (16) and (17) formalizes the idea that affixation is restricted to non-discharged (i.e. active) features:

(18) *Definition of Matching*

An affix A matches a meaning target M iff
every morphological feature F in A has an identical counterpart F' in M
such that F' is still active for all phonological tiers specified in A

We will illustrate the working of (17) by Antipassive affixation. The relevant parts of the affix lexicon for Bari are given in (19). Note that the segmental AP affix (as most segmental verbal affixes in Bari) is ordered before the tonal Stem-Level affix):

(19) *Affix Lexicon*

a. +Antipassive ↔ -ɟa (Stem Level)

b. +Antipassive ↔ -L / [σσ]$_{\text{Base}}$ ___ (Stem Level)

c. +Antipassive ↔ -L (Word Level)

(20) shows now the derivation for a monosyllabic root with the minimal meaning target [+Antipassive].

(20) *Antipassive Derivation for a Monosyllabic Root*

Meaning Target:	Base:	
[+Antipassive]	H pe	
[+Antipassive$_{\text{Segments}}$]	H pe -ɟa	A_1: +Antipassive ↔ -ɟa (Stem Level)
[+Antipassive$^{\text{Tones}}_{\text{Segments}}$]	H -L pe ɟa	A_2: +Antipassive ↔ -L / [σσ]$_{\text{Base}}$ ___ (Stem Level)
	H L pe ɟa	Stem Level Phonology
—-	—-	A_3: +Antipassive ↔ -L (Word Level)
—-	—-	Word Level Phonology

Since the algorithm goes through the affix lexicon in the order of its listing, the segmental affix -[ɟa] A_1 is affixed first. Discharge is represented simply by annotating the relevant feature in a meaning target with the relevant label, hence in this case 'Segments'. When the algorithm encounters the -L of A_2 [+Antipassive] is still active (unspecified) for tone, and the shape of the base satisfies the subcategorization of A_2 (at this point it is bisyllabic). Hence the word also undergoes tonal affixation and discharge. After phonological optimization (resulting in tone association), the resulting phonological shape and the discharged meaning target are transfered to the Word Level, where the only affix specifying [+Antipassive] A_3 is blocked from Matching since it is tonal (specifies a feature on the tonal tier), and tone is already marked as discharged for tone.

For a bisyllabic root, segmental affixation works in the same way as for monosyllabic roots. However, affixing A_1 renders the stem trisyllabic; hence at the point where the Algorithm checks matching for A_2 it doesn't match the bisyllabicity requirement of A_2 any more. No tonal affixation happens at the Stem Level and the root-H spreads. Consequently, at the Word Level, the meaning target is till undischarged tonally, and late L-affixation by A_3applies leading to a HL contour on the final syllable:

(21) *Antipassive Derivation for a Trisyllabic Stem*

Meaning Target:	Base:	
[+Antipassive]	H bo ro	
[+Antipassive$_{\text{Segments}}$]	H bo ro -ɟa	A_1: +Antipassive ↔ -ɟa (Stem Level)
—-	—-	A_2: +Antipassive ↔ -L / [σσ]$_{\text{Base}}$ __ (Stem Level)
	H bo ro ɟa	Stem Level Phonology
[+Antipassive$^{\text{Tones}}_{\text{Segments}}$]	H -L bo ro ɟa	A_3: +Antipassive ↔ -L (Word Level)
	H L bo ro ɟa	Word Level Phonology

While our proposal might seem tailor-made for syllable-counting allomorphy in Bari, we believe that its potential range of application is much broader. Thus the same separation of tone and segments also emerges in the language in suppletive portmanteau exponence which is not sensitive to phonology. Thus the combination of Antipassive, Itive and Instrumental is expressed tonally by a LHL melody superimposed over the lexical tone of verbs and neutralizing the lexical tone contrast among verb roots:

(22) *The Itive-Antipassive-Instrumental tone portmanteau (p. 60)*

	H	*LHL*
1/2/3σ	———	———
4σ	ɗɛ̀p-ád-dì-rì 'hold'	mòk-ád-dì-rì 'hold'
5σ	ɓùjút-àd-dì-rì 'sharpen'	sàpúk-àd-dì-rì 'overturn'
6σ	———	dìlílì-jàd-dì-rì 'winnow'
7σ	———	———

Segmentally, these forms are transparently concatenative: -[ri] is the general Instrumental suffix (as in the Passive Instrumental [ɗép-á-rî], see section 2 for more examples), -[ad] is the short allomorph of the Itive suffix which occurs in many combinations with other derivational suffixes as in the Imperative Antipassive [ɗɛ̀p-àd-dí-ʔ] (p.85). The latter example also shows that [-di] is the expected realization of the Antipassive suffix -[ɟa], where the consonant assimilates in place to the preceding stop and the vowel raises to [i] as in other Instrumental forms (see footnote 3 for a summary of the segmental changes affecting the Antipassive suffix). Tonally however, the LHL melody is clearly non-compositional. As we have already seen, all allomorphs of the Antipassive involve a suffixal -L. As we will see below in section 2, the same holds for the Instrumental and the Itive. Thus none of the single categories involves a LHL-melody (or a prefixal L(H) component). Thus the tonal exponent for the combination is a portmanteau. In our formalism, this can be simply captured by the entry in (23) which is ordered before the single tonal exponents for Itive, Antipassive and Instrumental (see section 4 for an account why tonal circumfixes overwrite underlying root melodies).

(23) $\begin{bmatrix} \text{+Itive} \\ \text{+Antipassive} \\ \text{+Instrumental} \end{bmatrix} \leftrightarrow$ L- -HL

Crucially the entry in (23) blocks the tonal affixes for Itive, Antipassive and Instrumental, but not the segmental ones, as predicted by the algorithm in (17).

The complementary case of a suppletive portmanteau only affecting the segmental tier, but not tonal exponence, is found in the Passive Ventive. This combination is expressed segmentally by the portmanteau suffix -[weʔ] (e.g. ɗép-wèʔ/*ɗép-ún-a/*ɗép-a-ún) instead of a combination of Passive -a (ɗép-â) and Ventive -un (ɗép-ún). However, the final -L in the Passive Ventive is not specific to this combination, but simply the default tone realization found in all Passive forms (independently of syllable count) where the Passive combines with another derivational category (e.g. the Passive Instrumental [dér-á-íkìn], see the discussion of (15) above). Again, blocking of -a and -un follows from a portmanteau entry at the segmental level preceding the less specific entries for Passive and Ventive as in (24). However since (24-a) is purely segmental, the algorithm in (17) correctly predicts that it doesn't block the tonal -L exponent for Passive:

(24) a. $\begin{bmatrix} \text{+Ventive} \\ \text{+Passive} \end{bmatrix} \leftrightarrow$ -we

b. +Passive $\leftrightarrow$ -a

c. +Ventive $\leftrightarrow$ -un

Note finally that evidence for the separation of phonological and morphological exponence can also be found outside of Bari. Thus it has been observed for a long time in many other Nilotic languages that tonal exponence is largely independent from segmental exponence and the marking through other modalities such as vowel quality and consonant mutation leading to an unusual amount of exuberant exponence (see, e.g., Andersen 1992 on Dinka). Similarly, in many Bantu languages, TAM categories are often expressed by prefixes and by tonal 'melodies' which often dissociate in their morphological properties (thus tonal melodies are typically affixed to the stem domain involving the root and derivational suffixes, whereas TAM-prefixes are concatenated in the larger 'Macrostem' domain), but otherwise freely cooccur. The approach developed here naturally predicts this situation without abandoning the central insight from morphophonological theory that equivalent affixes block each other.

1.4 The Phonological Side: Association and Spreading as Optimization

The analysis of tone mapping we assume here follows in all crucial respects the optimality-theoretic implementation of left-to right association by Yip (2002).[7] Tone association is driven by constraints requiring that all syllables have tone ($\sigma \rhd \tau$ (25-a)) and that all tones are associated to syllables. ($\tau \rhd \sigma$ (25-b)). For the latter constraint there are also two versions specific to the leftmost (25-c) and rightmost tone (25-d) in the Prosodic Word (instantiating positional faithfulness in the sense of Beckman 1997). $\tau] \rhd \sigma$ ensures later association of tonal suffixes at the Word Level:

(25) *Constraints on tone association*

a. $\sigma \rhd \tau$ Assign $*$ to every syllable which is not associated to a tone

b. $\tau \rhd \sigma$ Assign $*$ to every tone which is not associated to a syllable

c. $[\tau \rhd \sigma$ Assign $*$ to every PWord-initial tone which is not associated to a syllable

d. $\tau] \rhd \sigma$ Assign $*$ to every PWord-final tone which is not associated to a syllable

One-by-one-left-to-right association is then a consequence of $\tau] \rhd \sigma$ (ensuring that the first tone is associated even if too few syllables are available) and the constraints ALIGN-

[7] See Zoll (2003), Trommer (2022) for several slightly different alternatives.

LEFT (26-a). Undominated (26-b) captures the fact that Bari categorically excludes Rising tones. While (26-c) is relatively low-ranked, it still ensures that Falling tones are only created if too few TBU's are available. Undominated (26-d) further restricts Falling tones to final syllables:

(26) *Constraints on contour tones and directionality*

a. AL-L For every tone T in the domain D:

Assign $*$ to every tone T' which intervenes between T and the left edge of D

b. *R̲ Assign $*$ to every L-H-sequence associated to the same syllable

c. *F̲ Assign $*$ to every H-L-sequence associated to the same syllable

d. *F̲σ] Assign $*$ every H-L-sequence associated to the same non-final syllable

(27) lists the standard faithfulness constraints on association lines assumed in the analysis:

(27) *Faithfulness constraints*

MAX | Assign $*$ to every underlying association line which is not realized on the surface

DEP | Assign $*$ to every surface association line which is not underlying

(28) illustrates the assumed ranking and its consequences with an example where the number of tones exceeds the number of syllables. AL-L effects that multiple association happens at the right periphery, not at the left edge as in (28-c). On the other hand, higher-ranked *R̲ and *Fσ] prevent that AL-L is satisfied even more by forming non-final contours as in (28-d,e):

(28) *Basic association of lexical tone melody with N(σ) > N(τ)*

Input: = a.	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max |	Al-L	*F	Dep |
a. ka di ra kin (Ⓛ Ⓗ Ⓛ unassociated)	*!**			*!	*	***				
b. ka di ra kin (L H L)	*!							*,**		***
c. ka di ra kin (L H L)								**,**!*		****
d. ka di ra kin (L H L)		*!						*		****
e. ka di ra kin (L H L)			*!					*,*	*	****
☞ f. ka di ra kin (L H L)								*,*		****

(29) is a complementary example with more tones than syllables. Here a contour is tolerated to satisfy σ ⊳ τ and [τ ⊳ σ, τ] ⊳ σ, τ ⊳ σ (cf. (29-a,b)). However, *R and *Fσ] ensure that this is a final Fall not an initial Rise as in (29-c):

(29) *Basic association of lexical tone melody with N(τ) > N(σ)*

Input: = a.	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max |	Al-L	*F	Dep |	
a. sa puk (Ⓛ Ⓗ Ⓛ unassociated)	*!*			*!	*	***				
b. sa puk (L H L)					*!	*		*		***
c. sa puk (L H L)		*!	*!					*		***
☞ d. sa puk (L H L)								*,*		***

Let us now turn to derivations for the Passive and Antipassive. For the Stem-Level allomorph of the Antipassive (found with short bases), root and affix tone are still unassociated at the point where Stem-Level phonology applies. One-by-one mapping is enforced by the anti-contour constraints excluding candidates such as (30-b,c)

(30) *Antipassive Stem-Level -L – H-Root*

Input: = a.	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	MAX |	AL-L	*F	DEP |
(H) -(L) a. pe ɟa	*!*			*!	*	**				
H L b. pe ɟa			*!							***
H L c. pe ɟa								*	*!	***
☞ d. H L pe ɟa								*		**

For a LHL-verb, the evaluation is basically as for a simple bisyllabic LHL-root (see (29)) under the assumption that adjacent identical tones fuse due to an undominated OCP constraint, as shown in (31). Fusion is implemented here as horizontal association of elements on the same tier under the convention that constraints evaluate stretches of horizontally associated nodes as single nodes. Thus ALIGN-L is only violated twice in (31-c), by the H and the L- -L unit, not three times as in (31-b) with two independent L's. Fusion doesn't have specific effects in cases like (31), but will become important for the evaluation of tonal prefixes as in the Imperative (see section 4 below).

(31) *Antipassive Stem-Level -L – LHL-Root*

Input: = a.	σ ⊳ τ	OCP	*$\underline{\text{R}}$	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max |	Al-L	*$\underline{\text{F}}$	Dep |
a. mo ka (Ⓛ Ⓗ Ⓛ Ⓛ)	*!*				*!	*	****				
b. mo ka (L H L L)		*!							*,*,*	*	****
☞ c. mo ka (L H L - - L)									*,*	*	*****

Compare (30) to a verb form with the Word-Level L-allomorph. Here the lexical tone of the verb root is already associated to all syllables at the point where OT-evaluation takes place. The suffix-L is associated to satisfy τ] ⊳ σ, and deassociation between the verbal H and the final syllable as in (32-b) is avoided because Max | outranks *$\underline{\text{F}}$:

(32) *Antipassive Word-Level -L*

Input: = a.	σ ⊳ τ	*$\underline{\text{R}}$	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max |	Al-L	*$\underline{\text{F}}$	Dep |
a. bo ro ja (H -Ⓛ)				*!	*					
b. bo ro ɟa (H L)							*!	**		***
☞ c. bo ro ɟa (H L)								**		**

The evaluation for the L-allomorph of the Passive which is also affixed at the Word Level is completely analogous to the one in (32). The tableau in (33) shows the Word-Level evaluation for the Passive H-allomorph. Again, τ] ⊳ σ enforces association of the tonal suffix, but this time this leads to deassociation to the final associated melody tone because keeping this association line as in (33-b) would violate undominated *$\underline{\text{R}}$:

(33) *Passive Word-Level -H*

Input: = a.	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max	Al-L	*F	Dep
a. L H L -Ⓗ sa pu ka					*!	*!		*,**		
b. L H L H sa pu ka		*!						*,**,**		*
☞ c. L H Ⓛ H sa pu ka							*	*,**		*

This concludes our analysis for the Antipassive and the Passive. In sections 3 and 4, we show that the approach developed here extends straightforwardly to all other instances of the Short-Stem Syndrome for simple affixation patterns, i.e. all cases where verbs just exhibit a single morphological category marked by affix material (e.g., only Causative or only Benefactive). See appendix C for a demonstration that the analysis also accounts for complex morphological verb forms (e.g., the Causative Benefactive form).

2 Non-alternating Tone Suffixation

In this section, we will briefly discuss two verbal affixation patterns *not* exhibiting syllable-counting (or other) tonal allomorphy in the Itive and Instrumental. These data provide additional evidence that the length effects in Bari tone morphology are category-specific and not due to general phonological alternations. Additional morphological categories lacking allomorphy will be discussed in section 4 where we address tonal allomorphy which overwrites lexical tone patterns.

2.1 Consistent L-suffixation in the Itive and Instrument Singular

The only morphological tone exhibited by Itive forms is a final L surfacing overtly with H-tone roots exhibiting a Fall on the final affixal syllable:

(34) *Itive tone (Yokwe 1986:53+54)*

	H	LHL
1σ	—	—
2σ	—	—
3σ	—	—
4σ	ɗép-árâʔ	mòk-áràʔ
5σ	ɓújút-árâʔ	sàpúk-àràʔ
6σ	—	dìlílì-jàràʔ

The simplest account in terms of the developed analysis is to posit a consistent Word-Level L-suffix for the Itive in parallel to the Word-Level L's found as allomorphs in the Passive and Antipassive.

The same pattern is also found in singular marking for Instrument nominalizations. Following Yokwe (1986)183) we interpret the segmental suffix -[et] as a – toneless – derivational exponent of the Instrument nominalization, and the final L as the singular marker since it is not found in the corresponding plural forms:

(35) *Singular of Instrument Nominalizations (Yokwe 1986:183+184)*

	H	LHL
1σ	—	—
2σ	ɗép-êt	mòk-êt
3σ	ɓújút-êt	sàpúk-èt
4σ	—	dìlílì-jèt
5σ	—	—

If -[et] is a Stem-Level affix and plural -L Word Level, root tones will associate and spread to the suffix at the Stem Level (Ⓗɗep-et → ɗép-ét) and the Word-Level affixation of -L will lead to a final contour as expected (ɗép-ét-Ⓛ → ɗép-êt).

2.2 *Consistent L-suffixation in the Instrumental*

Instrumental forms in Bari are either Passive or Antipassive (i.e., there are no fully transitive Instrumental forms). This is shown in (36) for the verb [sapuk] with two free variants each building segmentally on the simple Passive and Antipassive:

(36) *Different Instrumental forms of sapuk 'turn upside down'*

	Passive	Antipassive	
	sàpúk-à	sàpúg-ga	
+ Instrumental	sàpúk-à-rì-kìn	sàpúg-gì-rì	(long variant)
+ Instrumental	sàpúk-à-rì	sàpúg-gì	(short variant)

Despite the diverse range of segmental realization for the Instrumental, the tonal structure of Instrumental for all these patterns can be understood as the addition of a late – Word-Level – L-suffix which fuses with the trailing L of a LHL verb, and is added to H tone roots after spreading of the H resulting in a Fall:

(37) (38) *Instrumental tone (Antipassive variants)*

	Underlying	Antipassive	Antipasive + Long Instr	Antipasive + Short Instr	
	/déb/	déb-bà	déb-bi-rî	déb-bî	'hold'
H	/lág/	lág-gù	lá-gí-rî	lá-gî	'untie'
	/ɓújúd/	ɓújúd-djâ	ɓújúd-dí-rî	ɓújúd-dî	'sharpen'
	/mǒ̂g/	—	mòg-gí-rì	móg-gî	'hold'
LHL	/sàpûg/	sàpúg-ga	sàpúg-gì-rì	sàpúg-gì	'turn upside down'
	/dílìlì/	dílìlì-ɟà	dílìlì-ɟì-rì	—	'winnnow'

The Instrumental succinctly demonstrates two points: *First*, it shows once more that tonal exponence is independent from segmental affixation: Whereas in bare Passive and

Antipassive forms, segmental morphology is constant and tone exhibits allomorphy, in the Instrumental the situation is reversed: segmental allomorphy goes along with constant tone morphology. *Second,* the final L in the Instrumental is independent of syllable count. It occurs with monosyllabic and polysyllabic roots, and with bisyllabic overall forms, but also with longer word form. This indicates that the length sensitivity of the L-suffixes in the simple (non-Instrumental) Antipassive is not due to a general phonological pattern, but to a morpheme-specific factor. This idiosyncrasy is directly captured by an analysis in terms of syllable-counting allomorphy.

3 Zero-/Tone-Alternations

Further evidence for syllable-counting tone allomorphy comes from alternations between a H-tone suffix and forms without a tonal exponent. We will discuss this phenomenon in Benefactive (section 3.1) and Ventive forms (section 3.2), and show then that it also accounts for the Short-Stem Syndrome in bare forms without overt morphonology (section 3.3). We argue that it instantiates a tonal default morpheme which may be inserted independently of specific morphosyntactic features, but still selects prosodically for monoyllabic bases

3.1 -H/-Ø in the Benefactive

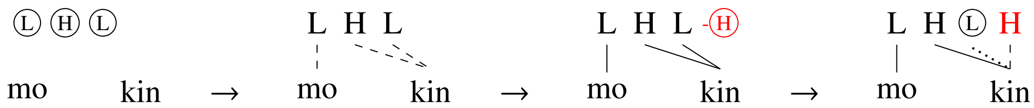
Recall from section 1.1 that in longer Benefactive forms there is no evidence for any affixal tones – only the lexical H or LHL-melodies of verbs surface. This is also confirmed by the trisyllabic and quattrisyllabic words in (39). However, LHL bisyllabic words show an unexpected tone pattern, they have a final H instead of expected HL (Falling, cf. simplex LHL [tèbôk] ‘fold up’). Thus, for both tonal classes of verbs, bisyllabic verbs end in a H:

(39) *Benefactive tone (Yokwe, 1986:24-25)*

	H		*LHL*		
0σ root	—-		—-		*1σ stem*
1σ root	ló-kín	'spread'	mò-kín	'smell'	*2σ stem*
	dérákín	'spread'	sùt-ákìn	'bet'	*3σ stem*
2σ root	búdú-kín	'hasten'	tòkú-kìn	'preach'	
2σ root	dújám-á-kín	'cause to collapse'	tèbókà-kìn	'fold up'	*4σ stem*
3σ root	—-		dìlílì-kìn	'winnow grain'	
4 σ root	—-		—-		*5σ stem*

A straightforward explanation by syllable-counting allomorphy is that the Benefactive in bisyllabic verbs is marked by a H-suffix which deletes a previously associated L to ensure association and to avoid a Rising tone exactly as with Passive -H (see (33)).

(40) *Stem Level* *Word Level*



(41) gives a slightly simplified OT-evaluation:

(41) *Benefactive -H at the Word Level*

Input: = a.	*R	[τ → σ	τ] → σ	MAX |	τ → σ	*F	DEP |
a. L H L -Ⓗ / mo kin			*!		*	*	
b. L H L H / mo kin	*!					*	*
☞ c. L H Ⓛ H / mo kin				*			*

Under this analysis, the asymmetry between long and short Benefactive forms can simply be captured by the affix entry in (42-b) and the assumption that there is no default tonal exponent for the Benefactive which would emerge in longer bases.[8]

(42) *Affix entries for the Benefactive*

a. +Benefactive ↔ -(a)ki(n) (Stem Level)

b. +Benefactive ↔ -H / $[\sigma\sigma]_{\text{Base}}$ __ (Word Level)

The Benefactive is instructive in two other respects beyond the fact that it shows tonal alternation with zero exponence. Note first that Benefactive -H appears specifically on *short* bases, whereas the Passive -H which behaves otherwise identically appears on *long* bases. This indicates that the presence of final H's is truly morphological – as captured by an allomorphy approach – and does not reflect general insertion of a H in forms with a specific length or prosodic structure. *Second*, syllable-counting tone in the Benefactive is clearly sensitive to the syllable number of the overall verb form not to the syllable number of the root. In most other constructions, these correlate. Thus simple Passive forms are always one syllable longer than the corresponding roots. In the Benefactive, this relation is more heterogeneous due to the specific nature of the initial [a]-vowel found in the segmental suffix, which doesn't show up after vowels ([mo-kin]*[mo-akin]) in contrast to Passive -[a] which triggers glide insertion ([lu-wa]/*[lu] 'to mount, p. 62').[9] As a consequence, vowel-final monosyllabic roots result in bisyllabic verb forms, and consonant-final ones in trisyllabic ones. We take the fact that only the former ones trigger the H-suffix in (42-b) as evidence that syllable counting potentially refers to complex units not generally to roots. In the Stratal-OT analysis here, this follows from the fact that the segmental Benefactive suffix is inserted at the

[8] One could in principle posit a zero-tone affix without any empirical difference. Note also that the affixation algorithm in (17) blocks affixation for already discharged features, but doesn't enforce feature discharge if no suitable affix is available to do so.

[9] Dimmendaal (1983) calls the etymologically related vowel in the Turkana Benefactive the 'epipatetic vowel'. Its properties are akin to ghost vowels in many other languages. See Zimmermann (2019) for recent discussion. and pointers to the relevant literature.

Stem Level, but the tonal affix only at the Word Level. Thus segmental affixation feeds syllable-counting selection for the tonal exponent, as in the analysis of the Passive and Antipassive allomorphy above.

3.2 -H/-Ø in the Ventive

In contrast to the Benefactive, the Ventive segmental affix has an initial vowel which consistently surfaces. Thus there is a fixed correspondence between the length of verbal roots and the resulting Ventive forms. Otherwise the tone pattern is completely identical to the Benefactive. Bisyllabic words have a constant final H, whereas longer forms simply show the lexical tone melody as in bare forms of the same syllable count.

(43) *Ventive tone (Yokwe, 1986:48-50)*

	H	*LHL*
1 σ stem	—	—
2 σ stem	ɗép-ún ‘hold’	mò-kún ‘catch’
3 σ stem	bújút-ún ‘sharpen’	sàpúk-ùn ‘overturn’
4 σ stem	—	ɗàlílì-jùn ‘float’
5 σ stem	—	—

Hence the affix entries are analogous to the ones for the Benefactive:

(44) *Affix entries for the Ventive*

a. +Ventive ↔ -un (Stem Level)

b. +Ventive ↔ -H / $[\sigma\sigma]_{\text{Base}}$ __ (Word Level)

3.3 -H/-Ø in Default Tone Affixation

A third and final case where a final H alternates with zero tone emerges in an unexpected context: bare forms without derivational and inflectional affixes:

(45) *Default Tone in Bare Roots (Yokwe, 1986:24-25)*

	H		*LHL*	
*1*σ	ló	'spread'	mó	'smell'
*2*σ	búdú	'hasten'	tòkû	'preach'
3 σ	—		kùkúɗì	'float'
4 σ	—		—	

This can be captured by an affix entry which is morphologically a default affix – it is ordered after all other entries in the affix lexicon and doesn't specify any morphosyntactic features – but is phonologically restricted to monosyllabic bases:[10]

(46) *Default Tone Affix Entry*

$[\quad] \leftrightarrow$ -H $/ [\sigma]_{\text{Base}}$ __ (Word Level)

The restriction of (46) to monosyllabic bases not only blocks its insertion for bisyllabic and trisyllabic roots, but also captures the fact that the affix is never found with derived verbs, i.e., Benefactive, Causative, Ventive or Itive verbs since all these derivational categories also have segmental affixes which contain at least one vowel and thus make verbs minimally bisyllabic. However, as we will see below in section 4, the default-H can appear in morphologically complex forms such as the Habitual paradigm, which has monosyllabic outputs because it lacks segmental affixes.

The following two tableaux show sample derivations. At the Stem Level (47), only the initial L of the LHL-melody is associated due to high-ranked [τ ⊳ σ. This excludes creating a Fall as in (47-c), and Rising tones as in (47-b) are independently excluded by the general ban on Rising tones in the language (high-ranked *R̲):

[10]Note that the affixation algorithm in (17) licenses affixation for a given affix *A* if all morphosyntactic features of *A* are active in the base. Since the entry in (46) doesn't specify any morphosyntactic features, this condition is fulfilled for (46) no matter what the featural content of the meaning target is.

(47) *Default Tone Suffix - 1σ LHL root* *(Stem Level)*

Input: = a.	$\sigma \rhd \tau$	*<u>R</u>	$[\tau \rhd \sigma$	$\tau] \rhd \sigma$	$\tau \rhd \sigma$	*<u>F</u>	DEP
Ⓛ Ⓗ Ⓛ a. mok	*!**		*!	*	***		
L H L b. mok		*!				*	***
Ⓛ H L c. mok			*!				**
L Ⓗ Ⓛ ☞ d. mok					*		*

Note that we assume with Trommer (2024) that $\sigma \rhd \tau$ is also satisfied by underlying association lines even if these are deleted in the output. Thus at the Word Level the initial L can be deassociated without violating the constraint. As a consequence, $\tau] \rhd \sigma$ favors replacement of the associated tone by the final H (48-c) over retaining it (48-a). Realizing both in the out put (48-b) is again excluded by *<u>R(ISE)</u>:

(48) *Default Tone Suffix - 1σ LHL root* *(Word Level)*

Input: = a.	$\sigma \rhd \tau$	*<u>R</u>	$[\tau \rhd \sigma$	$\tau] \rhd \sigma$	$\tau \rhd \sigma$	MAX	*<u>F</u>
L Ⓗ Ⓛ -Ⓗ a. mok				*!	**		
L Ⓗ Ⓛ H b. mok		*!			**		
Ⓛ Ⓗ Ⓛ H ☞ d. mok			*		**	*	

A further advantage of the analysis using syllable-counting allomorphy is thus that it avoids a morphosyntactic conundrum. Derivational categories like the Benefactive are typically not understood as binary features, but as part of substantial additive elements. Thus in many languages they can have different scopal properties depending on the order of affixation or can repeated to express e.g. causation of an causation event. Both facts cannot be expressed by a binary feature system, implying that there are no features like [-Benefactive] or [-Causative]. This makes it virtually impossible to model a morphological formative which occurs only in forms which are neither Causative nor Benefactive. The exceptional behavior of the Bari default -H, which apparently behaves like this, is therefore only possible because it is contingent on the special emergent property of the language that morphological unmarkedness corresponds to syllable number.

Note finally that the analysis of default-H provides further evidence for the assumption that syllable-counting allomorphy is based on stems, not on the syllable number of roots. Otherwise the default entry in (48) would select any word form based on a monosyllabic root.

4 Overwriting and Syllable-counting Allomorphy

4.1 Non-Alternating Tonal Overwriting: The Causative (p.76+77)

We turn now to the Causative/Reciprocal which show consistent tonal overwriting. Both derivations formed by prefixing the segmental affix [tɔ]- and uniformly changing the underlying tone to LHL. Thus the lexical tone constrast in verb roots is neutralized, and the resulting LHL melody is associated to the prefixed form, but otherwise just like lexical LHL's -left to right with final contours and spreading if necessary (see appendix B for other morphological constructions which show the same LHL overwriting pattern as the Causative):

(49) *Causative of Bare Roots*

	H		*LHL*	
1σ	tò-ɗêp	'sit on e.o.'	tò-môk	'hold e.o.'
2σ	tò-ɓújùt	'cause to sharpen'	tù-sápùk	'cause to turn upside down'
3σ		______	tò-dílìlì	'cause to winnow'
4σ		______		______

(50) *Causative Data*

	Ø		+Benefactive		+Ventive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	tò-ɗêp	tò-môk	—	—	—	—
3σ	tò-ɓújùt	tù-sápùk	??	??	tò-ɗép-ùn	tò-mók-ùn
4σ	—	tò-dílìlì	tò-ɗép-àkìn	tò-mók-àkìn	tò-ɓújùt-ùn	tù-sápùk-ùn
5σ	—	—	tò-ɓújùt-àkìn	tù-sápùk-àkìn	—	tò-dílìlì-ùn
6σ	—	—	—	tò-dílìlì-àkìn	—	—

Following Trommer (2022), we assume that complete overwriting of this type is the effect of a tonal circumfix L- -HL and the Contiguity constraint in (51) which marks overt tones intervening between tautomorphemic tones (i.e., circumfixal representations, two tones are *morphologically adjacent* iff they are of the same color *C* and no other tone of color *C* intervenes between them):

(51) Contiguity-□ (Ctg□):

For every pair of morphologically adjacent tones (τ_1,τ_2):

Count a violation for every phonetic tone τ that intervenes between τ_1 and τ_2

(52) shows the derivation of [tò-ɓújùt] 'cause to sharpen', where Contiguity Contiguity-□ (Ctg□) is added to the layer of highest-ranked constraints. Association of the lexical H as in (52-b) is directly blocked by the constraints. Hence the affix tones associate according in the same way as a lexical LHL-melody (but to the complex form including the prefix):

(52) *Causative Derivation (Stem Level)*

Input: = a.	CTG□	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	MAX	AL-L	*F	DEP
a. to ɓu jut (Ⓛ- Ⓗ -Ⓗ Ⓛ)		*!**	*		*	*	****				
b. to ɓu jut (L H H L)	*!								* ** **	*	****
☞ c. to ɓu jut (L Ⓗ H L)							*		* **		***

In the following section, we will see that the overwriting pattern found consistently in the Causative is also part of syllable-counting allomorphy patterns.[11]

4.2 *Overwriting + Syllable Counting: The Habitual*

Habitual forms are derived without overt segmental affixation purely by tonal change. We show here both bare roots (53) and Benefactive forms (54) which demonstrate more clearly the effect of segmental length (recall from section 3 that Benefactive forms with 3 and 4 syllables do not exhibit any affixal tone, the forms in (54) are hence likely to show only the tonal reflexes of the Habitual). Crucially, in Habitual forms with 3 or 4 syllables, the L/LHL contrast of verbs is neutralized just as in Causative forms. On the other hand, shorter words based on H-tone roots exhibit an unexpected initial L followed by a H in bisyllabic roots. Monosyllabic Bisyllabic LHL-roots surface exactly as in non-Habitual forms.

[11]It might seem that tonal overwriting in Bari is generally neutralization to LHL, but there are also overwriting patterns with other melodies. Thus deverbal formation of nouns expressing capability affix the suffix -[at] and neutralize verbal tone to H on all syllables. See appendix B for details and discussion.

(53) *[+Habitual] forms (Yokwe, 1986:381)*

	H		*LHL*	
1σ	dèp	'hold'	mók	'hold'
2σ	ɓùjút	'sharpen'	sàpûk	'overturn'
3σ	—		kùkúɗì	'float'
4σ	—		—	

(54) *[+Habitual] Benefactive forms (Yokwe, 1986:382)*

	H		*LHL*	
2σ	??		??	
3σ	dèp-ákìn	'hold'	mòk-ákìn	'hold'
4σ	ɓùjút-àkìn	'sharpen'	sàpûk	'overturn'
5σ	—		??	

We assume hence two allomorphs for the Habitual, the more specific one (55-a) is restricted to trisyllabic and longer bases, but in its phonological content identical to the tonal Causative circumfix. The second allomorph is a L- -H circumfix restricted to (shorter) H-tone bases. The motivation to posit the circumfix in (55-b) and not just a prefix L- is that it apparently overwrites the expected Antipassive final L (e.g., the Antipassive of [ɗep] 'hold' is [ɗȅbbá] not *[ɗȅbbâ], see section C.1.3 below for discussion).

(55) *Affix entries for [+Habitual]*

a. +Habitual ↔ L- -HL / $[\ldots\sigma\sigma\sigma]_{\text{Base}}$ ___ (Stem Level)

b. +Habitual ↔ L- -H / $[\ldots\text{H}]_{\text{Base}}$ ___ (Word Level)

The L -H circumfix fully surfaces on bisyllabic roots due to CTG□, [τ ▷ σ and τ] ▷ σ:

(56) *Habitual Derivation 2σ H-Root (Word Level)*

Input: = a.	Ctg□	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max	Al-L	*F	Dep
a. Ⓛ- H -Ⓗ ɓu jut	*!				*	*	**				
b. Ⓛ- H - H ɓu jut	*!								* ** **	*	****
c. L H - H ɓu jut	*!		*!				*		* **		***
☞ d. L Ⓗ H ɓu jut							*		* **		***

However, monosyllabic roots cannot host both tones of the circumfix since this would result in a Rising tone violating undominated *R (57-c). Since [τ ⊳ σ outranks τ] ⊳ σ it is not the suffixal H which survives as in (57-b), but the prefixal L- (57-d):

(57) *Habitual Derivation 1σ H-Root (Word Level)*

Input: = a.	Ctg□	σ ⊳ τ	*R	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max	Al-L	*F	Dep
a. Ⓛ- H -Ⓗ dep	*!				*	*	**				
b. Ⓛ- Ⓗ H dep					*!		*		* **		***
c. L- Ⓗ H dep			*!				*		* **		***
☞ d. L- Ⓗ -Ⓗ dep						*			* **		***

4.3 Abstract Noun Formation

A final case of overwriting not involving LHL is the formation of abstract nouns based on stative verbs, but also on nouns and adjectives. Segmentally this type of derivation adds the prefix [to]-/[tu]-, and optionally the suffix -[an]. Tonally

(58) *Abstract noun formation with short bases (p. 187+188)*

	Base		*Derivation*	
H	bér	'age class'	tó-bér-ôn	'initiation, peer group'
	(lú-)rwá	'black'	tó-rw-ân	'blackness'
L	(ló-)ɗìt	'small'	tó-ɗít-ân	'smallness'
			tó-ɗît	
LL	bòdò	'craftsman'	tó-bódw-ân	'craftsmanship'
	gìlà	'white man'	tó-gíl-ân	'white man's way/manner'
HH	kútúk	'mouth'	tó-kútúk-ân	'smallness'
			tó-kútûk	
LH	gèléŋ	'alone'	tó-gélêŋ	'loneliness'
	kòŋé	'eye'	tó-kóŋj-ân	'naughtyness'
HL	mónjè	'father'	tó-mónj-ân	'fatherhood'
	ɓúnùk	'witchdoctors'	tó-ɓúnûk	'witchcraft'

(59) *Abstract noun formation with long bases (p. 187+188)*

	Base		*Derivation*	
LL	pàɟòʔ	'far'	tó-páɟól-àn	'distance'
			tó-páɟôʔ	
HH	módóŋ	'old'	tó-módóŋ-àn	'old age'
LLF	lòmèrî	'poor'	tó-lómérj-àn	'poverty'
HL	dúmà	'big'	tó-dúmál-àn	'greatness'
HHH	likísó	'widow'	tó-líkís-àn	'widowhood'
HHF	márátê	'relative'	tó-márét-àn	'brotherhood'

We assume that as the segmental circumfixation suggests, this construction involves two morphological features [+Nominal] and [+Abstract], which are also expressed by different tonal exponents. [+Nominal] is expressed consistently b y a H- -H circumfix (60-a), while [+Abstract] exhibitgs SCA similar to the Antipassive: Long – quadrisyllabic forms have a Stem Level L-suffix (60-b) occupying its own syllable; shorter forms exhibbit a Word-Level -L resulting in a Falling contour

(60) *Affix entries*

a. +Nominal ↔ to- (Stem Level)

b. +Nominal ↔ H- -H (Stem Level)

c. +Abstract ↔ -an / $[\ldots\sigma\sigma\sigma\sigma]_{\text{Base}}$ ___ (Word Level)

d. +Abstract ↔ -an (Stem Level)

e. +Abstract ↔ -L (Word Level)

(61) *Different timing of Antipassive tone allomorphs*

	Stems with to- and H- -H	*Early Tone Affixation*	*Melody Association + Spreading*	*Late Tone Affixation*	*Surface Forms*
1 σ	H to ber -an		H -L to ber -an	H -L to ber -an	
1 σ	H to ma ret		H -L to ma ret an	H -L to ma ret an	
> *1* σ	H to ɓu nuk			H -L to ɓu nuk	

4.4 *The Imperative*

Imperative forms show again complete overwriting and neutralization of verbal root tone in long forms, and maintenance of lexical contrast for short forms – although with many differences in detail to the Habitual:

(62) *Imperative Tone – Bare roots (Yokwe, 1986:81-82)*

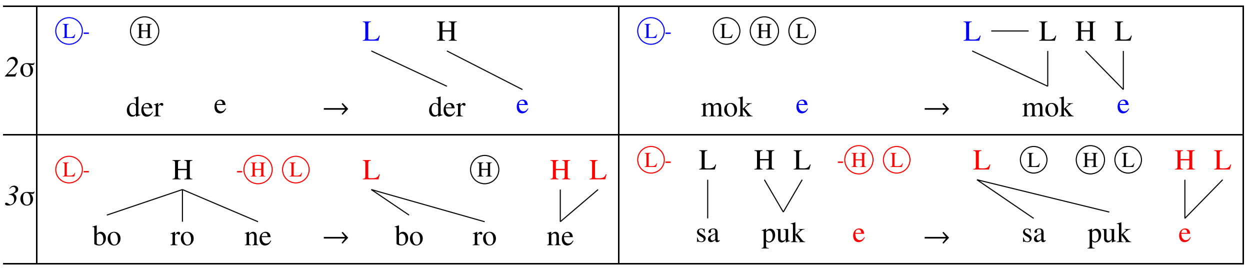
	H		*LHL*	
*1*σ	———		———	
*2*σ	dèr-é	‘cook’	mòk-ê	‘catch’
*3*σ	ɓùjùt-ê	‘sharpen’	sàpùk-ê	‘overturn’
*4*σ			dìlìlìlì-nê	‘winnow’

(63) *Imperative Tone – Benefactives (Yokwe, 1986:81-82)*

	H		*LHL*	
*3*σ	dèr-àkî	‘cook’	mòk-àkî	‘catch’
*4*σ	ɓùjùt-àkî	‘sharpen’	sàpùk-àkîn	‘overturn’

We will assume that the overwriting for long bases is again due to a L- -HL circumfix, whereas the singular pattern follows from a L-prefix. This transparently results in a LH-sequence for H-roots, and fusion with the initial L of LHL-roots:

(64) *Imperative morphology – basic analysis*



(65) shows the phonological evaluation for a short H-tone root. L-prefixation at the Stem Level leads straightforwardly to Left-to Right association due to the ranking of *R̲ above Align-L:

(65) *Imperative Bisyllabic H-Base (Stem Level)*

Input: = a.	CTG□	σ ▷ τ	*R̲	*Fσ]	[τ ▷ σ	τ] ▷ σ	τ ▷ σ	Max |	Al-L	*F̲	Dep |
a. Ⓛ- Ⓗ der e		*!*			*	*	**				
b. L H der e			*!								***
☞ c. L H der e									*		**

Let us now turn to the substantial differences of the LHL pattern in the Imperative with respect to the other cases of LHL-overwriting we have discussed so far. As we will see in section C.1.4, the Imperative-LHL not only neutralizes the verbal root tone, but also tonal morphemes such as the Passive -H (retained in other cases of LHL-tone). Moreover the alignment of the melodic LHL differs from the Causative in that the HL portion consistently shows up on the segmental suffix -[e] with multiple association at the left periphery for longer forms. In other cases of LHL, the pattern is roughly the opposite with left-edge association and multiple association at the right edge. The Benefactive forms in (67) not only show that this pattern holds for longer forms, but also that the final Fall is not due to underlying association to the suffix -[(n)e] which is missing here as in most Imperative forms with additional derivational morphology (the fact that -[n(e)] has a H in short H-tone roots of course is evidence for the same conclusion).

Both specific features of the Imperative can be captured under the assumption that it has the same tonal representation as the Causative, but is concatenated at the Word Level after most other tonal affixes. Assuming that the Word-Level phonology differs minimally from the Stem Level in having high-ranked Align-Right instead of Align-Left, the shape of the long Imperative directly falls out. This is illustrated in (66) for a trisyllabic bare root:

(66) *Imperative Polysyllabic (Word level)*

Input: = a.	CTG□	σ ▷ τ	*R	*Fσ]	[τ ▷ σ	τ] ▷ σ	τ ▷ σ	MAX |	AL-R	*F	DEP |
a. (L)- H -(H) (L) bo ro ne	*!				*	*	***				
b. (L)- (H) -(H) (L) bo ro ne					*!	*	***				
c. L (H) H L bo ro ne								***	*,*!*		***
☞ d. L (H) H L bo ro ne								***	*	*	***

The short allomorph doesn't show up in derived forms . This can be captured by assuming that the segmental Imperative suffixes are late in the affix lexicon follow the tonal exponent and select for a monosyllabic base which restricts it to bare roots since all derivational categoeries result in minimally bisyllabic gfporms

(67) *Affix entries for the Imperative*

+Imperative ↔ L- / $[\sigma]_{\text{Base}}$ ___ (Stem Level)

+Imperative ↔ -n(e) / $\surd$ ___ (Stem Level)

+Imperative ↔ L- -HL (Word Level)

Note finally that the Imperative provides especially clear evidence for the mutual blocking of syllable-counting allomorphs across strata. Consider, for example, a short H-stem such as dèr-é which carries the L-prefix. If this – Stem Level – allomoirph wouldn't block, the Word-Level L -HL circumfix we would predict that the latter overwrites this form resulting in incorrect dèr-ê with a final Fall.

4.5 Summary

Table (68) summarizes representative cases for the impact of syllable number on morphological tone:

(68)

	Short	Long
Causative	Stem L- -HL	
Passive	Word -L	Word -H
Antipassive	Stem -L	Word -L
Benefactive	Stem -H	Ø
Ventive	Stem -H	Ø
Habitual	Word L- -H	Stem L- -HL
Imperative	Stem L-	Word L- -HL
Instrumental	Word -L	
Itive	Word -L	

5 Alternatives

In this section, we discuss possible alternatives to account for Short-Stem-Syndrome effects in Bari, starting with Yokwe's (1986) orginal analysis of the data (section 5.1), turning then to potential approaches where SCA is implemented directly as allomorph choice via phonological optimization (section 5.2), or by selection but in a fully parallel version of OT (section 5.3), or with reference to the syllable number of roots (section 5.4). Finally, in section (section 5.5), we will shortly address the possibility to capture the Short Stem-Syndrome by morpheme-specific constraints.

5.1 Yokwe (1986) on Syllable counting

Yokwe approaches Short-Stem effects in Bari by a heterogeneous set of formal means summarized in the table in (69). His prose description of the Passive (69-a) suggests in fact a type of syllable-counting allomorphy analysis – however without providing a specific formal implementation, and refering to roots, not to stems (see section 5.4 below for critical discussion). For the Antipassive (69-b), he assumes that there is only a single late morphological -L, where a construction-specific rule deassociates the H from the final syllable in bisyllabic H-tone roots. This part of the analysis probably shows most clearly the missed generalization in the analysis:

A syllable-counting allomorphy approach in parallel to the Passive both directly captures the fact that the Antipassive pattern is construction-specific and sensitive to syllable number, aspects suspicious in a standard phonological rule. The patterns in the Benefactive, Ventive and Default tone (69-c,d,e) are all related to Yokwe's rule of 'Free tone association' which associates tones to the last syllable of a base after initial one-by-one association of syllables and tones through the universal tone association convention (UTAP). Since Free Tone Association is assumed to be blocked for affix syllables, the final L of a LHL melody can associate to a bisyllabic root (ⓁⒽⓁsapuk – UTAP → sàpúkⓁ– Free Tone Association → sàpûk), but not to the Benefactive or Ventive suffix attached to a monosyllabic root (ⓁⒽⓁmo-kin – UTAP → mòkínⓁ– Free tone association blocked). Free Tone Association is also assumed to be non-iterative. Thus in a monosyllabic LH root only the initial LH is associated (ⓁⒽⓁmo – UTAP → mòⒽⓁ– Free Tone Association → mǒⓁ) which is subsequenty changed to H by an independently motivated rule of Rise Simplification (mǒ → mó).

For the Short-Stem effects in the Imperative and Habitual (69-f,g), Yokwe just states the empirical facts without attempting an explicit analysis.

(69) *Yokwe's (1986) analysis of Short-Stem Syndrome effects*

a. Passive	Different affixal tones depending on syllable number of roots	(p. 68)
b. Antipassive	Construction-specific contour simplification rule for bisyllabic words: ɗébbâ → ɗébbà	(p. 47)
c. Benefactive -H	Free-tone association can only target lexical roots	(p.30)
d. Ventive -H		(p.50)
e. Default -H (in monosyllabic LHL-roots)	Incomplete Fre-tone association ⓁⒽⓁ→ LHⓁ feeds Rise simplification LH → H	(p.21)
f. Imperative	(No analysis)	(p. 92)
g. Habitual		(p. 381)

Overall, Yokwe's analysis requires phonological processes which are explicitly sensitive both to morphological structure (for the Benefactive and Ventive) and to specific morphemes (for the Antipassive) – breaches of modularity avoided in the analysis proposed here. Since he has to invoke in addition syllable-counting allomorphy (for the Passive) and sequential ordering/interleaving of morphological and phonological tone (e.g. by assuming that Causative tone is created early, but Antipassive tone late), the theoretical apparatus he employs seems to be a superset of what the unified reanalysis suggested here requires, which also achieves broader empirical coverage.

5.2 Optimizing Syllable-Counting Allomorphy

The prima facie main contender for any analysis invoking phonologically conditioned suppletion by subcategorization is one where suppletive allomorphy is due instead to phonological optimization selecting between output candidates based on several different allomorphs (see especially Kager 1996 on syllable-counting allomorphy). As many cases of segmental SCA, also the tonal case from Bari discussed here provides counterevidence against such an approach:

First, as we have already pointed out in section 1.2, it is not obvious in which sense allomorph selection in Bari would be optimizing. Thus there seems to be no independent motivation why long word forms should end in a H tone as in the Passive, independently of the preceding tones (e.g. after a H in [bújút-á] and after a L in [dìlìlì-já]). In fact, patterns as the Antipassive allomorphy seem to be 'anti-optimizing', i.e., unnatural since under standard assumptions on tone mapping final contour tones are expected to occur preferentially not in longer forms, but in shorter forms (due to the potential shortage in available TBU's) – an asymmetry which is also found in Bari underived verb forms (cf. LHL in trisyllabic [dìlílì] vs. bisyllabic [sàpûk]).

Second, identical tone quality and behavior of affixal tones might be restricted to short or to longer forms. in different allomorphy pairs, creating crossover patterns. Thus a H-allomorph is only found in long forms of the Passive, but only in short forms of the Ventive and Benefactive (and in short default forms). Similarly a final L combining with a lexical root H to form a Fall is found only in the short forms of the Passive, but only in the long forms of the Antipassive. Thus trying to derive all these patterns via markedness seems to render the notion of markedness vacuous. Long words with final H's and short words with final H's would both have to be relatively marked or unmarked depending on the morphological context.

Third, an optimization approach for allomorphy is incompatible with the fact that allomorphs are apparently concatenated and optimized in distinct sequential steps (under the proposed anaylsis: in different strata). The very notion of optimizing suppletive allomorphy seems to depend on a model where both allomorphs are evaluated in parallel to alllow for choosing between them by optimization. See section 5.3 below for more discussion of a potential parallel approach.

5.3 Syllable-Counting Allomorphy by Subcategorization, but without Strata

Already Paster (2006) argues that a number of cases involving phonologically conditioned suppletion require a cyclic architecture of the grammar where the subcategorization of a given affix is fulfilled at the cycle where it is concatenated, but later cycles render this fact opaque. Also Bari tone allomorphy provides evidence for cycles which we have interpreted here as the effect of Stem-Level and Word-Level strata in a Stratal-OT architecture.

Most obviously, parallel subcategorization would not account for the differential behavior of early and late Lows in the Antipassive. One might posit here that long bases actually select a Fall (HL) suffix and only short bases a L to account for the contrast in H-tone roots ([ɗéb-bà] 'hold' vs. [ɓújúd-djâ] 'sharpen') but this wouldn't explain why there is no Fall in longer LHL-roots (e.g., [kàbúr-ɟà] 'agitate') which follows naturally from a final L which fuses with the trailing L of the root melody. Taking for granted that the relevant exponents in Passive and Antipassive are L-suffixes the stratal account also provides the most natural explanation why in many contexts a marked Fall is created in a language which otherwise shows spreading of final tones (whether H or L). Thus adding a L to a trisyllabic H-toned root and associating them in parallel, we would expect H.L.L, not H.H.HL, both based on general markedness consideration and the behavior of Bari tone elsewhere On the other hand, under the stratal analysis every phonological optimization step is phonologically natural. The H of [ɓújúd-djâ] associates and spreads to the final syllable at the Stem Level because the affixal L is still not present Ⓗ[ɓujud-dja] → [ɓújúd-djá], and the Antipassive L is then attached and associated to guarantee association of a floating tone while avoiding deassociation of already associated tones [ɓújúd-djá]+Ⓛ → [ɓújúd-djâ]. The same point can be made with the Causative Passive where the affixal H only occupies the final syllable and the trailing melody L exhibits partial spreading (as in [tò-dílìlì-já]),

5.4 Syllable-Counting Allomorphy sensitive to Roots, not to Stems

A minor variant of the approach here would be to posit syllable-counting subcategorization which is consistently sensitive to roots, not to (potentially) complex stems. This seems to be Yokwe's take on tonal allomorphy in Passive forms (see section 5.1).

The clearest evidence against this account has already been discussed in section 3.1. There, we have shown that in Benefactive tone root and stem length criteria are not equivalent (due to the unstable initial vowel of the Benefactive suffix -[(a)kin]), and only stem-based subcategorization predicts the correct tonal allomorphs.

Also the analysis of default tone in section 3.3 depends on this assumption: If syllable counting would always refer to roots, then *all* derived polysyllabic forms based on monosyllabic roots should also exhibit the default -H which is otherwise unrestricted. Note finally that the Passive-H characteristic of longer stems shows up in Causative forms of monosyllabic roots (e.g. [tò-mók-á]. This would be inexplicable if it was restricted to polysyllabic roots.

5.5 Morpheme-specific Phonology

One might also try to avoid the use of syllable-counting allomorphy by positing morpheme-specific phonology, i.e., indexed constraints or cophonologies. However, this seems to run into the same problems as any account based primarily on phonological alternations. Thus, based on the Passive, we know of no phonological constraint which would impose a final H on short prosodic words or a Fall on short words. This would also have to be arbitrary since distributions are partially crossed, Final Hs are found on long Bases in the Passive, but restricted to short ones in the Ventive. Similarly final Falls are characteristic for short H-bases in the Passive, but for long H-bases in the Antipassive.

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Appendix

A Affix Lexicon (next page)

. . .

+Causative	↔ tɔ-		(Stem Level)
+Causative	↔ L- -HL		(Stem Level)
+Habitual	↔ L- -HL	/ [. . . σσσ]$_{Base}$ ___	(Stem Level)
$\begin{bmatrix}\text{+Passive}\\ \text{+Ventive}\\ \text{+Instrumental}\end{bmatrix}$	↔ -we-ʔ-i		(Stem Level)
$\begin{bmatrix}\text{+Passive}\\ \text{+Itive}\\ \text{+Instrumental}\end{bmatrix}$	↔ -a-ji-ʔ-i		(Stem Level)
$\begin{bmatrix}\text{+Ventive}\\ \text{+Passive}\end{bmatrix}$	↔ -we		(Word Level)
+Passive	↔ -a		(Stem Level)
$\begin{bmatrix}\text{+Benefactive}\\ \text{+Applicative}\end{bmatrix}$	↔ -ki	/ [+Passive]	(Word Level)
+Benefactive	↔ -(a)ki(n)		(Stem Level)
+Itive	↔ -ɟi	/ [+Passive]	(Word Level)
+Passive	↔ [c.g.] (-ʔ) /V$_{[-back]}$___		(Word Level)
+Itive	↔ -(ar)ad		(Stem Level)
+Antipassive	↔ -ɟa		(Stem Level)
+Ventive	↔ -un		(Stem Level)
+Instrumental	↔ -r(i)		(Stem Level)
+Applicative	↔ -kin	/ [+Passive]	(Word Level)
$\begin{bmatrix}\text{+Itive}\\ \text{+Antipassive}\\ \text{+Instrumental}\end{bmatrix}$	↔ L- -HL		(Stem Level)
+Passive	↔ -H	/ [. . . σσ	]$_{Base}$	(Word Level)

a

σ

Background Assumptions on Featural Representations:

- Instrumentals and Benefactives share the feature [+Applicative]:

$$\text{Instrumental} = \begin{bmatrix} \text{+Instrumental} \\ \text{+Applicative} \end{bmatrix}$$

$$\text{Benefactive} = \begin{bmatrix} \text{+Benefactive} \\ \text{+Applicative} \end{bmatrix}$$

- Passive and Antipassive share the Feature [+Detransitivizing]:

$$\text{Passive} = \begin{bmatrix} \text{+Passive} \\ \text{+Detransitivizing} \end{bmatrix}$$

$$\text{Antipassive} = \begin{bmatrix} \text{+Antipassive} \\ \text{+Detransitivizing} \end{bmatrix}$$

B Other Categories with Consistent Overwriting

Exactly the same pattern of tonal overwriting as in the Causative is found in two categories also involving reduplication, the Continuative and the Repetitive (p.94ff).

(70) *Repetitive Forms (p.98)*

	H	*LHL*
*1*σ	ɗè-ɗêp 'hold'	mò-môk 'hold'
*2*σ	ɓù-ɓújùt 'sharpen'	sà-sápùk 'overturn'
*3*σ	_____	??
*4*σ	_____	_____

The LHL overwriting pattern is also part of several constructions forming deverbal nouns. Thus a plural agentive noun can be formed by adding the prefix [ka]-, the suffix -[ak] and imposing LHL on the resulting string

(71) *Plural Deverbal Agentive nouns (p.179+180)*

	H	*LHL*
*1*σ	kà-ɗép-àk ‘holder’	kà-mók-àk ‘holders’
*2*σ	kà-ɓújùt-àk ‘sharpeners’	kà-sápùk-àk ‘overturners’
*3*σ	_____	kà-dílìlì-jàk ‘winnowers’
*4*σ	_____	_____

Deverbal formation of nouns expressing capability affix the suffix -[at] and neutralize verbal tone to H on all syllables (72).:

(72) *Capability Nominalizations (p.186)*

	H	LHL
1σ	_____	_____
2σ	dák-át ‘redeem’	mók-át ‘hold’
3σ	búrák-át ‘stir’	sápúk-át ‘overturn’
4σ	_____	??
5σ	_____	_____

The same holds for singular DeverbalAgentive nouns (73):

(73) *Singular Deverbal Agentive nouns (p.182+183)*

	H	*LHL*
*1*σ	ká-ɗép-é ‘holder’	ká-mók-é ‘holder’
*2*σ	ká-ɓújút-é ‘sharpener’	ká-sápúk-é ‘overturner’
*3*σ	_____	ká-dílílí-é ‘winnower’
*4*σ	_____	_____

C Combinations of Affixes

If tone allomorphy in Bari selects for the syllable number of stems, combinations of different morphological categories should provide additional evidence for this claim: Most of these categories also involve segmental affixes which create derived forms of different lengths. Hence these should predict the tonal allomorphs for other categories. In this section, we will show that this prediction is mostly born out (section C.1). However, combinations of affixes in Bari also have some non-compositional effects, which we will argue involve tonal portmanteaux and dual-level affixation.

C.1 Transparent Combinations of Tonal Affixes

C.1.1 Causative + Suffixal Tone

We will start our discussion with combinations of the Causative In this section, we show that the combinations of the Causative with suffixal tone follows directly from the analysis presented so far. (74) gives representative data, ordered again by the syllable number of the resulting output forms with systematic gaps due to the available root shapes and the syllables provided by the respective affixes. Thus there are no monosyllabic Causatives since the Causative prefix invariably extends roots by another syllable:

(74) *Causative Data*

	Ø		+Benefactive		+Ventive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	tò-ɗêp	tò-môk	—	—	—	—
3σ	tò-ɓújùt	tù-sápùk	??	??	tò-ɗép-ùn	tò-mók-ùn
4σ	—	tò-dílìlì	tò-ɗép-àkìn	tò-mók-àkìn	tò-ɓújùt-ùn	tù-sápùk-ùn
5σ	—	—	tò-ɓújùt-àkìn	tù-sápùk-àkìn	—	tò-dílìlì-ùn
6σ	—	—	—	tò-dílìlì-àkìn	—	—

	+Itive		+Antipassive		+Passive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	—	—	—	—	—	—
3σ	—	—	tò-ɗéb-bà	tò-móg-gà	tò-ɗép-á	tò-mók-á
4σ	tò-ɗép-àràʔ	tò-mók-àràʔ	tò-ɓújùd-djà	tù-sápùg-gà	tò-ɓújùt-á	tù-sápùk-á
5σ	tò-ɓújùt-àràʔ	tù-sápùk-àràʔ	—	tò-dílìlì-jà	—	tò-dílìlì-já
6σ	—	tò-dílìlì-jàràʔ	—	—	—	—

(75) shows schematically the differences between suffixal tone in these forms (with Causative morphology) and corresponding non-Causative forms. Each line contains 3 tone formulas for monosyllabic/bisylllabic and longer words (in the Passive 3-syllabic and longer forms are also differentiated). The bottom line contains our analysis in terms of tonal affixes Pairs like -H_l/-Ø specify the long and the short allomorph respectively, where the subscripts stand for l(ate) and e(arly).

(75)

a. *Simple suffixal tone:*

	Ø	Ben	Ven	It	AP	Pas
	-Ø	-(a)kin	-un	-araʔ	-ɟa	-a
H:	H/HH/HHH. . .	–/HH/HHH. . .	–/HH/HHH. . .	–/–/HH. . . HL	–/HL/HH. . . HL	–/HHL/HHH. . .
LHL:	H/LHL/LHL. . .	–/LH/LHL. . .	–/LH/LHL. . .	–/–/LHL. . .	–/LHL/LHL. . .	–/LHL/LHH/LHL. . . H
	-H$_l$/-Ø/-Ø	–/-H$_l$/-Ø	–/-H$_l$/-Ø	–/–/-L$_l$	–/L$_e$/L$_l$	–/L$_l$/H$_l$

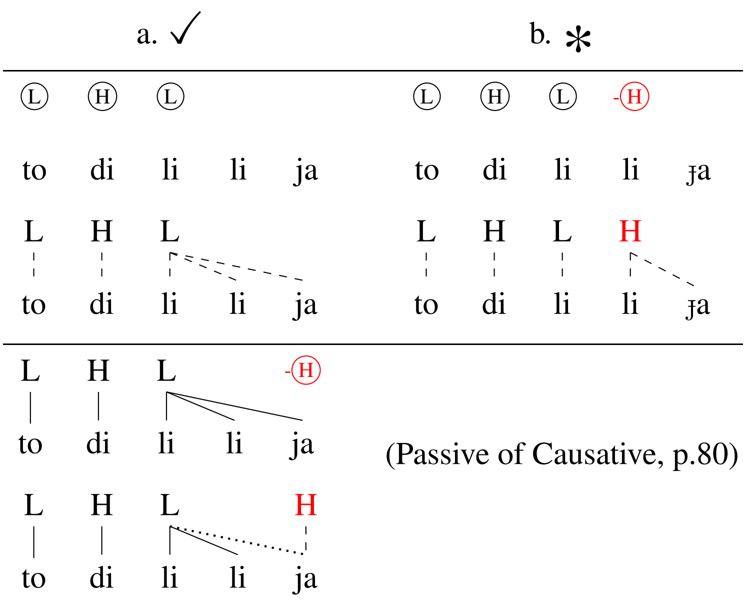
b. + *Causative:*

	Ø	Ben	Ven	It	AP	Pas
	tɔ- -Ø	tɔ- -(a)kin	tɔ- -un	tɔ- -araʔ	tɔ- -ɟa	tɔ- -a
H:	–/LHL/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHH/LHL. . . H
LHL:	–/LHL/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHL. . .	–/–/LHH/LHL. . . H
	L- -HL$_e$-Ø	L- -HL$_e$-Ø	L- -HL$_e$-Ø	L- -HL$_e$-L$_l$	L- -HL$_e$-L$_l$	L- -HL$_e$-H$_l$

The picture in (74) and (75) is apparently one of almost complete neutralization of suffixal tone morphology. Apart from the final -H in Passive forms, only the overwriting LHL of the Causative seems to surface. However, this actually results in a completely compositional way considering that Causative forms are systematically longer by one syllable than the corresponding non-Causative forms. Thus a bisyllabic Ventive takes a suffixal H-allomorph, but the corresponding Causative form is trisyllabic and consequently gets the allomorph for longer bases (in this case, Ø). In effect the Causative lengthens all verb bases in a way that even forms based on monosyllabic roots turn into long bases. However, apart from the Passive the long bases all select either a –Ø or a -L allmorph. Neutralization is directly predicted by Ø-allomorphs, and also L-suffixation is phonetically vacuous on the uniform LHL pattern of the Causative since the final L of the LHL-melody and the suffixal L simply fuse (see section 1.2 for discussion). Thus the decomposition in (75) precisely predicts the neutralization pattern. The Passive sticks out in escaping neutralization simply because it is the only morphological category where the long allomorh is a suffixal H.

It is also instructive to take a look at longer Causative forms because it provides clear evidence for the two-level analysis, where L- -HL applies at the Stem Level, but Passive -H is added at the Word Level. Thus, the Causative Passive of [dìlílì] 'winnow grain' is [tò-dílìlì-já] which follows from spreading the final L of the Causative LHL at the Stem Level and subsequent replacement of the final association line by the Passive-H. If both tonal affixes would apply at the same stratum we would expect the incorrect outcome in (76-b), where the final H being the fourth unassociated tone associates to the fourth syllable by one-by-one mapping and then spreads:

(76) *Long Causative Passive*



C.1.2 Antipassive + other tone suffixes

Combinations of the Antipassive with other suffixal tones show similar neutralization effects as the Causative but under maintainance of the lexical tone classes: All H-tone verbs have H tone throughout with a final Fall (HL), and all LHL verbs show the characteristic LHL mappings (note that the combination of Passive and Antipassive is apparently impossible in Bari):

(77) *Antipassive Data*

	Ø		+Benefactive		+Ventive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	ɗéb-bà	dòg-gû	—	—	—	—
3σ	ɓújúd-djâ	kàbúr-jà	—	—	ɗép-ún-djâ	mòk-ún-djà
4σ	—	dìlílì-jà	ɗép-ákín-djâ	mòk-ákìn-djà	ɓújút-ún-djâ	sàpúk-ùn-djà
5σ	—	—	ɓújút-ákín-djâ	sàpúk-àkìn-djà	—	dìlílì-jùn-djà
6σ	—	—	—	??	—	—

	+Itive		+Instrumental (long)		+Instrumental (short)	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	—	—	—	—	déb-bî	mòg-gî
3σ	ɗép-ád-dû	mòk-ád-dù	ɗéb-bí-rî	mòg-gí-rì	ɓújúd-dî	sàpúg-gì
4σ	ɓújút-ád-dû	sàpúk-àd-dù	ɓújúd-dí-rî	sàpúg-gì-rì	—	??
5σ		dìlílì-jàd-dù	—	dìlílì-ɟì-rì	—	—
6σ	—	—	—	—	—	—

As shown by the schematic formulas in (78), this again follows simply from the fact that the Antipassive (and the other affixes) lengthen the bases to tonal allomorph selection (recall our assumption that most tonal exponents follow segmental affixation). Since the allomorphs for longer bases are either a late L or zero, they neutralize phonologically with the late L of the Antipassive:

(78)

a. *Simple Tone Suffixation:*

	Ø	Ben	Ven	It	Ins
	-Ø	-(a)kin	-un	-araʔ	
H:	H/HH/HHH...	–/HH/HHH...	–/HH/HHH...	–/–/HH...HL	—
LHL:	H/LHL/LHL...	–/LH/LHL...	–/LH/LHL...	–/–/LHL...	—
	-H_l/-Ø/-Ø	–/-H_l/-Ø	–/-H_l/-Ø	–/–/-L_l	—

b. + *Antipassive:*

	Ø	Ben	Ven	It	Ins (long)	Ins (short)
	-ɟa	-(a)kin-dja	-un-dja	-ad-du	-dji-ri	-dji
H:	–/HL/HH...HL	–/–/H...HL	–/–/H...HHL	–/–/H...HHL	–/–/H...HHL	–/H...HL
LHL:	–/LHL/LHL...	–/–/LHL...	–/–/LHL...	–/–/LHL...	–/–/LHL...	–/LHL/LHL...
	–/L_e-Ø/L_l-Ø	–/–/L_l-Ø	–/–/L_l-Ø	–/–/-L_l-L_l	–/–/-L_l-L_l	–/-L_l-L_l

C.1.3 Habitual

The Habitual is of special interest because it is the only verbal morphological category which is expressed only by tone without any segmental reflex. For the combination with other tonal suffixes, this predicts that more syllable-counting tonal allomorphy should be retained since there are also shorter stems exhibiting the allomorphs selecting them. This prediction is indeed borne out in different parts of the paradigm. Default (Ø) -H appears in monosyllabic LHL forms (mók), the Ventive -H in bisyllabic LHL-forms (mòk-ún), and the Passive -H in all trisyllabic forms (ɓùjút-á and sàpúk-á). On the other hand, -the Antipassive -L is apparently suppressed in bisyllabic forms (ɗȅb-bá, not *ɗȅb-bà or *ɗȅb-bâ)

(79) *Habitual Data*

	Ø		+Benefactive		+Ventive		+Passive	
	H	LHL	H	LHL	H	LHL	H	LHL
1σ	ɗɛ̀p	mók	—	—	—	—	—	—
2σ	ɓùjút	sàpûk	??	??	ɗɛ̀p-ún	mòk-ún	ɗɛ̀p-á	mòk-â
3σ	—	kùkúɗì	ɗɛ̀p-ákìn	mòk-ákìn	ɓùjút-ùn	sàpúk-ùn	ɓùjút-á	sàpúk-á
4σ	—	—	ɓùjút-àkìn	sàpúk-àkìn	—	??	—	??
5σ	—	—	—	??	—	—	—	—
6σ	—	—	—	—	—	—	—	—

	+Itive		+Antipassive		+Instrumental	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—		
2σ	—	—	ɗɛ̀b-bá	mòg-gâ		
3σ	ɗɛ̀p-áràʔ	mòk-áràʔ	ɓùjúd-djà	sàpúg-gà		
4σ	ɓùjút-àràʔ	sàpúk-àràʔ	—	??	??	
5σ	—	??	—	—		
6σ	—	—				

These facts directly follow from the order in which tonal morphemes are concatenated. In trisyllabic forms, the Word Level Passive-H attaches to a base associated to Habitual L -HL at the Stem Level, hence it overwrites the final L just as in all bare LHL roots (Ⓛ-Ⓗɓujut-a-ⒽⓁ → ɓùjút-à → ɓùjút-à-Ⓗ ɓùjút-á). In bisyllabic Ventive LHL-roots, there is no tonal exponent of the Habitual: L- -HL is restricted to bisyllabic and longer bases, and L- -H to H-roots. Thus Ventive -H overwrites the final syllable exactly as in underived roots (ⓁⒽⓁmok-un → mòk-ûn → mòk-ûn-Ⓗ → mòk-ún, note also that the H-toned ɗɛ̀p-ún gets the Habitual L -H so that the Ventive -H fuses with its trailing -H). Similarly underived monosyllabic LHL roots as mók show the default -H in the

Habitual because none of the Habitual tone affixes is present.

On the other hand, in bisyllabic Antipassive H-roots, the Habitual circumfix is concatenated outside of the Antipassive suffix. Thus Contiguity leads to the deletion of the Antipassive-L (Ⓗɗeb-ba → ɗéb-bá → Ⓛ-ɗéb-bá-Ⓛ-Ⓗ → ɗȅb-bá).

(80)

+Habitual	↔	L- -HL	$/\ [\ldots\sigma\sigma\sigma]_{\text{Base}}$ __ a	(Stem Level)
+Passive	↔	-H	$/\ [\ldots\sigma\sigma\ \vert\ ]_{\text{Base}}$ σ	(Word Level)
+Antipassive	↔	-L	$/\ [\sigma\sigma]_{\text{Base}}$ __	(Stem Level)
+Antipassive	↔	-L		(Word Level)
+Habitual	↔	L- -H	$/\ [\text{H}\ldots]_{\text{Base}}$ __	(Word Level)
+Ventive	↔	-H	$/\ [\sigma\sigma]_{\text{Base}}$ __	(Word Level)
[ ]	↔	-H	$/\ [\sigma]_{\text{Base}}$ __	(Word Level)

(81) again summarizes schematically the tone patterns and their compositional analysis in terms of affix tones:

(81)

a. *Simple suffixal tone:*

	Ø	Ben	Ven	It	AP	Pas
	-Ø	-(a)kin	-un	-araʔ	-ɟa	-a
H:	H/HH/–	–/HH/HHH. . .	–/HH/HHH. . .	–/–/HH. . . H͜L	–/HL/HH. . . H͜L	–/HH͜L/HHH. . .
LHL:	H/LH͜L/LHL	–/LH/LHL. . .	–/LH/LHL. . .	–/–/LHL. . .	–/LH͜L/LHL. . .	–/LH͜L/LHH/LHL. . . H
	-H_l/-Ø/-Ø	–/-H_l/-Ø	–/-H_l/-Ø	–/–/-L_l	–/L_e/L_l	–/L_l/H_l

b. + *Habitual:*

	Ø	Ben	Ven	It	AP	Pas
	-Ø	-(a)kin	-un	-araʔ	-ɟa	-a
H:	L/LH/–	–/–/LHL. . .	–/LH/LHL	–/–/LHL. . .	–/LH/LHL	–/–/LHH/LHL. . . H
	L- -H-H_l/L- -H-Ø/–	–/–/L- -HL_e	L- -H_e-H_l/ L- -HL_e-Ø	L- -HL_e-L_l	–/L- -L_l -H/ L- -HL_e-L_l	L- -HL_e-H_l
LHL:	H/LH͜L/LHL	–/–/LHL. . .	–/LH/LHL	–/–/LHL. . .	–/LH͜L/LHL	–/–/LHH/LHL. . . H
	Ø-H_l/Ø-Ø/L- -HL-Ø	–/–/L- -HL_e	-H_l/L -HL_e-Ø	L- -HL_e-L_l	–/Ø/L- -HL_e-L_l	L- -HL_e-H_l

C.1.4 Imperative Combinations

By assumption, the tonal and non-tonal Imperative exponents are affixed later than all other affixes (except the default -H for monosyllabic roots). This captures the fact that Imperative tone erases all reflexes of other syllable-counting allomorphy. Thus there is no final L in the Itive and Antipassive as would be expected (e.g., [ɗȅp-àráʔ] not *[ɗȅp-àrâʔ] and [ɓùjùd-dí-ʔ] not *[ɓùjùd-dî-ʔ]), and bisyllabic Ventive forms do not show a final H ([ɗȅp-û] not *[ɗȅp-ú]). The late ordering of Imperative affixation also contributes to explaining why the effects of syllable-counting allomorphy of the Imperative itself seem to be neutralized in combination with the Ventive. The H-toned root ɗȅp-û has the LHL allomorph characteristic of longer forms not the L prefix characteristic of bare imperatives of the same syllable count as [dèr-é].

(82) *Imperative Data*

	Ø		+Benefactive		+Ventive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	dèr-é	mòk-ê	??	??	ɗȅp-û	mòk-û
3σ	ɓùjùt-ê	sàpùk-ê	dèr-àkî	mòk-àkî	ɓùjùt-û	sàpùk-û
4σ	—	dìlìlì-nê	ɓùjùt-àkî	sàpùk-àkî	—	dìlìlì-jû
5σ	—	—	—	??	—	??
6σ	—	—	—		—	—

	+Itive		+Antipassive		+Passive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	—	—	—	—	—	—
3σ	—	—	ɗȅb-bí-ʔ	mòg-gí-ʔ	ɗép-à-ní-ʔ	mòk-à-ní-ʔ
4σ	ɗȅp-àráʔ	mòk-àráʔ	ɓùjùd-dí-ʔ	tèbòg-gí-ʔ	ɓùjùt-à-ní-ʔ	sápùk-à-ní-ʔ
5σ	ɓùjùt-àráʔ	sàpùk-àráʔ	—	dìlìlì-ɟí-ʔ	—	dìlìlì-jà-ní-ʔ
6σ	—	dìlìlì-jàráʔ	—	—	—	—

In our analysis this follows from the fact that the Imperative L- selects monosyllabic bases before the corresponding segmental Imperative suffix is attached (Ⓗder → Ⓛ-Ⓗder → Ⓛ-Ⓗder-e → dèré). In contrast, in a Ventive form of a monosyllabic root, the segmental suffix is attached before all of the Imperative affixes. At the point where L- could be attached the base is already bisyllabic and therefore the default L- -HL allomorph is chosen instead (Ⓗɗep-u → Ⓗɗep-u → ɗép-ú → Ⓛ-ɗép-ú-ⓁⒽ → ɗȅp-û)

(83) *Imperative Affixes*

a. +Imperative	↔	-ni	/ [+Passive]	(Word Level)
b. +Imperative	↔	L-	/ $[\sigma]_{\text{Base}}$ —	(Stem Level)
c. +Imperative	↔	-(n)e	/ $\surd$ —	(Stem Level)
d. +Imperative	↔	-c.g. (-ʔ)	/ [+Detrans]	(Word Level)
e. +Imperative	↔	L- -H	/ $[\ldots ʔ]_{\text{Base}}$ —	(Word Level)
f. +Imperative	↔	L- -HL		(Word Level)
g. [ ]	↔	-H	/ $[\sigma]_{\text{Base}}$ —	(Word Level)

Finally, there is a surprising case of tonal allomorphy in complex forms, but it is not driven by syllable count.

Some combinations (Imperative +{Benefactive, Ventive}) have the expected L...HL, but others (Imperative +{Itive, Antipassive, Passive}) have instead a L...H pattern with a L on all prefinal syllables and a simple H on the final syllable. The generalization we build on here is that the L...H pattern is found in exactly the forms which have a final glottal stop. This glottal stop appears either as part of the Itive suffix or as an independent exponent of the Imperative. We assume that the latter is an affix (83-d) consisting only of the feature [constricted glottis] (c.g.) which is then extended by phonology to a full glottal stop. In line with our assumption that morphological feature discharge is tier-specific, this accounts for the fact that this exponent in principle freely cooccurs with segmental and tonal Imperative affixes. To account for its restriction to Passive and Antipassive Imperatives we assume that it has a context restriction to the feature [+Detransitivizing] shared by both valency-decreasing categories.

Since the glottal Imperative suffix and the exponent for the Iterative are introduced before the Word-Level tone affixes for the Imperative the selection for ʔ-final bases in (83-e) correctly predicts the distribution of the L...H allomorph.

C.2 Passive: Segmental Word-Level Affixes in the Passive

The Passive shows pervasive neutralization of syllable-counting allomorphy in combinations with other morphological categories. The H-suffix found in all long (≥ 3 σ) simple Passive forms is systematically missing. Instead all complex Passive forms have a final L:

(84) *Passive Data*

	Ø		+Benefactive		+Ventive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	ɗép-â	mòk-â	—	—	ɗép-wè-ʔ	mòk-wê-ʔ
3σ	bújút-á	sàpúk-á	ɗép-á-kì-ʔ	mòk-á-kì-ʔ	ɓújút-wè-ʔ	sàpúk-wè-ʔ
4σ	—	dìlílì-já	ɓújút-á-kì-ʔ	sàpúk-à-kì-ʔ	—	dìlílì-wè-ʔ
5σ	—	—	—	??	—	—
6σ	—	—	—	—	—	—

	+Itive		+Instrumental (short)		+Instrumental (long)	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	—	—	—	—	—	—
3σ	ɗép-á-ɟì-ʔ	mòk-á–ɟì-ʔ	ɗép-á-rî	mòk-á-rì	—	—
4σ	ɓújút-á-ɟì-ʔ	sàpúk-à-ɟì-ʔ	ɓújút-á-rî	sàpúk-à-rì	dér-á-rí-kìn	mòk-á-rì-kìn
5σ	—	dìlílì-jà-ɟì-ʔ	—	dìlílì-jà-rì	ɓújút-á-rì-kìn	sàpúk-à-rì-kìn
6σ	—	—	—	—	—	??

We analyze this by refining the phonological subcategorization for the tonal exponent as in (85-h). Passive -H requires a base which is trisyllabic *and* ends in a low vowel. Since all segmental affixes used in Passive forms are concatenated prior to the tonal exponents of Passive and the simple Passive forms are the only ones ending in -[a], this correctly predicts that the final -H will only be affixed in Simple Passive forms.[12] Passive -L is the tonal default exponent, which consequently shows up in all other parts of the paradigm – shorter simple Passives and complex Passives of any length.

(85) *Passive Affixes*

a.	[+Ventive, +Passive]	↔	-we		(Word Level)
b.	+Passive	↔	-a		(Stem Level)
c.	[+Benefactive, +Applicative]	↔	-ki	/ [+Passive]	(Word Level)
d.	+Itive	↔	-ɟi	/ [+Passive]	(Word Level)
e.	+Passive	↔	[c.g.] (-ʔ)	/$V_{[-back]}$__	(Word Level)
f.	+Instrumental	↔	-r(i)		(Stem Level)
g.	+Applicative	↔	-kin	/ [+Passive]	(Word Level)
h.	+Passive	↔	-H	/ [. . . σσ $\overset{a}{\underset{\sigma}{\vert}}$]$_{Base}$	(Word Level)
i.	+Passive	↔	-L		(Word Level)

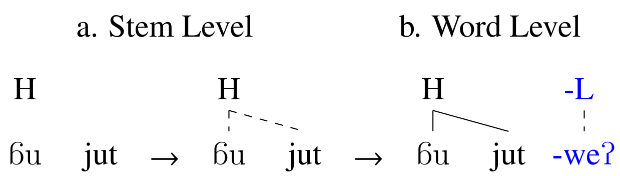
The second special feature of many complex Passive forms is that the final -L of the Passive is apparently associated in a different way than in all other paradigms (Passive or otherwise) discussed so far. We will discuss this point with the Ventive Passive forms which also show a segmental Portmanteau -[we] instead of the expected combination of Passive -[a] and Ventive -[un]. In bisyllabic forms, the Ventive Passive seems to be associated as the early -L in bisyllabic Antipassive forms. But if the L in these forms

[12]Under this analysis, -H is triggered only by the presence of -[a] (since no other relevant affix ends in [a]), but they do not form a single exponent, The latter approach might seem to result in a simpler analysis. However, under a single exponent analysis -H should also surface in forms where -[a] is non-final; but in these forms it is consistently absent (see, e.g., the short Instrumental [mòk-á-rì]).

is the default -L of the Passive it must be late, not early. Moreover, given that at the Stem Level, spreading to surplus syllables in Bari is generally at the right edge (e.g. in Benefactive LHL verbs such as [kàdír-àkìn] 'to look at carefully', see the discussion of (3) and (4) in section 1.1), this predicts the wrong tone alignment for [ɓújút-wè-ʔ] which should be *[ɓújùt-wè-ʔ] instead. A simple solution to this problem emerges if we assume that the tonal affix is late (Word Level) -L, as expected, but that the segmental suffix -[we] – in contrast to all other segmental affixes is also Word Level.

This provides a maximally simple account of the tone association in [ɓújút-wè-ʔ] as shown in (86). At the Stem Level (86-a) only the root and its lexical tone are present which leads to association and spreading just as in non-derived forms. The segmental and tonal affix are added only at the Word Level where they are associated since they are the only unassociated elements:

(86) *Passive Ventive: Bisyllabic H-root*



Positing Word-Level segmental affixes also fills a gap in thne affixal inventory of our analysis which so far only contains tonal Stem and Word-Level, but only Stem-level segmental affixes.

To derive the Word-Level mapping, the only extension to the already established constraint ranking at this stratum is the constraint in (87) (Trommer 2023) which allows for multiple association of underlyingly unassociated tones (i.e., simulataneous multiple docking), but blocks spreading proper:

(87) *Spr(ead) ∘ Assign ∗ to every epenthetic association line of a tonal root node N to a syllable S_2 if N is also phonetically and morphologically associated to a syllable S_1, $S_1 \neq S_2$

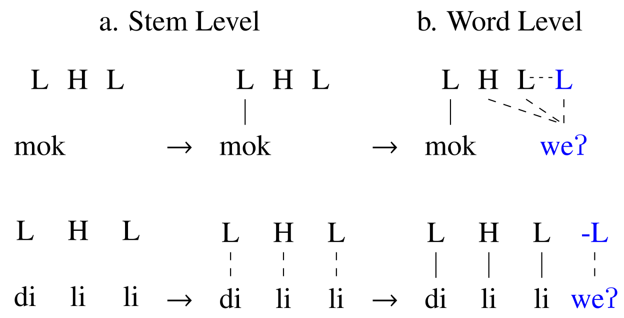
Without *Spread, (88-c) with a final Fall (88-c) would become optimal which minimizes Align-L violations as in the Imperative L- -HL patterns. Note that in the Imperative and all other Word-Level tone affixation discussed so far (87) is never violated since the involved tone affixes are underlyingly floating at the Word Level. (88-b) with multiple association of the affix-L is also excluded since it would lead to a word-internal Fall. Hence we get unmarked one-by-one association as in (88-d):

(88) *Passive Ventive (Word Level)*

Input: = a.	σ ⊳ τ	*Spr	*Fσ]	[τ ⊳ σ	τ] ⊳ σ	τ ⊳ σ	Max	Al-R	*F̲	Dep
H -Ⓛ a. ɓu jut -weʔ	*!				*	*				
H -L b. ɓu jut -weʔ			*!						*	**
H -L c. ɓu jut -weʔ		*!							*	**
H -L ☞ d. ɓu jut -weʔ								*		*

For monosyllabic roots with LHL tone, the analysis is slightly more complicated. We assume that here at the Stem Level only the first lexical tone is associated whereas the trailing HL-sequence remains floating and is inherited to the Word Level, where it is associated to the Ventive-Passive suffix together with the affixal -L:

(89) *Passive Ventive: Monosylllabic LHL-Root*



Again this follows from a minimal extension of the constraint system already assumed above by adding the constraint in (90):

(90) *Skip-τ: Assign ∗ to every floating tone which is preceded and followed by associated tones

In the Stem-Level evaluation, *Skip-τ blocks association of the final L across the intervening H (91-c). Associating the first two tones or all three tones as in (91-b) is already excluded by *Rise. On the other hand, the first tone must be associated due to high-ranked [τ ⊳ σ excluding an otherwise plausible association of the second and last tone resulting in a Fall (91-d:)

(91) *Passive Ventive (Stem Level)*

Input: = a.	σ ▷ τ	*Skip-τ	*<u>R</u>	*Fσ]	[τ ▷ σ	τ] ▷ σ	τ ▷ σ	Max	Al-L	*<u>F</u>	Dep
Ⓛ Ⓗ Ⓛ a. mok	*!				*!	*	***				
L H L b. mok			*!							*	***
L Ⓗ L c. mok		*!					*				*
Ⓛ H L d. mok					*!		*			*	**
☞ L Ⓗ Ⓛ e. mok						*	**				*

At the Word Level, all floating tones are associated to the affix with simultaneous fusion of the final two L-tones (we assume that *Skip is ranked low at the Word Level):

(92) *Passive Ventive Bisyllabic LHL (Word Level)*

Input: = a.	σ ▷ τ	*Spr	OCP	*Fσ]	[τ ▷ σ	τ] ▷ σ	τ ▷ σ	Max	Al-R	*<u>F</u>	Dep	*Skip
L Ⓗ Ⓛ -Ⓛ a. mok we	*!		*!			*	***		*			
L H Ⓛ -Ⓛ b. mok we						*!	**		*		*	
L Ⓗ L-L c. mok weʔ		*!					*				****	*
☞ L H L-L d. mok weʔ									*	*	****	

In a trisyllabic LHL-root Stem-Level association of the lexical verb melody procedes as shown in (29) above resulting in a Fall on the final root syllable. Under suffixation, this Fall becomes non-final violating high-ranked *Fσ] as in (93-b) and must therefore be repaired. Since merging the L-part of the contour with the final L as in (93-c) results in a violation of *Spread (both L-ton es become non-distinct by fusion, hence associating the affix-L means also associating the root-L for the sake of constraint evaluation) deassociation of the L as in (93-d) is prefered:

(93) *Passive Ventive Trisyllabic LHL (Word Level)*

Input: = a.	σ ▷ τ	*Spr	OCP	*Fσ]	[τ ▷ σ	τ] ▷ σ	τ ▷ σ	Max	Al-R	*F	Dep	*Skip
a. L H L Ⓛ / sa puk we (L–sa; HL–puk; Ⓛ floating)	*!		*!			*	***		*			
b. L H L L / sa puk we (L–sa; HL–puk; L - - we)				*!		*!	**		*		*	
c. L Ⓗ L - L / sa puk we (L–sa; Ⓗ delinked, L - - puk; L - - we)		*!					*				****	*
☞ d. L H Ⓛ L / sa puk we (L–sa; H–puk, Ⓛ delinked; L - - we)									*	*	****	

C.3 *Segmental Dual-Level Affixes*

In section C.2, we have seen that two affixes which occur only in combination with the Passive the Itive allomorph -[ɟi] and the Ventive-Passive portmanteau -[we] are best understood as being affixed late – at the Word Level. However, adding the Instrumental to these forms, a different pattern of tone mapping emerges. We find the same pattern as with segmental Stem-Level affixes such as the Instrumental where H-roots show spreading to the last syllable and consequent attachment of default -L. Hence it appears that -[we] and -[ɟi] are attached at the Stem Level:

(94) *Passive Data*

	Ø		+Ventive		+Itive	
	H	LHL	H	LHL	H	LHL
1σ	—	—	—	—	—	—
2σ	lók-â	mòk-â	ɗép-wè-ʔ	mòk-wê-ʔ	—	—
3σ	bújút-á	sàpúk-á	ɓújút-wè-ʔ	sàpúk-wè-ʔ	ɗép-á-ɟì-ʔ	mòk-á–ɟì-ʔ
4σ	—	dìlílì-já	—	dìlílì-wè-ʔ	ɓújút-á-ɟì-ʔ	sàpúk-à-ɟì-ʔ
5σ	—	—	—	—	—	dìlílì-jà-ɟì-ʔ
6σ	—	—	—	—	—	—

		+Ventive +Instrumental		+Itive +Instrumental	
		H	LHL	H	LHL
1σ		—	—	—	—
2σ		—	—	—	—
3σ		kúr-wé-ʔ-î	kùr-wé-ʔ-ì		
4σ	—	ɓújút-wé-ʔ-î	sàpúk-wè-ʔ-ì	ɗép-á-ɟí-ʔ-î	mòk-á-ɟì-ʔ-ì
5σ		—	??	ɓújút-á-ɟí-ʔ-î	sàpúk-à-ɟì-ʔ-ì
6σ		—	—	—	??

Our interpretation of these facts is that -[we] and -[ɟi] are dual-level affixes in the sense of Kiparsky (2005) (see also Bermúdez-Otero 2018), affixes which attach under specific conditions at the Word Level, but otherwise at the Stem Level. Since there is no canonical approach to capture the dual level distribution of such affixes, our analysis at this point is tentative and guided by using only a minmimal extension to the formal machinery otherwise necessary to account for the Bari data.[13] We assume that the special behavior of -[we] and -[ɟi] in Passive

[13] An interesting alternative analysis would be to posit coercion, where attaching a Stem-Level affix such as Instrumental -[(r)i] outside of a Word Level affix such as -[we] forces the latter to attach at the same level contrary to its own specification. This would assimilate this pattern to the phenomenon of Smothering in Prosodic Phonology (Bennett et al. 2018, Rolle and Hyman 2019). However, a coercion analysis would imply abandoning the locality of affixation

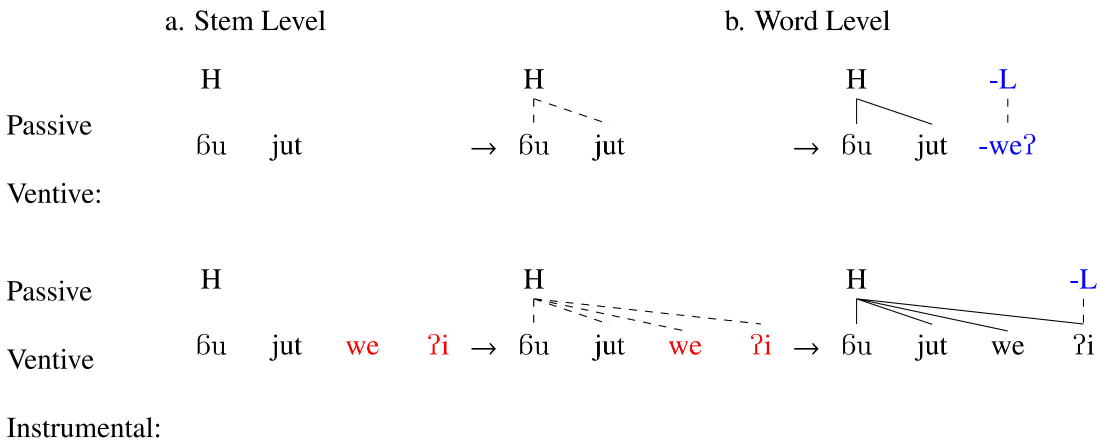
and Instrumental forms is captured simply by listing the relevant combinations of these affixes as independent affix entries as in (95-a,b). These are hence formally portmanteaux blocking the use of the corresponding simple affixes in the same way as -[we] blocks the use of -[a] and -[un].

(95) *Affixes*

a.	$\begin{bmatrix} \text{+Passive} \\ \text{+Ventive} \\ \text{+Instrumental} \end{bmatrix}$	↔	-we-ʔ-i		(Stem Level)
b.	$\begin{bmatrix} \text{+Passive} \\ \text{+Itive} \\ \text{+Instrumental} \end{bmatrix}$	↔	-a-ɟi-ʔ-i		(Stem Level)
c.	$\begin{bmatrix} \text{+Ventive} \\ \text{+Passive} \end{bmatrix}$	↔	-we		(Word Level)
d.	+Passive	↔	-a		(Stem Level)
e.	+Itive	↔	-ɟi	/ [+Passive]	(Word Level)
	+Passive	↔	[c.g.] (-ʔ)	$/V_{[\text{-back}]}$——	(Word Level)
	+Ventive	↔	-un		(Stem Level)
	+Instrumental	↔	-r(i)		(Stem Level)
	+Passive	↔	-L		(Word Level)
	+Itive	↔	-L		(Word Level)
	+Instrumental	↔	-L		(Word Level)
	+Ventive	↔	-L	/ [+Passive]	(Word Level)

Redundant storage of complex units is of course one of the major design features of stratal models such as Lexical Phonology and Morphology and Stratal Optimality Theory (see Bermúdez-Otero 2012 for recent discussion). The approach used here simply extends this option from complex stems and words to affix combinations. The added value of this move is of course that lexicalized combinations may have idiosyncratic properties not predictable from their constituents (for example the meaning of [original] is not the compositional result of [origin] and adjectivizing -[al]). This allows us to capture the fact that -[we-ʔ-i] as a whole is a Stem Level object, whereas [-we] is Word Level. (96) shows the derivation of a Passive Ventive Instrumental in comparison to the form without Instrumental:

(96) *Passive Ventive (+Instrumental): Bisyllabic H-root*



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