

The cycle in a syllable*

The *v*P phase in Dinka morphology

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1 Introduction

1.1 Cyclic spell-out in syntax and phonology

A key hypothesis in contemporary work:

Phasal computation explains both *syntactic locality* and *cycles in phonology/prosody*.

(E.g. Marvin 2002; Newell 2009; Embick 2010; Samuels 2012; Sande et al. 2020 a.o.;
At this conference: Sande, this morning, Fenger et al. & Newell, just now).

Focus today:

1. Are syntactic phases and morphophonological domains parallel?

- ▷ Considerable debate about which heads are phases exactly (*v*P, DP, PP, category-defining heads, and possibly Appl)
- ▷ Additional mechanisms sometimes suggested to account for apparent divergences (d' Alessandro and Scheer 2015; Cheng and Downing 2016; Fenger 2020)

2. Is there strict (phonological) phase impenetrability?

- ▷ Syntactic phase impenetrability delivers successive cyclicity, though these effects *could* derive from cyclic linearization (Fox and Pesetsky 2005; Davis 2020)
- ▷ At PF, phase impenetrability explains why **phonological processes fail to apply across some morpheme boundaries**, such as vowel deletion in Ojibwe:

(1) Vowel hiatus tolerated across phase boundary:

- a. name:-**ag** → name:-g
sturgeon-PL sturgeon-PL
- b. gi:-**a**:gam-ose → gi:-**a**:gam-ose
PST-snowshoe-walk PST-snowshoe-walk
(Ojibwe; Newell and Piggott 2014:332–333)

- ▷ But also processes that can apparently alter the content of lower domains (e.g. Lowenstamm 2010; Embick 2013)

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1.2 Cyclicity in Dinka nonconcatenative morphology

- ▷ Western Nilotic languages are well-known for rich systems of **nonconcatenative morphology within a monosyllabic root** (e.g. Andersen 1993 et seq; Reh 1996).
- ▷ Dinka (South Sudan) has extensive paradigms of verbal morphology, so that verbs routinely contain **multiple nonconcatenative morphemes**:

(2) Centripetal triggers breathy voice, 1SG vowel lowering:

Root	Centripetal (breathy voice + fronting)	1SG (lowering)	1SG centripetal (breathy voice + lowering)	Meaning
wèc	wè̤c	wè̤c	wè̤̤c	'kick'
bàr	b̤èr	bàar	b̤àar	'take along'
miit	m̤iit	m̤jèet	m̤jèet	'pull'

(Agar; Andersen 1993:28; Andersen 2017:12–13)

⇒ Many morphemes **are realized in the same place and via similar processes**. A great testing ground for the effects of cyclicity!

- ▷ In addition, there is detailed work investigating syntactic phase boundaries in Dinka (Van Urk 2015, 2018; Van Urk and Richards 2015; Keine and Zeijlstra 2023).

Contributions of this talk:

1. Do syntactic phases correspond to PF domains?

Answer: Yes!

- ▷ Syntactic diagnostics line up with a well-known distinction between **inner and outer morphology** in Western Nilotic.
- ▷ Templatic restrictions and tonal allomorphy show the root + inner morphology is a **locality domain**, providing evidence for a **clause-internal phase**.

2. Can we find any evidence of phase impenetrability?

Answer: A little, but mainly no!

- ▷ Inner and outer morphemes trigger the **same processes of nonconcatenative morphology**, altering vowel quality, length, tone
- ▷ At the same time, some phonological properties (voice quality) are **fixed** in the inner domain (the *v*P phase).

⇒ In Dinka, phonological material remains accessible to outer morphemes.

2 Successive cyclicity and the vP phase

Van Urk (2015, 2018) & Van Urk and Richards (2015):

Two morphosyntactic effects diagnose a clause-internal phase.

1. Movement **satisfies the V2 property** of each intervening verb:

(3) Yè **ḡ** cǐi Áyèn [vP cḡok [céem Ból]]?
 be.3SG what PRF.OV Ayen.GEN make.NF eat.OV Bol.GEN
 ‘What has Ayen made Bol eat?’

2. Movement leaves a **copied pronoun kḡek** before intervening verbs:

(4) Yè **kḡc-kò** yǐi Ból [vP **kḡek** luḡeel è cǐi Áyèn [vP **kḡek** tǐi]]?
 be.3SG people-which be.OV Bol.GEN 3PL say.NF C PRF.OV Ayen.GEN 3PL see.NF
 ‘Which people is Bol saying that Ayen has seen?’

2.1 V2 in the verb phrase

- ▷ Dinka is a Western Nilotic language (South Sudan). Van Urk (2015, 2018) and Van Urk and Richards (2015) argue for a **vP phase**, with data from Dinka Bor.
- ▷ Dinka has clause-level verb-second: the highest verb/auxiliary obligatorily moves to second position.

(5) *Clause-level verb-second in Dinka:*

- a. **Ayén à-cám** cuḡin nḡ pǎal.
 Ayen 3s-eat food P knife
 ‘Ayen is eating food with a knife.’
- b. **Cuḡin à-céem** Áyèn nḡ pǎal.
 food 3s-eat.OV Ayen.GEN P knife
 ‘Food, Ayen is eating with a knife.’

- ▷ There is a **V2 effect in the verb phrase also!** A transitive object must precede an in-situ lexical verb:

(6) *V2 in the verb phrase with in-situ verb:*

- a. Yǐin bḡ [vP **mǐir** tǐi]
 2SG FUT giraffe see.NF
 ‘You will see a giraffe.’
- b. *Yǐin bḡ [vP tǐi **mǐir**].
 2SG FUT see.NF giraffe
 ‘You will see a giraffe.’

- ▷ In ditransitives, one object precedes and one follows the verb:

(7) *One object before the verb in ditransitives:*

- a. Yǐin cḡ [vP **Ból gǎam** cáa akól].
 2SG PRF Bol give.NF milk day
 ‘You have given Bol milk in the afternoon.’
- b. Yǐin cḡ [vP **cáa gǎam** Ból akól].
 2SG PRF milk give.NF Bol day
 ‘You have given Bol milk in the afternoon.’

2.2 Two reflexes of successive cyclic movement

Observation: This object position is **also the target for intermediate movement**.

- ▷ **First**, movement out of a verb phrase must **satisfy its V2 property**:

(8) *Object movement must transit through Spec-vP in ditransitives:*

- a. Yè **ḡ** cǐi mḡc [vP yiḡen Áyèn]?
 be.3SG what PRF.OV man.GEN give.NF Ayen
 ‘What has the man given Ayen?’
- b. *Yè **ḡ** cǐi mḡc [vP **Áyèn** yiḡen]?
 be.3SG what PRF.OV man.GEN Ayen give.NF
 ‘What has the man given Ayen?’
- c. Yè **ḡá** cǐi mḡc [vP yiḡen kitáap]?
 be.3SG who PRF.OV man.GEN give.NF book
 ‘Who has the man given the book to?’
- d. *Yè **ḡá** cǐi mḡc [vP **kitáap** yiḡen]?
 be.3SG who PRF.OV man.GEN book give.NF
 ‘Who has the man given the book to?’

(9) *Movement must transit through Spec-vP in causatives:*

- a. Yè **ḡ** cǐi Áyèn [vP cḡok [céem Ból]]?
 be.3SG what PRF.OV Ayen.GEN make.NF eat.OV Bol.GEN
 ‘What has Ayen made Bol eat?’
- b. *Yè **ḡ** cǐi Áyèn [vP **Ból** cḡok [céem]]?
 be.3SG what PRF.OV Ayen.GEN Bol make.NF eat.OV
 ‘What has Ayen made Bol eat?’
- c. Yè **ḡá** cǐi Ból [vP cḡok [cám cuḡin]]?
 be.3SG who PRF.OV Bol.GEN make.NF eat food
 ‘Who has Bol made eat the food?’
- d. *Yè **ḡá** cǐi Ból [vP **cuḡin** cḡok [cám]]?
 be.3SG who PRF.OV Bol.GEN food make.NF eat
 ‘Who has Bol made eat the food?’

- ▷ **Second**, long-distance movement of a plural phrase **leaves the plural pronoun *kêek*** in each Spec-vP position on the path of movement (Van Urk 2018):

(10) *Pronoun copying at each vP edge:*

Yè **kɔ̃c-kò** yíi Ból [_{vP} **kêek** luɛeɛl ɛ cɛ́i Áyèn [_{vP} **kêek** t̥iŋ]]?
 be.3SG people-which be.OV Bol.GEN 3PL say.NF C PRF.OV AyeN.GEN 3PL see.NF
 ‘Which people is Bol saying that AyeN has seen?’

⇒ Obligatory intermediate movement suggests a **clause-internal phase in Dinka**.

What is the size of this clause-internal domain?

- ▷ This domain is **below the passive** (sec. 3), but includes **argument structure morphology** such as applicative and antipassive.
- ▷ A number of **adverbial auxiliaries** can surface in the vP domain (Andersen 2007):

(11) *Adverbial auxiliaries in the vP domain:*

- Tiik à-cɛ́ [_{vP} cuɪ̃n **d̥aac** t̥aaal].
 woman D-PRF food do.quickly.NF cook.NF
 ‘The woman has cooked the food quickly.’ (Bor)
- ... [bɛ́ [_{vP} j̃in **b̥ɛr** l̥ɔ̃k ɲɔ̃ɲ]].
 FUT.3SG eye do.again.NF do.afterwards.NF be.POOF.NF
 ‘...to be worried again.’ (idiomatic) (Agar; Andersen 2007:102)

- ▷ In contrast, the perfect auxiliary *cɛ́*, the negative clitic *cɛ́*, and the negative perfect *kêec* only appear in *clause-level* second position (Andersen 2007):¹

(12) *Perfect cɛ́ and negative kêec in second position:*

- Ayèn à-cɛ́ [_{vP} cuɪ̃n c̥am nɛ́ p̥aal].
 AyeN D-PRF food eat.NF P knife
 ‘AyeN has eaten food with a knife.’ (Bor)
- Tiik à-kêec [_{vP} t̥aaal].
 woman D-NEG.PRF cook.AP.NF
 ‘The woman has not cooked.’ (Agar; Andersen 2002:95)

⇒ This domain is **relatively low** in the clause, below aspect, negation, and passive. I’ll continue to label this inner domain **the vP domain**.²

¹There is dialectal variation with the future auxiliary *bɛ́*, which can be in the inner domain in Bor (Van Urk and Richards 2015:p. 123), but remains outside of it in Agar (Andersen 2007:p. 95). This auxiliary is derived from the motion verb *bɛ́* ‘come’ (Andersen 2007:98), and so could variably instantiate a Tense head (Agar) or a semantically bleached motion verb (Bor).

²I posit two separate heads for two functions often associated with *v*: a category-defining head that combines with the root (below argument structure morphology and any adverbial auxiliaries), and a phase head that hosts object movement (above argument structure morphology and auxiliaries).

3 Nonconcatenative morphology in Dinka

Dinka roots are usually restricted to a monosyllabic template. Within the root, distinctions in **length, tone, and voice quality** are used to mark morphological categories.

Where would the phasal boundary lie in this morphological system?

- ▷ Syntactic diagnostics converge with Andersen’s (1993) division between **outer (“inflectional”) and inner (“derivational”) morphology**.
- ▷ All inner morphology **remains on the in-situ verb** when an auxiliary is present:

Outer morphology (OV)	Inner morphology (APPL)
(13) Mariaal à-cɛ́ b̥ii d̥aaŋ-dè Marial D-NEG FUT. OV boy-3S ‘Marial’s boy will not beat the child for the woman tomorrow.’ (Agar; Andersen 1992:7)	[_{vP} mɛ́t̥ t̥aat tiik]. child beat. APPL .NF woman ‘child beat woman.’

3.1 Monosyllabicity in Dinka roots

- ▷ I’ll make use of data from the Agar variety Andersen (1993, 2014, 2017), as well as Luanyjang (Remijsen and Ladd 2008; Ladd et al. 2009; Remijsen and Manyang 2009).
- ▷ Dinka roots are generally **monosyllabic with an obligatory onset and coda**:

(14) Noun	Meaning	Verb	Meaning
a. jòom	‘wind’	e. máaan	‘hate.NF’
b. kít	‘color’	f. kóoot	‘care.for.NF’
c. pj̥ɛ̃n	‘viper’	g. kw̥ãat̥	‘wrap.NF’
d. gw̥ɛ̃l	‘collar bone’	h. t̥ɛ̃t	‘pick.NF’

(Luanyjang; Remijsen and Ladd 2008:180,186, Remijsen and Manyang 2009:115,119)

Andersen (1993:2) and Remijsen and Manyang (2009:114) give the template in (15):³

(15) **Surface template for Dinka nouns and verbs:**
 C (w) (j) V (V) (V) C

Length, voice, and tone in Dinka roots

- ▷ Dinka vowels display a **ternary contrast in length** (Remijsen and Gilley 2008):⁴

(16) Short	Long	Overlong
l̥aŋ ‘k.o. berries’	l̥aaŋ ‘k.o. berry’	l̥aaaŋ ‘slave’
kít ‘color’	k̥j̥it ‘colors’	k̥j̥iit̥ ‘cloth bag’
cól ‘mouse’	c̥ool ‘charcoal’	c̥ool̥ ‘charcoal.PL’

³The *underlying* form of roots is more restricted and maximally permits a long vowel and one glide (Andersen 1993, 2014; Ladd and Blum 2021).

⁴Luanyjang examples are taken from the Remijsen (2013) corpus of noun pairs, where a source is not specifically indicated.

- ▷ Most Dinka dialects distinguish **three or four tones**, high /ó/, low /ò/, falling /ô/, and sometimes also rising /ǒ/.
- ▷ Finally, vowels show a binary contrast between **modal/creaky voice (unmarked)** and **breathy voice /ǒ/**, in all vowels except *u*:⁵

(17)	Unmarked		Breathy	
	jáak	‘pelican’	jǎal	‘visitor, guest’
	gwéṭ	‘Nile perch’	gwét	‘bead’
	ḡééer	‘k.o. gazelle’	nwḡéer	‘Nuer’
	kliir	‘big river’	kǎiir	‘thorny k.o. tree’
	tóoc	‘swamp’	tòoḡ	‘pot’
	rwòḡḡ	‘stone of fruit’	rwòḡḡ	‘year’
			wǎuk	‘wing’

3.2 Inner and outer morphology in Dinka

Andersen (1992, 1993) draws a distinction between two types of morphology in Dinka’s verbal paradigms:⁶

Table 1. Verbal paradigm of *m̂it* ‘pull’.

	Transitive	CF	CP	APPL	APPL.AP	AP
SV	m̂it	m̂iit	m̂iit	m̂it	m̂iit	m̂it
OV	m̂iit	m̂iit	m̂iit	m̂it	m̂iit	m̂iit
NF	m̂iit	m̂ĵéet	m̂ĵéet	m̂ĵéet	m̂ĵéet	m̂iit
1SG	m̂ĵéet	m̂ĵéet	m̂ĵéet	m̂ĵéet	m̂ĵéet	m̂ĵéet
2SG	m̂it	m̂ĵéet-é	m̂iit	m̂ĵéet-é	m̂ĵéet-é	m̂ĵéet-é
3SG	m̂iit	m̂iit	m̂iit	m̂it	m̂iit	m̂iit
1PL	m̂iit-k̂ú	m̂iit-k̂ú	m̂iit-k̂ú	m̂it-k̂ú	m̂iit-k̂ú	m̂it-k̂ú
2PL	m̂ĵéet-k̂á	m̂ĵéet-k̂á	m̂ĵéet-k̂á	m̂ĵéet-k̂á	m̂ĵéet-k̂á	m̂ĵéet-k̂á
3PL	m̂iit-k̂é	m̂iit-k̂é	m̂iit-k̂é	m̂it-k̂é	m̂iit-k̂é	m̂it-k̂é
PASS	m̂it	m̂iit-é	m̂iit-é	m̂it-é	m̂iit-é	—
PASS.OBLV	m̂iit-é	m̂iit-é	m̂iit-é	m̂it-é	m̂iit-é	m̂iit-é

- Inner morphology (horizontal, traditionally “derivational”):**
Associated motion marking (centrifugal, CF, and centripetal, CP), the applicative (APPL), and the antipassive (AP)
- Outer morphology (vertical, traditionally “inflectional”):**
Agreement, passive (PASS), and Austronesian-style voice morphology (Subject Voice (SV), Object Voice (OV), and Oblique Voice (OBLV)), as well as the non-finite (NF), though see below

⁵I follow Andersen and mark voice and tone only on the first vowel.

⁶The layout of these paradigms may suggest that a verb is always the combination of one inner and one outer category. But this is not the case. Both inner categories and outer categories can stack, as evident in the applicative antipassive and the passive Oblique Voice (see also the non-finite).

3.3 Inner morphology is in the vP

Claim: The vP phase corresponds to the **domain of inner morphology**.

Without an auxiliary:

The verb **raises to second position** (because of clause-level V2) and carries along both inner and outer morphology:

- (18) *Inner and outer morphology on raised verb:*

Outer morphology (OV)		Inner morphology (APPL)
Wéḡ à-m̂it	ḡòok	[_{vP} — m̂òc n̂é jŵĵéen].
cow D-pull. _[APPL.OV]	boy	man P rope
‘The cow, the boy is pulling for the man with the rope.’		
(Agar; Andersen 1992:13)		

When an auxiliary is present:

Inner morphology stays on the in-situ verb, but outer morphology is on the auxiliary:

- (19) *Inner morphology on verb, outer morphology on auxiliary:*

Outer morphology (OV)		Inner morphology (APPL)
Mariàal à-ĉé b̂i	ḡáan-d̂é	[_{vP} m̂èṭ ḡáat tiik].
Marial D-NEG FUT. _[OV]	boy-3SG	child beat. _{[APPL].NF} woman
‘Marial’s boy will not beat the child for the woman tomorrow.’		
(Agar; Andersen 1992:7)		

⇒ There is one exception (the non-finite)! But the non-finite is **inner morphology**, and does not combine with outer morphology because **only finite verbs raise to 2nd position**.

A clausal hierarchy with two domains:

- (20) *Clausal hierarchy for Dinka:*

CP phase (“outer”)	vP phase (“inner”)
(C - T - Neg/Perf); Agr/Voice; Pass	NF - Appl/CF/CP - AP - Root

(Slashes indicate heads that do not combine and may occupy the same position. Semi-colons separate heads that either combine or do not co-occur for independent reasons, but for which I have no evidence that bears on order.)

4 An inner domain in morphology

Question: Does the root plus inner morphology constitute a locality domain?

Yes!

1. The root with inner morphemes must **obey the monosyllabic template**. Only outer morphemes can be expressed via affixation.
2. Only inner morphemes show **allomorphy based on verb class**. A phase boundary means outer morphology cannot “see” verb class.

4.1 Inner morphemes obey the monosyllabic template

Consider again outer and inner morphology in the verbal paradigms of the verb *m̄it* ‘pull’ (Andersen 2017:12):

Table 2. Verbal paradigm of *m̄it* ‘pull’.

	Transitive	CF	CP	APPL	APPL.AP	AP
SV	m̄it	m̄iit	m̄iit	m̄it	m̄iit	m̄it
OV	m̄iit	m̄iit	m̄iit	m̄it	m̄iit	m̄iit
NF	m̄iit	m̄j̄eet	m̄j̄eet	m̄j̄et	m̄j̄eet	m̄iit
1SG	m̄j̄eet	m̄j̄eet	m̄j̄eet	m̄j̄et	m̄j̄eet	m̄j̄eet
2SG	m̄it	m̄j̄eet-ɛ̄	m̄iit	m̄j̄et-ɛ̄	m̄j̄eet-ɛ̄	m̄j̄eet-ɛ̄
3SG	m̄iit	m̄iit	m̄iit	m̄it	m̄iit	m̄iit
1PL	m̄it-k̄ù	m̄iit-k̄ù	m̄iit-k̄ù	m̄it-k̄ù	m̄iit-k̄ù	m̄it-k̄ù
2PL	m̄j̄et-k̄á	m̄j̄eet-k̄á	m̄j̄eet-k̄á	m̄j̄et-k̄á	m̄j̄eet-k̄á	m̄j̄et-k̄á
3PL	m̄it-k̄é	m̄iit-k̄é	m̄iit-k̄é	m̄it-k̄é	m̄iit-k̄é	m̄it-k̄é
PASS	m̄it	m̄iit-ɛ̄	m̄iit-ɛ̄	m̄it-ɛ̄	m̄iit-ɛ̄	—
PASS.OBLV	m̄iit-ɛ̄	m̄iit-ɛ̄	m̄iit-ɛ̄	m̄it-ɛ̄	m̄iit-ɛ̄	m̄iit-ɛ̄

- ▷ Table 2 displays a mix of nonconcatenative morphology and suffixation. All **suffixes express outer morphology**, while inner morphology is **never** marked by affixation.⁷
- ▷ The same observation extends to the limited inventory of prefixes, which combine with all finite forms in Table 2 and are clearly part of the outer domain also:

- (21) *Outer prefixes:*
 Declarative particle à/áa-
 Past ɛ̄-

Proposal:

Phases may obligatorily correspond to prosodic constituents (Kahnemuyipour 2004; Adger 2007; Kratzer and Selkirk 2007). The first phase in Dinka **maps to a syllable**.⁸

⁷The same asymmetry appears in related languages (e.g. Anywa, Reh 1996; Nuer, Reid 2020).

4.2 Allomorphy based on verb class

- ▷ Another piece of evidence that the inner domain is a phasal domain comes from **allomorphy in grammatical tone**.
- ▷ Most morphological categories in Dinka are associated with **changes in tone in the root**. But only inner morphemes show verb class variation in the exponents of these!

⇒ The lack of allomorphy in outer morphemes reflects the presence of a phase boundary.

Four verb classes

- ▷ Andersen (1993) distinguishes **four classes of transitive verbs**, based on the tone they carry in the **transitive non-finite** (an inner morpheme):⁹

(22) *Tone in the non-finite involves four verb classes:*

CVC/F	CVC/L	CVVC/F	CVVC/H
ḡút ‘stab.NF’	t̄eɲ ‘dust.NF’	m̄iit ‘pull.NF’	t̄eem ‘cut.NF’
ḡ̄or ‘spear.NF’	n̄àaj ‘plait.NF’	l̄eet ‘roll.NF’	ḡ̄aaɲ ‘open.NF’

(Agar; Andersen 1992:23–24,28–29, Andersen 2017:10–13)

- ▷ Variation in grammatical tone based on verb classes is found in a **range of inner categories**: the centrifugal, applicative, antipassive, and applicative antipassive.
- ▷ **No outer category** displays a regular pattern of tonal allomorphy. Instead, we find patterns of **consistent replacive tone**.¹⁰

Object Voice (ov), for instance, is always marked by a replacive high tone:

(23) *Tone in the Object Voice involves consistent tone:*¹¹

CVC/F	CVC/L	CVVC/F	CVVC/H
ḡút ‘stab.ov’	t̄eɲ ‘dust.ov’	m̄iit ‘pull.ov’	t̄eem ‘cut.ov’
ḡ̄er ‘spear.ov’	n̄eɛj* ‘plait.ov’	l̄eet ‘roll.ov’	ḡ̄eɛɲ* ‘open.ov’

(Agar; Andersen 1992:28–29, Andersen 2017:10–13)

Proposal:

Outer morphemes are separated from the root by a phase boundary, and so cannot “see” the root for the purposes of allomorphy (Bobaljik 2000, 2015; Embick 2010).¹²

⁸An alternative may be to make use of the notion of a morphological stem, the level at which the monosyllabic template would be enforced. In any case, it is clear that the root plus inner morphemes is a significant morphological domain in Dinka.

⁹Note that the non-finite also triggers lengthening.

¹⁰There are tonal patterns based on verb class in the passive and 2sg of the simple transitive. In both cases, though, the regular exponent of the outer category is missing. It is not clear that these forms involve an outer morpheme. I present an analysis of the resulting tonal pattern in Van Urk (In prep.).

¹¹Forms marked with * are constructed based on Andersen’s description.

¹²I propose tone variation reflects the realization of a verbal categorizing head (these patterns are

5 Partial opacity in Dinka morphophonology

Question: Do we find phase impenetrability in Dinka morphophonology?

A little bit, but mainly no!

- ▷ Inner and outer morphology trigger the **same nonconcatenative processes**, altering vowel quality, length, and tone.
- ▷ At the same time, *some* phonological changes **do only occur in the inner domain**, such as the introduction of breathy voice.

⇒ In Dinka at least, **no strict phase impenetrability!**

5.1 Absence of opacity in vowel fronting and lowering

Two processes of nonconcatenative marking:

Nonconcatenative morphology in Dinka is typically expressed through vowel fronting or vowel lowering, described by Andersen (1993) via **three distinct vowel “grades”**:

Table 3. Dinka vowel grades.

Root vowel (Grade 1)	Creaky					Breathy					
	i	e	a	ɔ	o	ĩ	ẽ	ã	ɔ̃	õ	ʉ
Fronting (Grade 2)	i	e	ɛ	ɔ	o	ĩ	ẽ	ɛ̃	ɔ̃	õ	ʉ
Lowering (Grade 3)	jɛ	ɛ	a	a	wɔ	jɛ̃	ɛ̃	ã̃	ã̃	ɔ̃	wɔ̃

How to read Table 3:

Grade 1: The underlying vowel in the root.¹³

Vowel fronting (Grade 2): A number of different inner and outer categories involve *vowel fronting*, primarily of the central vowel *a*:

(24)

Root	3SG (fronting)	Applicative (fronting)	Meaning
t̥ar	t̥ɛr	t̥ɛr	‘spear’
g̥ut	g̥uut	g̥uut	‘stab’
miit	miit	m̥it	‘pull’

(Agar; Andersen 2017:10–12)

unique to verbs), contributing a “theme tone”. Spell-out rules for this head will not be able to reference outer morphemes, in line with Bobaljik (2000, 2015) and Embick (2010). See Van Urk (In prep.).

¹³This vowel is most frequent and surfaces in unmarked forms (see Andersen 1993, 2017).

Vowel lowering (Grade 3): Other morphological categories systematically involve *vowel lowering* (and breaking of peripheral vowels), except with *a*:

(25)

Root	1SG (lowering)	NF Applicative ¹⁴ (lowering)	Meaning
t̥ar	t̥aar	t̥aar	‘spear’
g̥ut	gw̥oot	gw̥oot	‘stab’
miit	m̥j̥ɛɛt	m̥j̥ɛɛt	‘pull’

(Agar; Andersen 2017:10–12)

- ▷ Vowel fronting and lowering mark a wide range of morphological categories, both **outer** (1SG, 3SG, etc.) and **inner** (applicative, non-finite, etc.).
- ▷ Vowel fronting and lowering also trigger **lengthening and changes in tone**.

No evidence here for strict phase impenetrability!

- ▷ The inner domain is **not opaque**
- ▷ Higher affixes can induce changes in vowel quality, length, and grammatical tone
- ▷ In fact, when morphemes compete for realization, the **outermost morpheme wins out** (Inkelas 1998; Alderete 2001; Rolle 2018). (See Appendix.)

5.2 Partial opacity in voice quality

Is there *any* evidence of phase impenetrability?

Observation: Voice quality *does* become fixed in the inner domain.

- ▷ **In outer morphology:** Vowel fronting *never* changes the voice quality of the root vowel. **Creaky vowels remain creaky** and **breathy vowels remain breathy** (26).

(26) *Vowel fronting never changes voice quality in outer morphology:*

Root	3SG (fronting)	Meaning
l̥at	l̥ɛt	‘insult’
m̥aaɬ	m̥ɛɛɬ	‘smoke’
n̥ak	n̥ɛk	‘kill’
d̥j̥an	d̥j̥ɛn	‘stir’

(Agar; Andersen 1993:11,12)

¹⁴Most inner categories are associated with vowel fronting, but the non-finite is expressed via vowel lowering. The non-finite applicative illustrates, because the transitive non-finite is irregularly Grade 1.

- ▷ **In inner morphology:** Vowel fronting *can* introduce a shift to breathy voice, such as in the applicative, centripetal and antipassive.

(27) *Vowel fronting adds breathy voice in applicative:*

Root	Applicative (fronting + breathy voice)	Meaning
bār	b̥ɛ̃r	‘take along’
nāj	n̥ɛ̃j	‘plait’
ɲāɲ	ɲ̥ɛ̃ɲ	‘open’

(Agar; Andersen 1992:29, Andersen 2017:11,14)

(28) *Vowel fronting adds breathy voice in centripetal:*

Root	Centripetal (fronting + breathy voice)	Meaning
bār	b̥ɛ̃r	‘take along’
tēm	t̥ɛ̃em	‘cut’
tōoc	t̥ūuc	‘send’

(Agar; Andersen 1992:29,37, Andersen 2017:11)

(29) *Vowel fronting adds breathy voice in antipassive:*

Root	Antipassive (fronting + breathy voice)	Meaning
bār	b̥ɛ̃r	‘take along’
māan	m̥ɛ̃n	‘hate’
rāak	r̥ɔ̃k	‘milk’

(Agar; Andersen 1992:41,42, Andersen 2017:11,18)

Note: Shift to breathy voice triggers an independent process of vowel raising (which, as a result, is only found in the inner domain) (see Andersen 2017:sec. 4).

⇒ Vowel fronting is **able to shift voice quality** in the inner domain. (A similar asymmetry obtains for number and case: only vowel fronting for number introduces breathy voice.)

Some qualities are fixed in the inner domain, but others are not:¹⁵

- ▷ Voice quality is fixed and cannot be altered by outer morphology¹⁶
- ▷ But outer morphology can still front and lower a vowel

No obvious *qualitative difference* in opaque vs. non-opaque phonological properties.

¹⁵Similar asymmetries exist in related Nilotic languages. In Shilluk and Anywa, for example, only inner morphology appears to alter the [ATR] quality of the root (Reh 1996; Remijsen and Ayoker 2022).

¹⁶Andersen (2017) describes a difference between inner and outer morphology when it comes to vowel fronting that can also be explained in these terms. In outer morphology, vowel fronting only affects the central vowel *a*. But inner morphemes also optionally trigger fronting of the back vowel *ɔ̃*. This difference can be modeled if backness, like voice quality, is fixed in the first cycle.

What model of cyclicity captures partial opacity?

- ▷ I adopt a family of **phase faithfulness constraints** in the phonological grammar (Šurkalović 2013; McPherson 2014; McPherson and Heath 2016):

(30) IDENT_{PHASE}[X]: Assign a violation mark for a feature X present in a phase in the input that is not present in the output.

- ▷ High ranking of constraints like (30), such as IDENT_{PHASE}[±breathy] (Dinka) or MAX_{PHASE}V (Ojibwe), ensures that phonological properties **can be fixed in the first cycle**.
- ▷ But changes in vowel height and frontness can still occur in later cycles! **No necessary difference** in properties that become fixed and those that do not.

⇒ **Consequence:** No aspect of the output of previous cycles is inaccessible, but morphemes in inner domains can always **affect greater changes**.

Conclusion

1. *Are syntactic phases and morphophonological domains parallel?*

- ▷ Syntactic diagnostics for a clause-internal domain line up exactly with a morphological distinction between **inner and outer morphology**.
- ▷ These facts provide novel evidence for a **a clause-internal vP phase** (contra Keine and Zeijlstra 2023).

2. *Is there strict phase impenetrability?*

- ▷ Cyclic evaluation of a phasal domain does **not render phonological structure inaccessible**. In Dinka, the content of the root remains visible to cyclic insertion of outer morphemes.
- ▷ At the same time, there are morphophonological rules that only apply in a phase, which I attributed to **phase faithfulness** (Šurkalović 2013; McPherson 2014).

Abbreviations used for Dinka:

AP = antipassive, APPL = applicative, CF = centrifugal, CP = centripetal, D = declarative, FUT = future, GEN = genitive, NEG = negation, NF = non-finite, PASS = passive, OBLV = Oblique Voice, OV = Object Voice, PRF = perfect, SV = Subject Voice

References

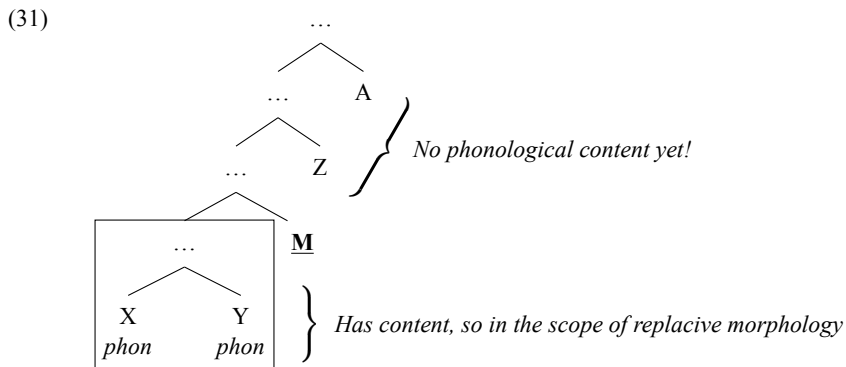
- Adger, David. 2007. Stress and phrasal syntax. *Linguistic Analysis* 33:238–266.
- Alderete, John. 2001. *Morphologically governed accent in Optimality Theory*. New York: Routledge.
- Andersen, Torben. 1992. Morphological stratification in Dinka: On the alternations of voice quality, vowel length, and tone in the morphology of transitive verbal roots in a monosyllabic language. *Studies in African Linguistics* 23:1–64.
- Andersen, Torben. 1993. Vowel quality alternation in Dinka verb inflection. *Phonology* 10:1–42.
- Andersen, Torben. 2002. Case inflection and nominal head marking in Dinka. *Journal of African Languages and Linguistics* 23:1–30.
- Andersen, Torben. 2007. Auxiliary verbs in Dinka. *Studies in Language* 31:89–116.
- Andersen, Torben. 2014. Number in Dinka. In *Number—constructions and semantics: Case studies from Africa, Amazonia, India and Oceania*, ed. by Anne Storch and Gerrit J. Dimmendaal, 221–264. Amsterdam & Philadelphia: John Benjamins.
- Andersen, Torben. 2017. Vowel quality alternation in Dinka verb derivation: The Agar variety. *Journal of African Languages and Linguistics* 38:1–50.
- Bobaljik, Jonathan David. 2000. The ins and outs of contextual allomorphy. *University of Maryland working papers in linguistics* 10:35–71.
- Bobaljik, Jonathan David. 2015. *Universals in comparative morphology: Suppletion, superlatives, and the structure of words*. Cambridge, MA: MIT Press.
- Cheng, Lisa Lai-Shen, and Laura Downing. 2016. Phasal syntax = cyclic phonology? *Syntax* 19:156–191.
- d’Alessandro, Roberta, and Tobias Scheer. 2015. Modular PIC. *Linguistic Inquiry* 46:593–624.
- Davis, Colin. 2020. The linear limitations of syntactic derivations. Doctoral dissertation, MIT.
- Embick, David. 2010. *Localism versus globalism in morphology and phonology*. Cambridge, MA: MIT Press.
- Embick, David. 2013. Phase cycles, φ -cycles, and phonological (in)activity. Manuscript, University of Pennsylvania.
- Fenger, Paula. 2020. Words within words: The internal syntax of verbs. Doctoral dissertation, University of Connecticut.
- Fenger, Paula, Nadja Fiebig, Sören Tebay, and Philipp Weisser. This afternoon. Syntactic height impacts prosodic size: An argument for cyclic prosodification. NELS 55, Yale.
- Fox, Danny, and David Pesetsky. 2005. Cyclic linearization of syntactic structure. *Theoretical Linguistics* 31:1–45.
- Inkelas, Sharon. 1998. The theoretical status of morphologically conditioned phonology: A case study from dominance. *Yearbook of Morphology* 121–155.
- Kahnemuyipour, Arsalan. 2004. The syntax of sentential stress. Doctoral dissertation, University of Toronto.
- Kalin, Laura, and Philipp Weisser. 2022. Minimalism and morphology. In *Cambridge Handbook of Minimalism*. Cambridge University Press.
- Keine, Stefan, and Hedde Zeijlstra. 2023. Clause-internal successive cyclicity: Phasality or DP intervention? *Natural Language & Linguistic Theory*.
- Kratzer, Angelika, and Elisabeth Selkirk. 2007. Phase theory and prosodic spell-out: The case of verbs. *The Linguistic Review* 24:93–135.
- Ladd, D. Robert, and Mirella Blum. 2021. On the systematic nature of Dinka number morphology. *Journal of African Languages and Linguistics* 42:223–252.
- Ladd, D. Robert, Bert Remijsen, and Caguor Adong Manyang. 2009. On the distinction between regular and irregular inflectional morphology: Evidence from Dinka. *Language* 85:659–670.
- Lowenstamm, Jean. 2010. Derivational affixes as roots: Phasal spell-out meets English stress shift. Manuscript, Université Paris-Diderot and CNRS.
- Marvin, Tatjana. 2002. Topics in the stress and syntax of words. Doctoral dissertation, MIT.
- McPherson, Laura. 2014. Replacive grammatical tone in Dogon languages. Doctoral dissertation, UCLA.
- McPherson, Laura, and Jeffrey Heath. 2016. Phrasal grammatical tone in the Dogon languages: The role of constraint interaction. *Natural Language & Linguistic Theory* 34:593–639.
- Newell, Heather. 2009. Aspects of the morphology and phonology of phases. Doctoral dissertation, McGill University.
- Newell, Heather. This afternoon. English irregular verb roots = regular phonology: No allomorphy, no readjustment rules, no delayed phase spell-out required. NELS 55, Yale.
- Newell, Heather, and Glyne Piggott. 2014. Interactions at the syntax—phonology interface: Evidence from Ojibwe. *Lingua* 150:332–362.
- Reh, Mechthild. 1996. *Anywa language: Description and internal reconstructions*. Köln: Rüdiger Köppe Verlag.
- Reid, Tatiana. 2020. The phonology and morphology of the Nuer verb. Doctoral dissertation, University of Surrey.
- Remijsen, Bert. 2013. Dinka_LuanyjangDialect_Jan-May2007_controlled_NounsSingular-AndPural. Dataset, University of Edinburgh DataShare, <https://doi.org/10.7488/ds/141>.
- Remijsen, Bert, and Otto Gwado Ayoker. 2022. *A grammar of Shilluk*. Language Documentation & Conservation.
- Remijsen, Bert, and Leoma Gilley. 2008. Why are three-level vowel length systems so rare? Insights from Dinka (Luanyjang dialect). *Journal of Phonetics* 36:318–344.
- Remijsen, Bert, and D. Robert Ladd. 2008. The tone system of the Luanyjang dialect of Dinka. *Journal of African Languages and Linguistics* 29:173–213.
- Remijsen, Bert, and Caguor Adong Manyang. 2009. Luanyjang Dinka. *Journal of the International Phonetic Association* 39:113–124.
- Rolle, Nicholas. 2018. Grammatical tone: Theory and typology. Doctoral dissertation, UC Berkeley.
- Samuels, Bridget. 2012. Consequences of phases for morpho-phonology. In *Phases: De-*

- veloping the framework*, ed. by Angel Gallego, 251–282. Berlin: De Gruyter Mouton.
- Sande, Hannah. This morning. Discontinuous harmony in Guébie: Consequences for cyclic spell out. *NELS* 55, Yale.
- Sande, Hannah, Peter Jenks, and Sharon Inkelas. 2020. Cophonologies by Ph(r)ase. *Natural Language & Linguistic Theory* 38:1211–1261.
- Šurkalović, Dragana. 2013. Modularity, Phase-Phase faithfulness and prosodification of function words in English. *Nordlyd* 40:301–322.
- Trommer, Jochen. 2022. The concatenative structure of tonal overwriting. *Linguistic Inquiry* 1–57.
- van Urk, Coppe. 2015. A uniform syntax for phrasal movement: A case study of Dinka Bor. Doctoral dissertation, MIT.
- van Urk, Coppe. 2018. Pronoun copying in Dinka Bor and the Copy Theory of Movement. *Natural Language & Linguistic Theory* 36:937–990.
- van Urk, Coppe. In prep. Outermost wins in Dinka tone. Manuscript, QMUL.
- van Urk, Coppe, and Norvin Richards. 2015. Two components of long-distance extraction: Successive cyclicity in Dinka. *Linguistic Inquiry* 46:113–155.
- van Urk, Coppe, and Zhouyi Sun. 2021. Dinka number morphology is regular and concatenative. Talk at NELS52, Rutgers University.

Appendix: Outermost wins

- ▷ Exceptions to phonological phase impenetrability have sometimes been treated in a later **non-cyclic phrasal phonology**.
- ▷ But replacive morphology in Dinka is **cyclic!** In competition, the **outermost wins**, in vowel lowering and fronting as well as replacive tone (Inkelas 1998; Rolle 2018).

⇒ **Kalin and Weisser (2022)**: Outermost wins may follow from **bottom-up cyclic insertion**, since replacive morphology by a morpheme M is necessarily inward-looking (31).



The outermost generalization: lowering above fronting → lowering wins

- ▷ Some outer morphemes trigger vowel lowering (Grade 3), such as 1SG and 2PL:

(32) *1SG and 2PL trigger vowel lowering:*

Root	1SG (lowering)	2PL (lowering)	Meaning
wèc	wèec	wèc-kà	‘kick’
bàr	bàar	bàr-kà	‘take along’
miit	mjèet	mjèet-kà	‘pull’

(Agar; Andersen 1993:28; Andersen 2017:12–13)

- ▷ When we combine these with inner morphemes that trigger *vowel fronting*, **the higher morpheme wins** and only vowel lowering is observed:

(33) *Outer vowel lowering wins over inner vowel fronting:*

Root	Centripetal (fronting)	1SG centripetal (lowering wins)	2PL centripetal (lowering wins)	Meaning
wèc	wèec	wèec	wèec-kà	‘kick’
bàr	bèer	bàar	bàar-ka	‘take along’
miit	mjiit	mjèet	mjèet-ka	‘pull’

(Agar; Andersen 1992:28; Andersen 2017:12–13)

The outermost generalization: fronting above lowering → fronting wins

- ▷ Resolution in favor of lowering is not phonologically determined. Nouns have a configuration in which a fronting morpheme is higher than a lowering morpheme.
- ▷ Locative case is marked by vowel fronting (Andersen 2002:sec. 4.3).

(34) *Locative case triggers vowel fronting:*

Root	Locative (fronting)	Meaning
atàŋ	atèeŋ	‘kind of basket’
càam	cèem	‘left arm’
gòom	gòoom	‘kind of gourd’

(Agar; Andersen 2002:13)

- ▷ For nouns with vowel lowering for number (Andersen 2014; Ladd and Blum 2021; Van Urk and Sun 2021), **vowel fronting wins out in the locative** (Andersen 2002:13):

(35) *Vowel fronting for locative case wins over lowering for number:*

Singular (lowering)	Locative (fronting wins)	Meaning
rjàaj	rjèeaj	‘boat’
əŋwəɔɔŋ	əŋóoŋ	‘grass, weed’
əjjèek	əjjiik	‘papyrus mat’

(Agar; Andersen 2002:13)

Outermost wins in replacive tone

- ▷ When multiple morphemes impose a replacive tone, the tone associated with the **outermost morpheme wins** (see also Inkelas 1998; Rolle 2018).
- ▷ The outer morphemes 2SG (L tone), Object Voice (H tone), and the passive (F tone) contribute replacive tones. When combined with inner morphemes, such as the centripetal (L tone) or centrifugal (H/F alternation), the **outer grammatical tone wins**.¹⁷

(36) *Tonal pattern of outer OV morpheme wins over inner centrifugal:*

Root	Centrifugal (H/F alternation)	OV Centrifugal (H tone wins)	Meaning
t̥èl	t̥éel	t̥éel	‘pull’
nàj	nêej	nêej	‘plait’
miit	miit	miit	‘pull’
tòoc	tóooc	tóooc	‘send’

(Agar; Andersen 2017:13)

- ▷ Outermost wins follows from **bottom-up Vocabulary insertion** (Embick 2010; Kalin and Weisser 2022): replacive morphology must be *inward-looking*.
- ▷ This generalization follows if all Dinka nonconcatenative morphology is part of the **cyclic grammar**.

¹⁷Trommer (2022) argues against outermost wins for Dinka tone, because inner replacive tones seem to replace some outer tones (e.g. 1SG, 3SG). But Van Urk (In prep.) argues that the relevant outer morphemes never contribute a tone. For some, the only attested tones are in independently irregular forms. For others, the only evidence for a grammatical tone comes from an L tone in the simple transitive, which could mark the transitive paradigm itself. See Van Urk (In prep.) for more detail.