The subtonal structure of Shilluk nouns

Surname, Name (Affiliation)

In Shilluk (Western Nilotic, South Sudan), a tonal suffixation analysis of nominal inflection is challenged by the fact that there is no clear morphological base for nouns and that grammatical tone effects are not always constant for a given category. I show that both of these problems for the concatenative analysis disappear if one decomposes tone into an internally structured set of subtonal features, and that tones may be underspecified in various ways.

Keywords: Shilluk, subtonal features, grammatical tone, floating tones, underspecification

1 Introduction and data

Shilluk is a Western Nilotic language spoken in the Upper Nile state of South Sudan. The data I analyse in this article were collected by Bert Remijsen and his native speaker co-author Otto Gwader Ayoker (RA followed by year of publication). In the following subsections, I provide a short overview of the Shilluk tonal system and nominal

inflectional paradigms, and highlight the challenges that form the empirical core of this contribution.

1.1 Shilluk tone

Unlike most languages it is related to, its tonal system contrasts the three tonal heights L(ow), M(id) and H(igh) (Gilley 1992; Remijsen *et al.* 2011). On heavy syllables (i.e. CV(ː)C, (C)Vː), these level tones can combine to form two classes of contour tones: the falling contours HM, HL and ML, as well as the rising contours LH and MH (Remijsen & Ayoker 2018). Three additional contour tones are found, whose distribution is limited to morphologically derived environments: the late-aligned HL and ML falls, which I notate HXL and MXL, respectively, and the falling-rising HLH (Remijsen & Ayoker 2019, 2021).

1.2 Nominal inflection in Shilluk

Shilluk nouns are highly restricted in shape. The lexical CV(ː)C root may appear together with a prefix, a suffix, both a prefix and a suffix, or alone. Grammatical tone alternations in nominal inflection affect the nominal stem, a mono- or bisyllabic constituent which excludes prefixes.

(1) The inflectional paradigm of Shilluk nouns

Inflection	Tonal pattern	Form	Gloss	
BF		ɡwok^{ML}	‘dog’	RA19: 13
PERT.SG	MOD	ɡwoːːk^{HM} twɔːŋ^{H}	‘Twong’s dog’	RA19: 13
CS		ɡwoːːŋ^{HM} dwɔːŋ^{HL}	‘a big dog’	RA19: 14
PERT.PL		ɡwoːːk^{H} mʌːn^{H}	‘the women’s dog’	RA19: 13
PROX		ɡwoːːŋ^{HXL}	‘this dog’	RA19: 15
APL		ɡwoːːk^{H}	‘assoc. of the dog’	RA21: 60
VOC		ɡwok^{MH}	‘dog!’	RA21: 71

The inflectional paradigm of Shilluk nouns is illustrated above in the table in (1). In addition to their base form (BF), which is used in isolation as well as in the context of modification by numerals, Shilluk nouns inflect for possession (PERT.SG, PERT.PL), modification by a clausal-like element (CS), proximal deixis (PROX), associative plurality (APL) and direct address (VOC). Tonal alternations align with these categories, but collapse the PERT.SG and CS categories together into an alternation which I henceforth refer to as the MOD alternation.

1.3 Challenges and how to account for them

As illustrated in the table in (1), the tonal alternations involved in the inflection of Shilluk nouns all target the right edge of the noun, and are in principle amenable to a tonal suffixation analysis. This being said, it is not immediately clear which form these tonal suffixes would be attached to. First consider the BF datapoints laid down in the table in (2) below.

(2) The BF: preservation and neutralization of underlying contrasts

		BF		MOD	Gloss	
a.	a-boːːp-ɔ	-H.L	a-bom-ɪ	-HM.M	‘ambatch’	RA19: 38
	rʌːːt-ɪː	H.M	rʌn-ɪ	HM.M	‘radio’	RA19: 42
	dɔːːr-ɔ	H.H	dɔːr-ɪ	HM.M	‘axe’	RA19: 38
	tul-ɔ	HL.L	tul-ɪ	HM.M	‘owl’	RA19: 39
	ɟaːːk-ɔ	HM.M	jaːŋ-ɪ	HM.M	‘chief’	RA19: 39
b.	kwot	ML	kwoːːt	HM	‘shield’	RA19: 40
	tɔk	ML	tɔk	ML	‘edge’	RA19: 40

For the nouns in (2-a), the MOD inflection neutralizes contrasts realized in the BF. The nouns in (2-b) display the reverse pattern: their MOD tonal shapes differ from one another, but their BF is identical. Since the BF both preserves and neutralizes tonal contrasts between nouns, it cannot qualify as the underlying form of nouns. The first empirical

challenge I address in this contribution is the representation of the underlying tonal specifications of Shilluk nominal stems. More concretely, I argue that Shilluk nominal stems may be tonally underspecified, and that this underspecification may come about in two ways: ① via TBU underspecification, i.e. tonelessness (2-a), and ② defective tonal representations (2-b). In the absence of any grammatical tone, these tonally underspecified representations are subject to default tonal realization requirements, which derive the BF.

The second empirical challenge I address in this contribution is the representation of the grammatical tone categories which themselves undergo tonal alternations. Consider the MOD and APL datapoints laid down in the table in (3) below.

(3) The MOD and APL: natural class behaviour for tones

		BF		MOD	APL	Gloss	
a.	bɔːːt̪-ɔ	L.L	bɔː(ː)t̪-ɪ(ː)	L.L	L.M	'craftsman'	RA19/21: 37/63
	paːːl-ɔ	ML.L	pal-ɪ	ML.L	–	'knife'	RA19: 26
	tul-ɪ	ML.L	tul-ɪː	–	ML.M	'owls'	RA21: 64
b.	djeːːr-ɔ	M.M	djeːr-ɪ	M.M	–	'truth'	RA19: 41
	taːn-ɔ	M.M	taːn-ɪː	–	M.M	'roof'	RA21: 63
	ɟaːːk-ɔ	HM.M	ɟaːŋ-ɪ/ɟaːːk-ɪː	HM.M	HM.M	'chief'	RA19/21: 39/63
	dɔːːr-ɔ	H.H	dɔːr-ɪ	HM.M	–	'axe'	RA19: 38
c.	wut-ɔ	ML.H	wut-ɪ	ML.L	–	'ostrich'	RA19: 42
	ɲʌːːl-ɔ	ML.H	ɲʌːːl-ɪː	–	ML.H	'python'	RA21: 63
d.	tul-ɔ	HL.L	tul-ɪ	HM.M	–	'owl'	RA19: 39
	cɔl-ɔ	HL.L	cɔl-ɪː	–	HM.M	'Shilluk'	RA21: 63
	goːːc-ɪː	H.M	goːɲ-ɪ/goːːc-ɪː	HM.M	H.M	'machete'	RA19/21: 26/64

In bisyllabic stems, the suffix tone alternates between M and L for MOD, and H and M for APL. In both MOD and APL, tones are grouped into phonological classes: MOD surfaces as L only after L (3-a), and APL as M after L and M (3-a,b). Moreover, H-initial stems share

the resulting grammatical M over both of their syllables (3-b,d). I analyse MOD and APL as underlyingly M and H, respectively, and propose to unify the alternations they undergo in terms of a featural decomposition of tone: tone lowering (3-a,b) and tone sharing (3-b,d) are both used to satisfy phonological output requirements on a low register feature, which both L and M possess. I also argue that the seemingly idiosyncratic behaviour of MOD in the context of ML.H nouns (3-c) and APL in the context of H.M nouns (3-d) directly follows from the defective tonal representations required to derive the BF facts.

The remainder of the paper is structured as follows: in section 2, I present the theoretical assumptions I use to represent Shilluk tone and morphological structure. In section 3, I illustrate how the proposed tonal representations derive the facts outlined in tables (2) and (3). Section 4 concludes.

2 Theoretical assumptions

In this section, I present the theoretical devices which underlie my analysis of Shilluk tone. I first discuss the representational model I use to decompose tone into subfeatures, before turning to some crucial assumptions about the phonology-morphology interface.

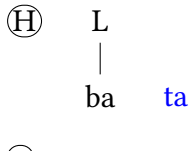
I represent tone using Register Tier Theory (Snider 1999), which combines a decomposition of tone into two subfeatures with the geometrical principles of autosegmental representations (see e.g. Yip (1980) for an early argument in favour of such a decomposition). In this theory, tone is decomposed over three autosegmental tiers: the register tier, which hosts the register features l(ow) and h(igh); the melody tier, which hosts the melody features L(ow) and H(igh); and the tonal root node tier, which mediates the association between subtonal features and T(one-)B(earing-)U(unit)s. A fully specified tone combines all three elements, yielding a maximally four-way contrast in (full) specification:

(4) Tone in Register Tier Theory

I assume that Shilluk [L], [M] and [H] respectively correspond to {L,l}, {H,l} and {H,h}. I also assume that each of these tonal subcomponents can appear floating, i.e. unassociated, and that tonal root nodes may be underspecified with respect to any subtonal feature.

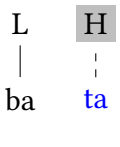
I analyse all grammatical tone in Shilluk nouns as tonal suffixation, in line with the Concatenativist Hypothesis (Bye & Svenonius 2012). In addition to that, I assume that the phonology's access to morphosyntactic information is restricted to knowing the morphemic affiliation of autosegments, which is encoded in the form of morphological 'colours' (van Oostendorp 2006). Morphological colours are a phonological object which provides a way to distinguish between monomorphemic (single colour) and multimorphemic (multiple colours) representations, as well as between underlying (coloured) and epenthetic (colourless) material.

(5) Morpheme boundaries



/Ⓗbà-ta/

(6) Epenthetic material



/bà-ta/ → [bà-tá]

The toy representation in (5) exemplifies a bimorphemic sequence. The first exponent is made up of the sequence /ba/, an associated L and a floating H, since all three elements bear the same colour. The second exponent solely consists of the sequence /ta/, since it is the only element to bear that colour. Since colours encode morphological *affiliation* rather than *identity*, the notation Ⓗbàta is equivalent to that used in (5), thereby preventing morphosyntactic features from influencing the phonology. The toy representation in (6) illustrates the shaded box notation used to denote epenthetic material.

3 Analysis

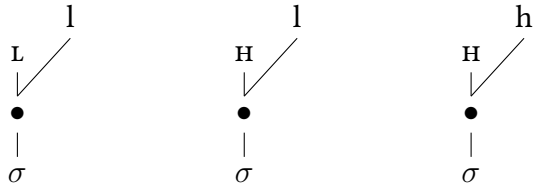
In this section, I present an analysis of the underlying representation of tone in Shilluk nominal stems before illustrating how they help provide an account of the tonal shapes found in the BF (§3.2), the APL (3.3) and the MOD (3.4). (Add a sentence on cyclicity)

3.1 The UR of nominal stems

I propose that the mono- or bisyllabic nature of a nominal stem is an inherent property of the root it contains. Accordingly, stems are either represented with one (σ) or two ($\sigma\sigma$) syllabic nodes.

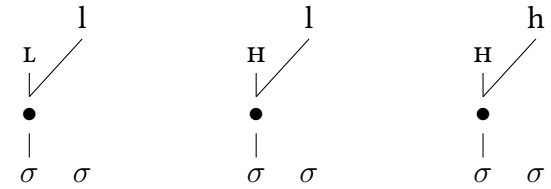
Monosyllabic stems which surface as [L], [M] and [H] are straightforwardly represented as in (7) below.

(7) Monotonal roots, monosyllabic stems



Their bisyllabic counterparts can be analysed in a similar fashion, except that their second syllable is underlyingly toneless. This is illustrated below in (8).

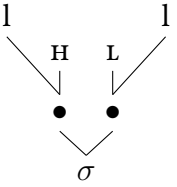
(8) Monotonal roots, bisyllabic stems



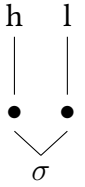
Root syllables can also accommodate contour tones, which I represent as a sequence of two tonal root nodes associated to the same syllabic TBU. Importantly, these tonal root nodes may be partially specified, a possibility I use to represent the underlying contrast

between nouns like tɔk ‘edge’ and kwot ‘shield’, both of which surface as ML in the BF (2-b).

(9) ‘edge’: full specification



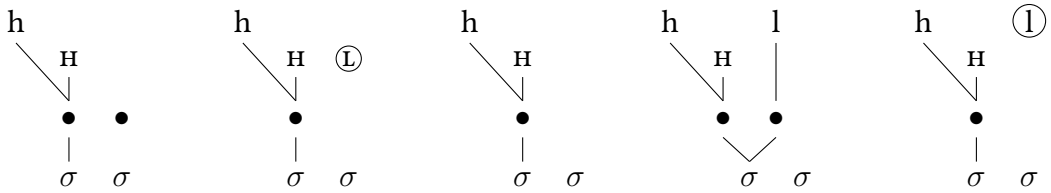
(10) ‘shield’: •-underspecification



More concretely, I propose in (10) that nouns that belong to the ‘shield’ type differ from those that belong to the ‘edge’ type by having tonal root nodes that lack an underlying specification for melody features.

Full tonal realisation requires subtonal features to be associated to a tonal root node, and for that tonal root node to be itself associated to a syllabic TBU. Importantly, association between the relevant tiers may be partially specified, a possibility I use to represent the underlying contrasts between the various types of H-initial stems in the language, all of which surface differently in the BF (2-a).

(11) Underlying contrast, neutralization in inflection: the H-initial stems (2-a)



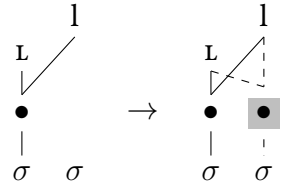
More concretely, I propose in (11) that tonal root nodes (H.L), melody features (H.M) and register features (HM.M) may be underlyingly floating.

To summarize this section, I propose that Shilluk nominal stems are generally only partially specified at the underlying level, and that the tonal underspecification they display can be further categorized into three types: ① TBU tonelessness (bisyllabic stems); ② underspecified tonal root nodes (‘shield’ type, HL.L); and ③ floating autosegments (H.L, H.M and HM.M).

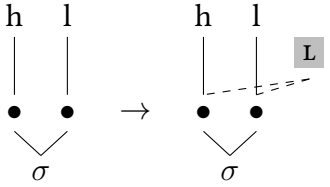
3.2 The BF: contextual epenthesis

The BF is phonologically derived from the UR of the stem. Accordingly, no additional exponent is introduced, and the relevant phonological representation is monomorphemic. From the standpoint of the URs I have proposed for Shilluk stems, the BF satisfies a requirement that TBUs have a fully specified tone in the output. Fully specified syllables as in (7) already satisfy this requirement, and no further alterations are required. Partially specified syllables must be altered in order to fulfill this requirement, and the type of underspecification they exhibit dictates how this is to be achieved.

(12) [L.L]: •-epenthesis

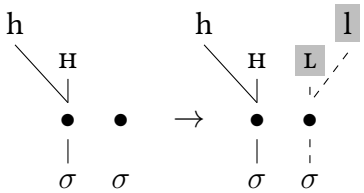


(13) 'shield' type: L-epenthesis

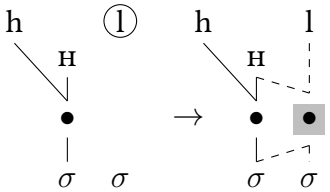


Full specification of toneless syllables as in (12) require it to associate to a •. Spreading of the already available • would amount to tautomorphemic spreading, a configuration ruled out for Shilluk and otherwise dispreferred cross-linguistically (Wolf 2007). •-epenthesis therefore applies and allows for featural spreading, since epenthetic material is colourless (i.e., non-tautomorphemic). Full specification of underspecified •'s as in (13) simply requires epenthesis of the default value of the missing feature, which I take to be L/l.

(14) [H.L]: docking



(15) [HM.M]: double docking



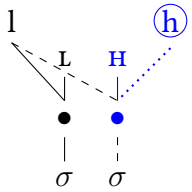
The integration of a floating element also depends on its type. A floating subtonal feature as in (15) requires •-epenthesis and additional feature spreading to ensure full specification. A floating • as in (14) requires featural epenthesis since tautomorphemic

spreading is ruled out. Since the • in (14) bears the same colour as both available TBUs, •-integration and avoidance of tautomorphemic association clash, a situation which the phonology resolves by producing (minimal) tautomorphemic association. By virtue of being epenthetic, the • in (15) escapes these considerations and docks in a way that also satisfies a phonological requirement on register-l, namely that it be shared between adjacent syllables. This output requirement on l also plays a role in the analysis of APL and MOD, to which I turn in the following subsections.

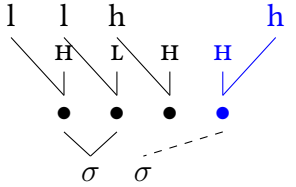
3.3 The APL: floating H

The APL is morphologically derived from the UR of the stem. As such, it combines the stem with a tonal suffix which I analyse as a floating H tone.

(16) /Lσ + Ⓗ/ → L.M



(17) /MLHσ + Ⓗ/ → ML.H

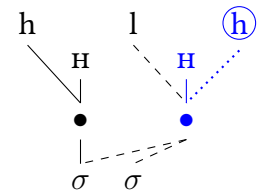


Association of the tonal affix to the available toneless syllables ensures that all syllables are specified for tone and that •'s are properly integrated within the prosodic structure. I analyse the H ∼ M alternation described in (3) as register spreading, which the presence of more than one colour enables. In (16), adjacency on both the tonal and syllabic tiers allows the stem register-l, which both L and M possess, to spread onto the APL syllable to satisfy the l-sharing requirement, correctly producing an M-toned suffix syllable (recall 3-a,b). In (17), adjacency on the tonal tier is not met, as a H intervenes between the stem register-l and the APL suffix, and no spreading occurs, correctly producing H (recall 3-c).

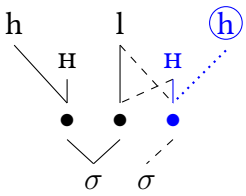
Nouns whose BF is HL.L, HM.M or H.M all surface with an M-toned suffix syllable in the APL, but different outcomes are found for their root syllables: the HL.L and HM.M nouns display a HM root syllable in the APL, whereas the H.M nouns display a H root

syllable in the same context. This contrast follows from the URs I proposed in section 3.2, as illustrated below.

(18) APL HM.M

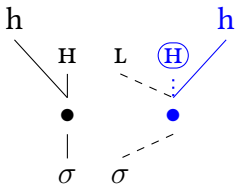


BF: [HM.M]



BF: [HL.L]

(19) APL H.M



BF: [H.M]

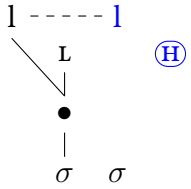
As proposed in (11), the UR of the nouns that surface as HM.M or HL.L in the BF contains a l, whereas that of the nouns that surface as H.M only contains a L. In (18), this l is subject to the sharing requirement, which is either enforced by feature spreading (BF: HL.L) or •-sharing (BF: HM.M). In (19), the floating L associates to the APL suffix, and no further operation is required since no l is present in the representation. This means that Shilluk [M] must represent the phonetic neutralization of the two phonologically different tones {H,l} and {L,h}, a state of affairs which has also been reported for Northern Mao (Ahland (2012); Omotic, Ethiopia), Supyire (Carlson (1994); Senufo, Mali) and Gaahmg (Trommer (2021); Eastern Jebel, Sudan).

To summarize, I analyse the APL tonal shape as the morphological combination of a nominal stem with a floating H-suffix. I explain the H ∼ M alternation that this suffix undergoes with subtonal spreading/docking of l/L, and show that further idiosyncrasies of the APL follow from the URs I proposed for nominal stems.

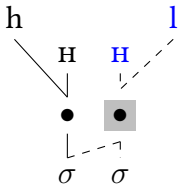
3.4 The MOD: disjointed, floating M

The MOD is morphologically derived from the UR of the stem. As such, it combines the stem with a tonal suffix which I analyse as the combination of two independent subtonal features, a floating l and a floating H.

(20) After l: subtonal fusion



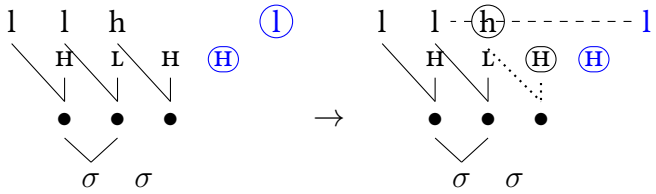
(21) After h: •-epenthesis



Since the MOD suffix does not introduce a • of its own, it must rely on already available structure to be realized. Assuming that exponent realization simply requires an element of each input colour to be present in the output, realization of MOD would be ensured even if ① only l associates, or ② only H associates. In (20), MOD appears after L, i.e. an l-containing tone. Minimal compliance with the affix realization requirement only forces one of the floating subtonal features to associate to the base, and from that perspective, l and H compete for realization. I suggest that Shilluk prioritizes association of l, which manifests here as subtonal fusion after another register-l. This means that after L or M, the suffix syllable agrees with the root syllable tone, correctly deriving (3-a,b). In (21), MOD appears after H, i.e. a h-containing tone. Since l-integration cannot proceed via subtonal fusion, the grammar resorts to •-epenthesis, which also allows for H-association. Just as was the case for the APL, the l-sharing requirement between adjacent syllables is complied with via •-sharing. This means that after H, the suffix syllable is M-toned, correctly deriving the facts for dɔ::r-ɔ ‘axe’ (3-b).

Unexpected at this stage is the fact that nouns whose BF is ML.H surface as ML.L in the MOD, especially since ML.M is a possible output, as evidenced by the APL shape of ML.L nouns (3-a). I propose that this effect is due to the creation of an unpermissible sequence of register features upon morphological concatenation of these nouns with the MOD suffix.

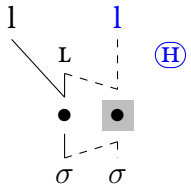
(22) The unexpected behaviour of [ML.H] nouns (3-c)



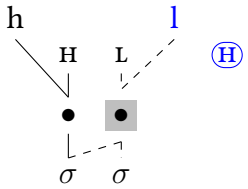
As shown in (22), the concatenation of a BF ML.H noun with the MOD suffix results in an l-h-l sequence on the register tier, which is otherwise unattested in Shilluk words. I suggest that this is because Shilluk exhibits some form of tonal plateauing, which eliminates the tone that intervenes between the two l's and provides the context for subtonal fusion of MOD l with the stem-l.

Also unexpected at this stage is the fact that the representations in (20) and (22) leave the suffix syllables toneless. Full tonal specification of that syllable in the context of the MOD would require systematic •-epenthesis, which would produce incorrect results with respect to the suffix syllable tone. To see why that is, consider the representations below:

(23) BF [L.L]: ✔



(24) BF [H.M]: ✘



Under this analysis, full specification of the suffix syllable if the epenthetic • associates to both a register feature and a melody feature. In (23), L and H therefore compete for association to the epenthetic •. Since nouns whose BF is L.L appear as L.L in the MOD (3-a), this would indicate prioritization of L-association over H-association. In (24), since the same configuration is manifested, the expected MOD shape would be HL.L, which is incorrect (3-d): the attested outcome is HM.M, suggesting that H-association was given priority over L-association. I take this to mean that in computing the MOD tonal shape, full tonal specification of syllables comes in as a side effect to more pressing phonological demands. The conflicting requirements of the MOD and the BF with respect to the full specification of TBUs can be solved with a step-wise phonological derivation: the MOD

would be assigned to an early cycle where full tonal specification is not required, and the BF, to a later cycle where full specification would be required.

To summarize, I analyse the MOD tonal shape as the morphological combination of a nominal stem with a "disjointed" suffix made up of a floating l and a floating H. I explain the M ∼ L alternation that this suffix undergoes with the prioritization by the grammar of l-association over H-association, and suggest that the phonological differences between the MOD and the BF are best captured in terms of a multi-step phonological derivation.

Conclusion

Shilluk nouns display grammatical tone effects in their inflectional paradigm that systematically target their right edge, suggesting that a tonal suffix analysis might be on the right track. I identified two empirical challenges that this approach would have to overcome: first, the morphologically simplest form of their paradigm, the BF, also appears to be derived; and second, the grammatical tone effects for a given morphological category are not uniform throughout, as evidenced by the MOD and APL inflections. In this paper, I showed that both of these problems for the tonal suffix analysis are amenable to the same representational solution: the decomposition of tone into a register feature, a melody feature and a tonal root node, and the various ways in which this fine-grained structure can come to be phonologically underspecified. I also suggested that additional phonological properties of the Shilluk facts support the idea that the phonological computation must proceed in a step-wise, cyclic fashion.

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