Outermost wins in Dinka tone*

Coppe van Urk, QMUL

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1 A possible generalization about replacive tone

Dinka (South Sudan) displays a complex system of grammatical tone, as demonstrated in Table 1 for Agar Dinka (Andersen 1992):

Table 1. Agar Dinka tonal morphology across verbal paradigms.

	Transitive	Centrifugal	Centripetal	Applicative	Appl. antipassive
UNM	L	H/F	L	H/F	H/F
1/3SG	L	H/F	L	H/F	H/F
1/2/3PL	H/L	H/F	L	H/F	H/F
NF	H/L/F	H/F	L	H/F	H/F
NTS	H	H	H	H	H
2SG	H/L/F	L	H	L	L
PASS	H/F	F	F	F	F
PASS:CT	F	F	F	F	F

L = low, H = high, F = falling (Agar Dinka; Andersen 1992)

- ▷ A large number of morphological categories appear to be marked by tonal alternations. As evident in Table 1, this tone often ***varies*** across morphological category or root class.
- ▷ As a result, it's difficult to establish the logic of grammatical tone and even what the **underlying tones of verbs are (if any)** (e.g. Andersen 1992 et seq. vs. Trommer 2022).

1.1 Outermost wins

- ▷ An influential claim about grammatical tone is that the **outermost replacive tone wins out** (Inkelas 1998; Alderete 2001; Rolle 2018).
- ▷ In Hausa, for example, the ventive imposes an **all-H melody**, and the imperative **replacive LH**. In the ventive imperative, the demands of the outer imperative suffix win out:

(1) *Hausa ventive imperative:*
nè:mó: 'seek.VEN.IMP' (Newman 2000)

- ▷ Rolle (2018) argues at length for the outermost generalization for replacive tone. Its validity is a key factor in distinguishing theories of grammatical tone.[1] And, as discussed by Kalin and Weisser (2022), outermost wins is an argument for the **bottom-up cyclicity of insertion**.

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[1]See also McPherson (2014) and McPherson and Heath (2016) on the role of c-command in replacive tone.

1.2 Trommer's challenge: A three-way division of Dinka tones

Trommer (2011, 2022) argues that Dinka provides **evidence against that the outermost can lose out in replacive tone**. He conceptualizes the pattern in Table 1 as in Table 2:

Table 2. Trommer's (2022) proposal, for one transitive root class CVC.

	Transitive	Centrifugal	Centripetal	Applicative antipassive
UNM	L	H	L	F
1/3SG	L	H	L	F
1/2/3PL	H	H	L	F
NF	F	H	L	F
NTS	H	H	H	H
2SG	L	L	**H**	L
PASS	**H**	F	F	F
PASS:CT	F	F	F	F

Trommer divides morphological categories into three classes:

- ▷ **"Weak" inflectional tones (UNM, 1/3SG, 1/2/3PL, NF), not boxed:** These inflectional categories determine tone in the basic transitive, but are overwritten by derivational tones.
- ▷ **Derivational tones (CF, CP, APPL), in vertical box:** These categories overwrite weak inflection, but not strong inflection.
- ▷ **"Strong" inflectional tones (NTS, 2SG, PASS), in horizontal box:** These categories overwrite derivational tones (two irregular forms bolded).

⇒ Trommer (2022): different constraints may favor different tones. CONTIGUITY forces overwriting by circumfixal tones, but a constraint on gapped association favors innermost tones.

Could we make different assumptions about height?

- ▷ No. Derivational morphemes are definitely lower than inflectional morphemes! In auxiliary+verb constructions, **inflection is on the auxiliary** (with the exception of NF), while **derivational tones remain on the verb**:

(2) *Applicative morphology on the verb, NTS on auxiliary:*
Mariàal à-cẹ̀ **bḭ́i** d̪á̤aŋ-dè mèt̪ **t̪áat** tìik.
Marial D-NEG FUT.NTS boy-3s child beat.APPL.NF woman
'Marial's boy will not beat the child for the woman tomorrow.'
(Agar Dinka; Andersen 1992:7)

- ▷ Also, in the domain of vowel grades (vowel fronting/vowel lowering), "weak" inflection like the 1SG *does* win out over derivational morphology!
- ▷ And, finally, it seems odd to think 1SG and 3SG attach in a different location than 2SG.

A novel analysis of Dinka tone

Key insight: A number of forms in Table 1/2 are **independently irregular**.

- ▷ *The problem of underlying tone:*
  In regular forms, there is **one recurring pattern of root-based variation**: H or F tone. These are the "basic" tones of verbs, reflecting an H tone aligned with the first mora.
- ▷ *"Weak" inflection:*
  "Weak" inflection in regular forms is exponed by an L tone. I propose that the L tone is the exponent of the transitive paradigm, and not of different inflectional categories.
- ▷ *Profile of grammatical tone:*
  In this view, the paradigm in Table 1 only reflects a handful of tonal morphemes, all of which impose a **consistent overwriting tone**, with the **outermost affix winning** in cases of competition (in accordance with Rolle 2018).

2 The default tone of Dinka verbs

A new proposal for basic tone:

- ▷ Particularly in the transitive paradigm, a number of forms are **independently irregular**.
- ▷ In fully regular verbal forms, there is **one recurring pattern of variation by root class**: H tone alternating with F tone. These reflect the basic tones of verbs!

Why are there no L-toned verbs?

- ▷ "Underlying" tone reflects the realization of a *v* head as an H tone. But this H tone must associate with the first mora.
- ▷ Functionally, this morpheme provides a consistent demarcation of the monosyllabic stem domain (Albright 2004).

2.1 Two tonal profiles for morphological categories

1. **Consistent tone**
   A number of morphological categories display the same tone across verb classes:
   - ▷ *Strong inflection:*
     H (NTS), F (PASS), L (2SG)
   - ▷ *Derivation:*
     L (CP)
   - ▷ *Weak inflection:*
     L (UNM, 1SG, 3SG), H/L depending on mora count (1/2/3PL)
2. **Root-based variation**
   Other morphological categories display a different tone across verb classes, with two classes of short verbs (CVC_1 and CVC_2), and two classes of long verbs ($CVVC_1$ and $CVVC_2$):
   - ▷ *Strong inflection:*
     none
   - ▷ *Derivation:*

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
Centrifugal	H	F	H	F
Applicative	H	F	H	F
Applicative antipassive	F	F	H	F

   - ▷ *Weak inflection:*

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
NF	F	L	H	F
2SG in basic	L	L	H	F
PASS in basic	H	H	H	F

What is the basic tone of Dinka verbs?

2.2 The problem of irregular forms

Problem: Some categories with root-based variation are **independently irregular**, in that a regular exponent is found across derivational paradigms, but is **absent** in the transitive.

- ▷ Andersen (1992) identifies the **non-finite as the underlying form**, because it displays an unpredictable tonal pattern in the transitive (F or L on short verbs, H or F on long verbs):

(3) **NF transitive across verb classes:**

Verb	**NF transitive**	**Meaning**
wec	wêec	'kick'
teŋ	tèeŋ	'dust'
leer	lêeer	'roll'
teem	téeem	'cut'

(Agar Dinka; Andersen 1992:28–29)

- ▷ But (3) is an irregular exponent of the NF form. Across derivational paradigms, the non-finite is otherwise expressed by **vowel lowering** and no tonal effect:

(4) **NF transitive across verb classes:**

Verb	**NF centrif.**	**NF centrip.**	**NF appl.**	**NF AP appl.**	**Meaning**
wec	wɛ́ɛc	wɛ̀ɛc	wɛ̂ɛc	wɛ̌ɛc	'kick'
teŋ	tɛ̂ɛŋ	tɛ̀ɛŋ	tɛ̂ɛŋ	tɛ̌ɛŋ	'dust'
leer	lɛ̂ɛɛr	lɛ̀ɛɛr	lɛ̂ɛɛr	lɛ̌ɛɛr	'roll'
teem	tɛ́ɛɛm	tɛ̀ɛɛm	tɛ̂ɛɛm	tɛ̌ɛɛm	'cut'

(Agar Dinka; Andersen 1992:28–29)

Problems with Andersen's proposal:

1. As shown above, the nonfinite form of the basic transitive is **irregular**, so not a great candidate for the underlying form.
2. As Trommer notes, the nonfinite form is **morphologically marked** (by lengthening), so not obviously a default form.
3. **No clear reason** why the tones would be distributed across short and long verbs in this pattern.

2.3 A recurring root-based pattern

Trommer's (2022) alternative:
Dinka roots only permit simplex tones H or L underlyingly.

Advantages:

- ▷ Reasonable to think roots may avoid marked qualities, like complex tones (e.g. Dinka roots are not overlong underlyingly).
- ▷ An explanation of why there are four verb classes.

⇒ **A worry:** No morphological category displays this pattern.

A generalization about root-based variation
I identify a novel generalization about root-based variation. Consider the attested patterns of root-based variation, with forms that display irregularity highlighted in gray:

Derivation:

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
Centrifugal	H	F	H	F
Applicative	H	F	H	F
Applicative antipassive	F	F	H	F

Weak inflection:

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
NF	**F**	**L**	H	F
2SG in basic	**L**	**L**	H	F
PASS in basic	H	**H**	H	F

(gray = these forms show irregularity in affix, vowel quality, or length)

Two observations:

1. The only pattern of root-based variation in regular forms and long verbs across the board is the **alternation between H and F tones in the centrifugal and applicative**.
2. Strong inflection never shows root-based variation.

My proposal
Both observations are explained if the tonal pattern found in the centrifugal and applicative reflects underlying tones of verbs:

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
Centrifugal, applicative	H	F	H	F

2.4 High and falling as underlying tones

A schematic representation of this proposal across root classes is in Table 3:

Table 3. Current proposal for Agar Dinka, across root classes.

	Transitive	Centrifugal	Centripetal	Applicative	Appl. antipassive
UNM	L	H/F	L	H/F	H / F
1/3SG	L	H/F	L	H/F	H / F
1/2/3PL	H/L	H/F	L	H/F	H / F
NF	H/L/F	H/F	L	H/F	H / F
NTS	H	H	H	H	H
2SG	H/L/F	L	H	L	L
PASS	H/F	F	F	F	F
PASS:CT	F	F	F	F	F

Advantages:

- ▷ **Robustly attested:** At least five morphological categories are marked by (part of) the H-F pattern. Long verbs in the irregular non-finite, 2SG, and passive also display the right tones.
- ▷ **Root-based variation explained:** All morphological categories that display regular root-based variation are **toneless** (I return to the PL forms below).

Consistent tone is tonal overwriting

- ▷ Setting aside weak inflection for now, categories that trigger tonal overwriting **are the only morphological categories that contribute tone** (NTS, 2SG, PASS, centripetal, antipassive).
- ▷ Overwriting within these follows a simple logic: inflection beats derivation, or, in other words, **outermost wins**.

2.5 Underlying tones as edge marking

But why are there no low-toned verbs?

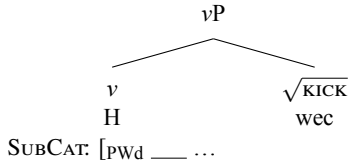
Proposal: Agar Dinka requires a **H tone to be aligned with the first mora of the verb**, and so only H and F tones are tolerated.

- ▷ I appeal to a *different source* of root exceptionality: some tonal effects may serve to **consistently demarcate a morphological domain** (Albright 2004). In Dinka, for example, obligatory coda consonants distinguish roots from functional material.
- ▷ This kind of effect is familiar from other tonal languages. In Bantu languages, many morphological categories sponsor an H tone in a fixed location in the "macrostem", often accompanied by H spreading.
- ▷ A similar effect is found with Shilluk verbs. Remijsen and Ayoker's (2022) classification of the most common root-based variation in transitive verbs can be understood if the final mora of the verb stem is aligned with an L tone.

How do we force left-alignment of an H tone?

Basic idea: The H tone as a realization of a categorizing head *v*.

(5)



- ▷ This morpheme comes with a **prosodic subcategorization requirement**, in the sense of Inkelas (1990) and Paster (2006), that aligns the H with the first vowel of the verb.
- ▷ The same restriction is absent in nouns (Ladd and Blum 2021; Van Urk and Sun 2021). (Also, in Shilluk, the verbal pattern appears in *inflected*, not bare, nouns (Ziegler 2024).)

3 Weak inflection as a transitive morpheme

What remains of the problem of weak inflection?

Table 4. Basic transitive paradigm across verb classes in Agar Dinka.

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$	
now	CVC_H	CVC_F	$CVVC_H$	$CVVC_F$	
UNM			L		*Weak inflection*
1SG			L		
3SG			L		
1/2/3PL	H	H	L	L	
2SG	**L**	**L**	H	F	*Irregular inflection*
NF	**F**	**L**	H	F	
PASS	H	**H**	H	F	
NTS			H		*Strong inflection*
PASS:CT			F		

(gray = these forms show some irregularity in vowel quality or length)

Two key observations:

- ▷ Weak inflection is predominantly characterized by a **consistent L tone**, in the 1SG, 3SG and UNM, and long PL verbs.
- ▷ The only exception is the H tone found in short PL verbs.

What if the basic transitive paradigm has an exponent?

> **Proposal:** "Weak" inflection reflects a **single L tone morpheme**, the realization of active Voice.

3.1 Weak inflection as transitive morpheme

I propose that **active Voice is realized as a floating L tone** when adjacent to *v*:

(6) $\text{Voice}_{\text{ACT}} \rightarrow \text{L} \; / \; \_\_\_ \; v$

- ▷ The L tone will **overwrite the root-based pattern**, because it is outermost
- ▷ The L tone will not surface in derivational paradigms, because derivational morphology **intervenes between Voice and *v***
- ▷ Voice morphology like the passive ends up on auxiliaries, and so this is compatible with the syntactic evidence for a higher locus for inflectional categories in (2).

Are there overt transitive suffixes in other Nilotic languages?

- ▷ In Lango, Noonan (1992:71) describes a **theme vowel** that is found on all transitive verbs (and some intransitives) and regularly deletes before suffixes.
- ▷ As (7) demonstrates, the theme vowel suffix *-o/ɔ* appears on transitives without suffixes, like the transitive infinitive, but deletes before the benefactive suffix *-ɪ*:

(7)

Transitive infinitive	**3SG benefactive**	**Meaning**
nèkk-**ò**	ò-nèkk-**ì**	'kill'
kèll-**ò**	ò-kèll-**ì**	'bring'
cwàll-**ò**	ò-cwàll-**ì**	'send'

(Lango; Noonan 1992:89)

- ▷ Reh (1996:189) identifies a similar suffix *-ɔ́* in Anywa associated with unsuffixed transitives.
- ▷ In Shilluk, the same suffix is analyzed by Remijsen and Ayoker (2022) as a marker of Object Voice, and by Ismael (2023) as an exponent of passive. Interestingly, it is dropped before arguments introduced by derivational morphology (Remijsen and Ayoker 2022:Ch. 1:3.3.2.4).

3.2 H-L alternation in the plural

One complication for this view arises before plural suffixes *-kụ̀/kạ̀/kẹ̀*. Long verbs carry the expected L tone before these suffixes, but **short verbs display an H tone**:

(8) **Plural forms in basic transitive.**

	CVC_H	CVC_F	$CVVC_H$	$CVVC_F$
	gʊ́t 'stab'	têŋ 'dust'	téem 'cut'	mîit 'pull'
UNM	gʊ̀t	tèŋ	tèem	mìit
1PL	gʊ́t-kʊ̀	téŋ-kʊ̀	tèem-kʊ́	mìit-kʊ́
2PL	gwʊ́t-kạ̀	táŋ-kạ̀	tɛ̀ɛm-ká	mjɛ̀ɛt-ká
3PL	gʊ́t-kẹ̀	téŋ-kẹ̀	tèem-ké	mìit-ké

Problem: These are active forms and the plural patterns like weak inflection (the H-L alternation is overwritten by derivational tones). We should see a uniform L tone!

What is the role of affix tone?

- ▷ I've ignored affix tone so far, like Trommer, because it is **predictable from the root tone**. There is an obligatory dissimilation pattern, with an L tone on the affix after an F tone.
- ▷ For the PL cases, I propose that the affix ***does* carry a tone**, specifically an underlying L on *-kụ̀/kạ̀/kẹ̀*.
- ▷ If so, my account predicts an L tone on the root (the exponent of $Voice_{ACT}$ in the transitive paradigm) and an L tone on the plural affix.

⇒ This configuration should trigger **obligatory dissimilation**.

What determines the outcome of dissimilation?

- ▷ **Stem tone is favored:** The root syllable is a prominent position in Dinka (Van Urk and Chong 2023), and I propose a high-ranked IDENTTONE faithfulness constraint indexed to this domain.[2] With long verbs then, the affix dissimilates to H.
- ▷ **No rise in short forms:** This idea predicts L-H in short forms too. But rising melodies are particularly susceptible to time pressure (Zhang 2001). I posit a high-ranked constraint *RISE($\sigma_\mu\sigma_\mu$) that penalizes an LH melody in such a form.[3]

[2] Exactly what to call this prosodic domain is not necessarily obvious. Since verbs in Dinka are maximally disyllabic, we could think of the initial syllable as an abstractly stressed syllable. An alternative would be to posit a morphological category Stem, which includes the root and nonconcatenative morphology, but excludes suffixes.

[3] Thanks to Laura McPherson for this suggestion. Andersen (1992:50–51) also suggests that the H tone in the short form as predictable from the CVC-CV shape, which is compatible with this idea.

4 Tone in a four-tone dialect

- ▷ To explain consistent L tone, Trommer's (2022) analysis posits L tone prefixes that overwrite H-toned roots because of **a ban on rising tone**.
- ▷ Blum (2023) provides a description of verbal morphology in Bor South, a **four-tone dialect with a rising tone**.

⇒ This dialect can distinguish between the two analyses. In line with the account developed here, Bor South "weak" inflection is still exponed by a **consistent L tone**.

4.1 The role of the rising tone in Trommer's analysis

- ▷ To get the consistent L tones in the transitive paradigm for Agar, **the absence of a rising tone in Agar Dinka** plays a key role in Trommer's (2022) analysis.
- ▷ He identifies weak inflection with **L tone prefixes**, which attach to both H and L tone roots:

(9) L- + $CVVC_H \rightarrow CVVC_L$
L- + $CVVC_L \rightarrow CVVC_L$

- ▷ **A ban on rising tones** in Agar blocks the realization of both the prefixal tone and the root tone. With low-toned roots, L+L is simplified to L.
- ▷ There is a prediction here that, in a dialect with rising tones, we would see LH alternate with L. But we don't! In Bor South, we see **the same L tones in the transitive**:

Table 5. Basic transitive paradigm across verb classes in Bor South (Blum 2023).

now	CVC_1 CVC_H	CVC_2 CVC_R	$CVVC_1$ $CVVC_H$	$CVVC_2$ $CVVC_R$	
UNM			L		*Weak inflection*
1SG			L		
3SG			L		
1/2/3PL	R	R	L	L	
2SG	**L**	**L**	H	R	*Irregular inflection*
NF	**F**	**L**	H	R	
PASS	**R**	R	**F**	R	
NTS			R		*Strong inflection*

(gray = these forms show some irregularity in vowel quality or length)

Bor South in my proposal:

- ▷ In Bor South too, **L tone is an exponent of the transitive paradigm**..
- ▷ Root-based variation in Bor South displays a different pattern with an alternation between **high and rising tones**.

- ▷ For Bor South then, I propose the **high and rising tones as the verb tones**, because H is aligned to the final mora of the monosyllabic verb instead of the first.
- ▷ Other than this, we see much the same profile of overwriting (though there are complexities in the derivational paradigms I do not fully understand yet!).

4.2 R-L alternation in the Bor South plural

Bor South displays different alternation in the plural forms of the basic transitive (10).

(10) **Plural forms in basic transitive in Bor South.**

	CVC_H dól 'roll up'	CVC_R dɔ̌k 'spin'	$CVVC_H$ míit 'pull'	$CVVC_R$ tɛ̌em 'pull'
UNM	dòl	dɔ̀k	mìit	tɛ̀em
1PL	dɔ̌l-kṵ	dɔ̌k-kṵ	mìit-kṵ	tɛ̀em-kṵ
2PL	dwɔ̌l-kạ́	dɔ̌k-kạ́	mjɛ̀ɛt-kạ́	tɛ̀ɛm-kạ́
3PL	dɔ̌l-kẹ́	dɔ̌k-kẹ́	mìit-kẹ́	tɛ̀em-kẹ́

- ▷ Instead of a H-L melody in the short roots, we see R on the verb and H on the suffix. So we see consistent H tone on the plural affix across verb classes.
- ▷ The idea of dissimilation explains this difference! In Bor South, rising tone is permitted on short syllables. As a result, a different response to *RISE($\sigma_\mu\sigma_\mu$) is possible: **H spreading** from the suffix into the root.

⇒ The four-tone dialect Bor South provides **independent evidence** for my approach to "weak" inflection in the transitive paradigm, including in the PL forms.

Conclusion

- ▷ This talk has presented a novel analysis of grammatical tone in Dinka, in which all root-based variation reflects the underlying tone of verbs. I attribute Dinka's verb classes to **an edge-aligned H tone on verbs**.
- ▷ I argued against the conclusion that derivational tones can overwrite inflectional tones, and suggested instead that apparently weak inflectional exponents reflect **an active Voice morpheme limited to the transitive paradigm**.
- ▷ This view is compatible with the generalization that the **outermost wins** in replacive tone (Inkelas 1998; Rolle 2018).

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Appendix 1: Deriving irregular forms

Let me be precise about how to derive irregular tonal exponents in Agar and Bor South. The forms are repeated in Table 6 and Table 7:

Table 6. Irregular forms of the transitive paradigm in Agar Dinka.

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
now	CVC_H	CVC_F	$CVVC_H$	$CVVC_F$
2SG	L	L	H	F
NF	F	L	H	F
PASS	H	H	H	F

Table 7. Irregular forms of the transitive paradigm in Bor South (Blum 2023).

	CVC_1	CVC_2	$CVVC_1$	$CVVC_2$
now	CVC_H	CVC_R	$CVVC_H$	$CVVC_R$
2SG	L	L	H	R
NF	F	L	H	R
PASS	R	R	F	R

Irregularity in these cells corresponds to the **absence of a regular exponent** (no lowering/fronting, no lengthening in the 2SG and passive, and no affix with the 2SG and passive).

What tone is predicted if the regular exponent is missing?

- ▷ 2SG: The 2SG should display an L tone across the board, the realization of active Voice. This is what we find in short verbs.
- ▷ PASS/NF: The passive and NF, though, are ***not*** predicted to show an L tone. The passive is a different voice and voice distinctions do not appear on non-finite forms, so we **predict default tones for verbs**. This prediction is held up in the long verbs.

Realization rules for irregular forms

- ▷ 2SG: I propose the 2SG has a zero allomorph in the transitive paradigm. For both varieties, tones on long verbs follow if there is also a zero allomorph of $\text{Voice}_{\text{ACT}}$ in this context:

(11) $\text{2SG} \rightarrow \varnothing$ / ___ $\text{Voice}_{\text{ACT}}$ *v*
$\text{Voice}_{\text{ACT}} \rightarrow \varnothing$ / 2SG ___ CVVC

- ▷ PASS: For the passive, it is sufficient to posit a zero allomorph in the transitive paradigm. With long verbs, we expect root-based variation. In short verbs, it is important to note that the passive is the only short form in which underlying tones are predicted to surface.

(12) $\text{Voice}_{\text{PASS}} \rightarrow \varnothing$ / ___ *v*

- ▷ To deal with short verbs in the NF, I posit irregular tonal allomorphs before particular root classes (in addition to an elsewhere zero allomorph before the root):

(13)

Agar			**Bor South**		
NF	→	∅ / ___ Root	NF	→	∅ / ___ Root
v	→	[___L] / ___ CVC_{Root}	*v*	→	[___L] / ___ CVC_{Root}