

**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***

Torben Andersen
Aalborg University

Dinka is a Western Nilotic language with three contrastive degrees of vowel length, two contrastive voice qualities in vowels, and three contrastive tones. Although to a large extent a monosyllabic language, Dinka has an elaborate morphology. In monosyllabic words the morphology is manifested solely by alternations among values of a number of phonological parameters of the root, including, among others, vowel length, voice quality, and tone. In this article the alternations of these three parameters are systematically set forth and described for the core of the derivational and inflectional morphology of transitive verbal roots in the Agar dialect of Dinka. Furthermore, it is argued that morphologically complex monosyllabic verb forms are analysable as configurations of morphological layers at which values of the phonological parameters are specified, such configurations being underlying phonological representations.

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1. Introduction

Dinka, a major Western Nilotic language spoken in the Sudan, is to a large extent a monosyllabic language, but, unlike monosyllabic languages like Chinese and Vietnamese, it has an elaborate morphology. Thus, many monosyllabic words in Dinka are morphologically complex, the morphology of such words being manifested by way of morphophonological alternations in the root. In nouns these alternations are exponents of number inflection and case inflection, and in verbs they are exponents of derivation, of subject inflection, and of inflection for topic selection. The phonological parameters regularly involved in alternations are vowel length, tone, voice quality, vowel quality, and final consonant.

The morphophonological alternations have been touched on in some previous studies of Dinka, e.g., in Tucker [1939] and Nebel [1948], but the treatment given to them in those studies is phonologically inadequate, especially with regard to tone, vowel length, and voice quality. The reason for this inadequacy is that, until recently, the system of phonological contrasts in Dinka has remained unclear. However, using the phonological findings in Andersen [1987], it now seems possible to begin revealing the facts of Dinka morphophonology systematically and to state these facts accurately.

The purpose of the present article, then, is to initiate a systematic description of Dinka morphology. I have chosen to concentrate on what I believe to be the core of the morphology of transitive verbal roots. What I intend to show is how the parameters of vowel length, voice quality, and tone are utilized, and how each of these contributes to the radical, the derivational, and the inflectional information encoded in verb forms. Vowel quality alternation also plays a crucial role in the verbal morphology, but lack of space prevents me from dealing with it here. However, the omission of this parameter is also justified by the fact that the other parameters operate completely independently of it. The fifth parameter, consonant alternation, is largely confined to the nominal morphology and is not used productively in the verbal morphology. Therefore, this parameter will also be ignored here.

The dialect of Dinka described in this article is Agar, which is spoken in the Rumbek area of the southern Sudan. The generalizations are based on an examination of some 500 roots.

The facts to be presented suggest that the morphology of Dinka is organized as a system of layers, each of which may specify values of phonological parameters. A formal analysis of the morphological stratification might well turn up arguments that bear in interesting ways on current issues in phonological theory. However, at the present stage of research on Dinka, I find it more important to provide as complete a description of the language as possible than to dwell on theoretical problems.

The article is organized as follows. Section 2 gives a brief outline of the phonological system of Agar Dinka. Section 3 identifies a set of derivational and

inflectional categories of verb forms with a transitive root. Section 4 presents a phonological classification of such roots, a classification on which the morpho-phonological alternations are crucially dependent. Sections 5, 6, and 7 spell out the alternations for each of the parameters: voice quality, vowel length, and tone. Section 8, finally, summarizes the model of morphological stratification suggested by the facts of Dinka morphology.

2. Phonological contrasts in monosyllabic words

In this section I outline the system of phonological contrasts existing in monosyllabic words of Agar Dinka. For more details the reader should see Andersen [1987]. The symbols used in the present article are IPA symbols as of 1989 (see International Phonetic Association [1989]).

Most monosyllabic words have an initial consonant, a medial vowel, and a final consonant, while a few lack the initial consonant and/or the final consonant. Since stems of words with affixes have the same structure, monosyllabic words will also be referred to as stems.

The inventory of consonant phonemes is shown in (1).¹

(1)	<u>labial</u>	<u>interdental</u>	<u>alveolar</u>	<u>palatal</u>	<u>velar</u>	<u>labiovelar</u>
voiceless stop	<i>p</i>	<i>t̪</i>	<i>t</i>	<i>c</i>	<i>k</i>	
voiced stop	<i>b</i>	<i>d̪</i>	<i>d</i>	<i>ɟ</i>	<i>g</i>	
nasal	<i>m</i>	<i>n̪</i>	<i>n</i>	<i>ɲ</i>	<i>ŋ</i>	
voiced fricative					(<i>ɣ</i>)	
trill			<i>r</i>			
lateral			<i>l</i>			
glide				<i>j</i>		<i>w</i>

All consonants occur in stem-initial position. The voiced stops do not occur in stem-final position, except that they are allophones of the voiceless stops before a suffix vowel, and [*ɣ*] does not occur stem-finally at all.

Dinka has seven contrasting vowel qualities, distinguishing four degrees of height, as shown in (2).

(2)	<i>i</i>		<i>u</i>
	<i>e</i>		<i>o</i>
	<i>ɛ</i>	<i>ɔ</i>	
	<i>a</i>		

¹ As argued by Duerksen [1989], the phonemic character of [*ɣ*] is questionable.

There are three contrasting degrees of vowel length: short, half-long, and long. These are symbolized by a sequence of, respectively, one, two, and three identical vowel symbols. The ternary opposition is demonstrated by minimal triplets like those in (3) and (4).²

- | | | | | |
|-----|-----------|--------------------|-----------------------------|-----------------|
| (3) | short | à-wèc ³ | 'You are kicking it' | (D-kick:2S) |
| | half-long | à-wèec | 'He is kicking it' | (D-kick:3S) |
| | long | à-weèec | 'He is sweeping it' | (D-sweep:3S) |
| (4) | short | à-bòk | 'It is being thrown at' | (D-throw:PAS) |
| | half-long | à-bòok | 'He is throwing it thither' | (D-throw:CF:3S) |
| | long | à-boòok | 'He is throwing repeatedly' | (D-throw:M:AP) |

In addition to the monophthongs in (2), there are a number of diphthongs, which have the following characteristics: (i) the first component is a high vowel; (ii) three degrees of length are distinguished, just like in monophthongs; and (iii) the length is realized phonetically by the second component. With those characteristics, the diphthongs should be conceived of as being associated with the skeletal tier (the CV-tier) in the manner exemplified in (5).

- | | | | | | |
|--------|-----------|----|------------|----|-----------|
| (5) a. | C V C | b. | C V V C | c. | C V V V C |
| | | | | | |
| | k u a c | | ṅ i a k | | l u e t |
| | /kuàc/ | | /ṅiàak/ | | /luèèèt/ |
| | 'leopard' | | 'tomorrow' | | 'saliva' |

That is, the second component of a diphthong is associated with the V-positions of the skeletal tier, and the first component is associated with the initial C-position together with the initial consonant. In addition, there are a couple of triphthongs, whose two first components are high vowels, and in which again the length is

² The following abbreviations are used in interlinear glosses and some of them in the text as well:

1S/2S/3S = first/second/third person singular

1P/2P/3P = first/second/third person plural

ALL = allative

CT = having a

NF = non-finite

AP = antipassive

CT = circumstantial topic

NTS = having a non-topical

B = benefactive

D = declarative

subject

BAP = benefactive-

FUT = future

PAS = passive

antipassive

GEN = genitive

PF = perfect

C = causative

LOC = locative

PL = plural

CF = centrifugal

M = multiplicative

PREP = preposition

CP = centripetal

NEG = negation

PRO = proform

³ The morpheme /à / is not a prefix but a proclitic particle, cf. section 3.1 below.

realized phonetically by the last component. In this case, then, the two first components should be conceived of as being associated with the initial C-position, as in (6).

- (6) C V V C

 j u i e n
 /jui^hen/ 'rope'

Vowel quality and vowel composition are independent of vowel length. That is, all monophthongs and all final components of diphthongs and triphthongs can occur with any of the three degrees of length. However, the underlying contrast between *a* and *ε* seems to be neutralized in the phonetic representation if the vowel is short, in which case I use the symbol *a* to the exclusion of *ε*.

Vowels are realized with one of two voice qualities or phonation types: creaky /^h/ and breathy /_h/. The contrast between them is shown by the minimal pairs in (7)-(8). The subscript diacritics are used only once for each vowel, whatever the number of vowel symbols.

- (7) ^ha-w_hεec 'He is kicking it' (D-kick:3S)
 ^ha-w_hεec 'He is kicking it hither' (D-kick:CP:3S)
- (8) ^ha-t_hεeη 'He is dusting' (D-dust:AP)
 ^ha-t_hεeη 'I am dusting for him' (D-dust:BAP:1S)

Generally speaking, voice quality and vowel quality are independent parameters in the sense that they can combine freely. A major exception is that the vowel quality *u* can only be breathy, unless it is the first component of a diphthong or triphthong.

There are three contrasting tones: High /^h/, Low /_h/, and Falling /^h/, the latter falling from the level of High to the level of Low. The contrast is shown by the minimal triplets in (9)-(10). The superscript diacritics are used only once for each vowel, whatever the number of vowel symbols.

- (9) H(igh) ^ha-w_hεec 'You are kicking it hither' (D-kick:CP:2S)
 L(ow) ^ha-w_hεec 'He is kicking it hither' (D-kick:CP:3S)
 F(alling) ^ha-w_hεec 'He is kicking' (D-kick:AP)
- (10) H ^ha-le_hεer 'You are rolling it hither' (D-roll:CP:2S)
 L ^ha-le_hεer 'He is rolling it hither' (D-roll:CP:3S)
 F ^ha-le_hεer 'He is rolling for him' (D-roll:BAP:3S)

Tone is independent of vowel length (and of voice quality and vowel quality), except that the contrast between H and F seems to be neutralized on short vowels.

3. Morphological categories

In this section I define a set of morphological categories that is needed for a description of the set of verb forms that manifests a transitive verbal root. Note that by “morphological category” I do not mean a paradigmatic category like number or person, but a category of verb forms with a particular derivational or inflectional meaning. First, I give a brief outline of the structure of clauses, then I identify a set of derivational categories, and, finally, I identify a set of inflectional categories. While the derivational categories to be dealt with are certainly not the only ones that are pertinent to transitive verbal roots, the list of inflectional categories is virtually exhaustive, and not only so for the morphology of transitive roots, but also for the verbal morphology as a whole.

3.1. Clause structure. As a prerequisite to defining the morphological categories of the verb in Dinka, this subsection outlines some aspects of clause structure. A basic distinction is made between declarative and non-declarative clauses. Declarative clauses conform to the scheme shown in (11).

(11) Declarative Clause Scheme:

Topic Decl Neg Verb_{fin} Subject Object_{dir} Verb_{nf} Object_{indir} Adv

This clause scheme, which consists of a finite number of slots, indicates the relative order in which clause constituents occur if they are present. Actually, the scheme in (11) is not exhaustive, since more slots have to be recognized, but it is sufficient for the present purpose. Some examples are given in Table 1.

Table 1: Analysis of a sample of declarative clauses in terms of the clause scheme

Topic	Decl	Neg	Verb _{fin}	Subject	Obj _{dir}	Verb _{nf}	Obj _{indir}	Adv
(a) <i>m̄ariàal</i> _i Marial	à _i D	c̄è NEG	<i>b̄íi</i> FUT:NTS	<i>d̄áaŋ-d̄è</i> _i boy-3S	<i>m̄èt</i> child	<i>t̄ áat</i> beat:B:NF	<i>ùik</i> woman	<i>niàak</i> tomorrow
(b) \emptyset _i	à _i D	—	<i>t̄ èet</i> beat:AP	\emptyset _i	—	—	—	—
(c) <i>r̄òor</i> _i men	à _i D:PL	—	<i>b̄iut</i> build:B	\emptyset _i	<i>γòt</i> house	—	<i>ùik</i> woman	—
(d) \emptyset _i	à _i D	—	<i>w̄èec</i> _j kick:3S	\emptyset _j	\emptyset _i	—	—	—
(e) <i>juièen</i> _i rope	à _i D	—	<i>c̄in-è</i> PF-PAS:CT	—	<i>w̄éŋ</i> cow	<i>m̄iit</i> pull:NF	—	\emptyset _i
(f) <i>γòt</i> _i house	à _i D	—	<i>leéer</i> roll:NTS	<i>ùik</i> woman	<i>doòot</i> stone	—	—	<i>t̄ in</i> _i PRO:LOC

“—” indicates an unfilled slot, “ \emptyset ” (zero) an empty trace. Subscripts indicate coreference among the topic, the declarative particle and a postverbal (zero or non-zero) constituent, or coreference between a verb and a postverbal zero subject.

- Key: (a) ‘Marial’s boy will not beat the child for the woman tomorrow’
 (b) ‘He is beating’
 (c) ‘The men are building a house for the woman’
 (d) ‘He is kicking it’
 (e) ‘The cow has been pulled with the rope’
 (f) ‘The woman is rolling a stone in the house’

Any clause has a topic, which occurs clause-initially. The topic is a noun phrase in the absolutive case, but if it is anaphoric, i.e., pronominal and third person, it is normally covert, i.e., expressed by zero. Whether overt or covert, the topic controls number agreement of the obligatory declarative particle, which occurs immediately after the topic slot, and which is procliticized on the following constituent, i.e., on the optional negation particle or on the obligatory finite verb. Thus, the declarative particle is /à-/ after a singular topic, and /áa-/ or /àa-/ after a plural topic. The topic can bear any of at least the following grammatical relations: subject, direct object, adverbial, and possessor (see Andersen [1991]). Constituents which are not topicalized occur in positions after the finite verb. A non-topical subject occurs immediately after the finite verb, where it is a noun phrase in the genitive case, unless it is expressed by a verbal suffix or is expressed in the verb stem.⁴ A non-topical direct object occurs immediately after the subject slot and has the absolutive case. Next comes another verbal slot, which may be filled by one or more non-finite verbs. These precede indirect objects,

⁴ The absolutive case is the unmarked member of the case category and hence left unglossed in the interlinear gloss. The genitive case form is also left unglossed if it is identical with the absolutive case form, which it often is. When formally different, these two case forms differ solely in tone.

which have the absolutive case. Non-topical adverbials occur in the clause-final slot, where they are either prepositional phrases, adverbs, nouns in the locative case, or some other type of locative expression. In addition, topicalized place adverbials need a coreferential proform in this slot (see example (f) of Table 1).

Non-declarative clauses lack the declarative particle. Moreover, their constituent order possibilities are somewhat different from those of declarative clauses.⁵ For instance, and that is what is relevant here, a topical subject follows the finite verb and has the genitive case (unless the clause contains the negation particle, in which case it immediately follows that particle and has the absolutive case). These differences between declarative and non-declarative clauses are exemplified by the subject topic clauses in (12) and the object topic clauses in (13), where the (a)-clauses are declarative, the (b)-clauses interrogative, and the (c)-clauses what may be called coordinative.

(12) Subject topic

- a. *fò à-kàc mèt*
 dog D-bite child
 'The dog is biting the child'
- b. *kác fò mèt*
 bite dog:GEN child
 'Is the dog biting the child?'
- c. *kù kác fò mèt*
 and bite dog:GEN child
 'and the dog bit the child'

(13) Object topic

- a. *mèt à-kéec fò*
 child D-bite:NTS dog:GEN
 'The dog is biting the child'
- b. *mèt kéec fò*
 child bite:NTS dog:GEN
 'Is the dog biting the child?'
- c. *kù kéec fò*
 and bite:NTS dog:GEN
 'and the dog bit him'

⁵ What is said about non-declarative clauses in this article does not apply to relative clauses (see Andersen [1991]).

3.2. Derivational categories. Dinka has a large number of derivational categories that are pertinent to transitive verbal roots, and all of these categories are expressed solely by root-internal alternations, i.e., by non-affixal modifications of the root. The derivational categories that I shall be dealing with, and all of which seem to be productive, are exemplified in (14) with a root meaning ‘to pull’. The clauses in (14) all have a subject topic.

(14) a. Simple

d̥ɔ̃k ̂-m̥it w̥ɛŋ
 boy D-pull cow
 ‘The boy is pulling the cow’

b. Centrifugal

d̥ɔ̃k ̂-m̥iit w̥ɛŋ
 boy D-pull:CF cow
 ‘The boy is pulling the cow thither’

c. Centripetal

d̥ɔ̃k ̂-m̥iit w̥ɛŋ
 boy D-pull:CP cow
 ‘The boy is pulling the cow hither’

d. Benefactive

d̥ɔ̃k ̂-m̥iit w̥ɛŋ m̥ɔ̃c
 boy D-pull:B cow man
 ‘The boy is pulling the cow for the man’

e. Benefactive-antipassive

d̥ɔ̃k ̂-m̥iit m̥ɔ̃c
 boy D-pull:BAP man
 ‘The boy is pulling for the man’

f. Antipassive

d̥ɔ̃k ̂-m̥it
 boy D-pull:AP
 ‘The boy is pulling’

A *simple* stem, as in (14a), is a non-derived stem. As opposed to the other stems, which are derived, it expresses the root meaning without any modification. Like other transitive stems, it is strictly transitive; that is, it requires a direct object, although the latter may be covert if it has the topic position. In Tables 8-10 below, this derivational category is symbolized by “∅”.

A *centrifugal* (CF) stem, as in (14b), basically indicates that the action is directed away from the deictic centre, which is typically the speaker. Conversely, a *centripetal* (CP) stem, as in (14c), indicates that the action is directed towards

the deictic centre. If a Goal is specified, as in (15), the stem must be either centrifugal or centripetal; that is, a simple stem cannot be used.

- (15) a. *d̥ɔ̀k à-m̥it t̥ɔ̀k ɣɔ̀t*
 boy D-pull:CF goat house:ALL
 'The boy is pulling the goat in (thither)'
- b. *d̥ɔ̀k à-m̥it t̥ɔ̀k ɣɔ̀t*
 boy D-pull:CP goat house:ALL
 'The boy is pulling the goat in (hither)'

Like simple stems, centrifugal stems and centripetal stems are monotransitive, and their direct object often has the same semantic role as the object of the corresponding simple stem, as it does in (14) and (15), viz. that of Patient. However, if the action is a movement of something which is different from the Patient, then what moves is typically made the object. This is illustrated by the set of examples in (16)-(17).

- (16) a. *d̥ɔ̀k à-b̥ɔ̀k d̥it*
 boy D-throw bird
 'The boy is throwing at the bird'
- b. *d̥ɔ̀k à-b̥ɔ̀k dòɔ̀t*
 boy D-throw:CF stone
 'The boy is throwing a stone thither'
- c. *d̥ɔ̀k à-b̥ɔ̀k dòɔ̀t*
 boy D-throw:CP stone
 'The boy is throwing a stone hither'
- (17) a. *t̥ik à-n̥iàc àl̥aɛt*
 woman D-squeeze cloth
 'The woman is wringing the cloth'
- b. *t̥ik à-n̥iɛc p̥iw*
 woman D-squeeze:CF water
 'The woman is squeezing water out thither'
- c. *t̥ik à-n̥iɛc p̥iw*
 woman D-squeeze:CP water
 'The woman is squeezing water out hither'

A *benefactive* (B) stem, as in (14d), is ditransitive, taking a Beneficiary object in addition to the Patient object of a simple stem. Either of these semantic roles can be mapped onto the syntactic role of direct object, the other becoming an indirect object. Thus, we have variants like those in (18).

- (18) a. *māk̄er* *à-būuṭ* *γòt* *mòc*
 Maker D-build:B house man
- b. *māk̄er* *à-būuṭ* *mòc* *γòt*
 Maker D-build:B man house
 ‘Maker is building a house for the man’

An *antipassive* (AP) stem, as in (14f), is an intransitive stem which demotes the object of the corresponding simple stem to an optional adverbial. The latter is a prepositional phrase with the preposition /*è/* ~ /*nè/*. In (19)-(20) the (a)-clauses contain a simple verb stem and an object Patient, the (b)-clauses contain an antipassive verb stem and an adverbial Patient, and the (c)-clauses contain an antipassive verb stem and no Patient.

- (19) a. *mòc* *à-dèk* *màaw*
 man D-drink beer
 ‘The man is drinking beer’
- b. *mòc* *à-dèek* *è* *màaw*
 man D-drink:AP PREP beer
 ‘The man is drinking beer’
- c. *mòc* *à-dèek*
 man D-drink:AP
 ‘The man is drinking’
- (20) a. *māk̄er* *à-t̄èr* *tòḡoŋ*
 Maker D-sharpen spears
 ‘Maker is sharpening spears’
- b. *māk̄er* *à-t̄èr* *è* *tòḡoŋ*
 Maker D-sharpen:AP PREP spears
 ‘Maker is sharpening spears’
- c. *māk̄er* *à-t̄èr*
 Maker D-sharpen:AP
 ‘Maker is sharpening’

A *benefactive-antipassive* (BAP) stem, as in (14e), is a monotransitive stem that combines the syntactic effects of the benefactive and the antipassive. That is, a Beneficiary (direct) object is introduced, and the Patient object is eliminated. However, it is not clear whether this derivational category should be analysed morphologically as consisting of one or two derivational elements.

In summary, for many transitive roots there are at least six stem types, each of which has a distinct derivational status: a simple stem, a centrifugal stem, a centripetal stem, a benefactive stem, a benefactive-antipassive stem, and an antipassive stem.⁶

3.3. Inflectional categories. Any verb form belongs to some inflectional category, which is either non-finite or one among ten finite categories. The inflectional category of a verb is independent of its derivational category, except that, for logical reasons, one of the finite categories cannot combine with the antipassive category (cf. below). Some inflectional categories are expressed solely by non-affixal modifications of the root. Others are sometimes or always expressed by suffixes, but often suffixation is accompanied by non-affixal modifications of the root as well. Thus, both inflection and derivation involve root-internal alternations.

All finite categories express two types of information: subject information and topic information. Thus, a finite verb indicates whether the clause has a subject or not, or it expresses a pronominal subject. In each case the finite verb also gives some indication of the grammatical relation of the topic. Loosely speaking, therefore, a finite verb is inflected both for subject and for topic selection.

In clauses that have a subject and in which the subject is a noun phrase, the finite verb indicates whether the subject is topical or non-topical. Thus, one verb form is used in clauses with a subject topic, while a different verb form is used in clauses with an object topic or a circumstantial topic, the latter being a topic which is either an adverbial or a possessor. The topical subject form of the verb is the unmarked member of this binary opposition (cf. below), and it is, therefore, left glossed in the interlinear gloss, labeled “ \emptyset ” (zero) in tables, and elsewhere referred to as “the (inflectionally) unmarked verb form”. The non-topical subject form of the verb is glossed “NTS” in the interlinear gloss. In (21)-(26) the two inflectional categories are illustrated with the root ‘to pull’ for each of the six derivational categories introduced in section 3.2. Each set of examples consists of propositionally identical clauses with a subject topic (S-topic), an object topic (O-topic) and/or a circumstantial topic (C-topic).

⁶ Other derivational categories are *inter alia* antipassive centrifugal, antipassive centripetal, multiplicative, antipassive multiplicative, reciprocal, and causative.

(21) Simple

S-topic *d̪ɔk ̱-m̪it w̪ɛŋ n̪ɛ juiɛn*
 boy D-pull cow PREP rope

O-topic *w̪ɛŋ ̱-m̪it d̪ɔk n̪ɛ juiɛn*
 cow D-pull:NTS boy PREP rope

C-topic *juiɛn ̱-m̪it d̪ɔk w̪ɛŋ*
 rope D-pull:NTS boy cow

‘The boy is pulling the cow with the rope’

(22) Centrifugal

S-topic *d̪ɔk ̱-m̪it w̪ɛŋ n̪ɛ juiɛn*
 boy D-pull:CF cow PREP rope

O-topic *w̪ɛŋ ̱-m̪it d̪ɔk n̪ɛ juiɛn*
 cow D-pull:CF:NTS boy PREP rope

C-topic *juiɛn ̱-m̪it d̪ɔk w̪ɛŋ*
 rope D-pull:CF:NTS boy cow

‘The boy is pulling the cow thither with the rope’

(23) Centripetal

S-topic *d̪ɔk ̱-m̪it w̪ɛŋ n̪ɛ juiɛn*
 boy D-pull:CP cow PREP rope

O-topic *w̪ɛŋ ̱-m̪it d̪ɔk n̪ɛ juiɛn*
 cow D-pull:CP:NTS boy PREP rope

C-topic *juiɛn ̱-m̪it d̪ɔk w̪ɛŋ*
 rope D-pull:CP:NTS boy cow

‘The boy is pulling the cow hither with the rope’

(24) Benefactive

S-topic *d̪ɔk ̱-m̪it w̪ɛŋ m̪ɔc n̪ɛ juiɛn*
 boy D-pull:B cow man PREP rope

O-topic *w̪ɛŋ ̱-m̪it d̪ɔk m̪ɔc n̪ɛ juiɛn*
 cow D-pull:B:NTS boy man PREP rope

C-topic *juiɛn ̱-m̪it d̪ɔk w̪ɛŋ m̪ɔc*
 rope D-pull:B:NTS boy cow man

‘The boy is pulling the cow for the man with the rope’

(25) Benefactive-antipassive

S-topic *d̥ɔk ɛ-m̥iit m̥ɔc n̥ɛ juiɛn*
 boy D-pull:BAP man PREP rope

O-topic *m̥ɔc ɛ-m̥iit d̥ɔk n̥ɛ juiɛn*
 man D-pull:BAP:NTS boy PREP rope

C-topic *juiɛn ɛ-m̥iit d̥ɔk m̥ɔc*
 rope D-pull:BAP:NTS boy man

‘The boy is pulling for the man with the rope’

(26) Antipassive

S-topic *d̥ɔk ɛ-m̥iit n̥ɛ juiɛn*
 boy D-pull:AP PREP rope

C-topic *juiɛn ɛ-m̥iit d̥ɔk*
 rope D-pull:AP:NTS boy

‘The boy is pulling with the rope’

The NTS-form of a verb always has a H tone. The other form may have any of the three tones, although only L and F occur in examples (21)-(26). This distribution of tones is the reason for considering the two forms marked and unmarked, respectively.

Note that the unmarked verb form is not restricted to clauses in which the subject is preverbal as in (21)-(26). As implied by the definition given above, this verb form is used whenever the subject is a topical noun phrase, whether it precedes the verb, as it does in declarative clauses, or follows the verb, as it does in non-declarative clauses. This state of affairs is illustrated in (27).

(27) a. *d̥ɔk ɛ-m̥iit w̥ɛŋ*
 boy D-pull cow
 ‘The boy is pulling the cow’

b. *m̥iit d̥ɔk w̥ɛŋ*
 pull boy cow
 ‘Is the boy pulling the cow?’

c. *w̥ɛŋ ɛ-m̥iit d̥ɔk*
 cow D-pull:NTS boy
 ‘The boy is pulling the cow’

d. *m̥iit d̥ɔk w̥ɛŋ*
 pull:NTS boy cow
 ‘Is the boy pulling the cow with it?’

In the interrogative clause (27b) the verb has the unmarked form, showing that the postverbal subject is topical just like the preverbal subject of the declarative clause (27a). In the interrogative clause (27d) the order of overt constituents is the same as in (27b), but the verb has the marked form, showing that the postverbal subject is non-topical as in the declarative clause (27c). However, while (27c) has an object topic, (27d) has a circumstantial topic, a fact which I shall not pursue further here.

A finite verb may alternatively indicate that the clause has no grammatical subject, i.e., that the clause is passive. In that case the verb also indicates whether the topic is a direct object or a circumstantial, although this distinction is neutralized if the verb is derived. Both of these inflectional categories are glossed "PAS" for "passive", and the category that cooccurs with a circumstantial topic is further glossed "CT". Examples (28)-(32) show propositionally identical clauses for each of the five transitive derivational categories. By virtue of being intransitive, a passive clause with an antipassive verb stem can only have a circumstantial topic, as in (33).

(28) Simple

O-topic *wɛŋ* *à-m̃it* *nɛ* *juɛɛn*
 cow D-pull: PAS PREP rope

C-topic *juɛɛn* *à-m̃it-ɛ* *wɛŋ*
 rope D-pull-PAS:CT cow

'The cow is being pulled with the rope'

(29) Centrifugal

O-topic *wɛŋ* *à-m̃it-ɛ* *nɛ* *juɛɛn*
 cow D-pull:CF-PAS PREP rope

C-topic *juɛɛn* *à-m̃it-ɛ* *wɛŋ*
 rope D-pull:CF-PAS:CT cow

'The cow is being pulled thither with the rope'

(30) Centripetal

O-topic *wɛŋ* *à-m̃it-ɛ* *nɛ* *juɛɛn*
 cow D-pull:CP-PAS PREP rope

C-topic *juɛɛn* *à-m̃it-ɛ* *wɛŋ*
 rope D-pull:CP-PAS:CT cow

'The cow is being pulled hither with the rope'

(31) Benefactive

O-topic *wɛŋ ɔ̀-m̩it-ɛ̀* *mɔ̀c nɛ̀* *juɪɛn*
 cow D-pull:B-PAS man PREP rope

C-topic *juɪɛn ɔ̀-m̩it-ɛ̀* *wɛŋ mɔ̀c*
 rope D-pull:B-PAS:CT cow man

‘The cow is being pulled for the man with the rope’

(32) Benefactive-antipassive

O-topic *mɔ̀c ɔ̀-m̩it-ɛ̀* *nɛ̀* *juɪɛn*
 man D-pull:BAP-PAS PREP rope

C-topic *juɪɛn ɔ̀-m̩it-ɛ̀* *mɔ̀c*
 rope D-pull:BAP-PAS:CT man

‘The man is being pulled for with the rope’

(33) Antipassive

C-topic *juɪɛn ɔ̀-m̩it-ɛ̀*
 rope D-pull:AP-PAS:CT

‘The rope is being pulled with’

As can be seen in (28)-(33), the O-topic passive form with a simple stem has no suffix, whereas a C-topic passive form has the suffix /-ɛ̀/, as does an O-topic passive form with a derived stem (cf. also Table 2 below).

It should be noted that although the passive verb forms exclude the presence of a grammatical subject, they can cooccur with an Agent which has been demoted to an adverbial. Compare the O-topic clauses in (34) and in (35), where (a) is active, (b) is passive with a demoted Agent, and (c) is passive without an Agent.

(34) a. *mɛ̀t ɔ̀-t̩ɛ̀t* *t̩ik*
 child D-beat:NTS woman
 ‘The woman is beating the child’

b. *mɛ̀t ɔ̀-t̩át* *nɛ̀* *t̩ik*
 child D-beat:PAS PREP woman
 ‘The child is being beaten by the woman’

c. *mɛ̀t ɔ̀-t̩át*
 child D-beat:PAS
 ‘The child is being beaten’

- (35) a. *m̈oc à-kuɛn m̈eẗ ɣɔk*
 man D-count:B:NTS child cows
 ‘The child is counting the cows for the man’
- b. *m̈oc à-kuɛn-ɛ ɣɔk n̈e m̈eẗ*
 man D-count:B-PAS cows PREP child
 ‘The cows are being counted for the man by the child’
- c. *m̈oc à-kuɛn-ɛ ɣɔk*
 man D-count:B-PAS cows
 ‘The cows are being counted for the man’

Instead of indicating that the clause has a subject or that it has no subject, the finite verb may express a pronominal subject. However, a pronominal subject is not always expressed by the verb. Therefore, before going into the details of subject inflection, it is necessary to outline under what circumstances a pronominal participant is given what kind of realization. The expression of a pronominal participant depends on four factors: (i) its grammatical relation, (ii) its position, (iii) its topicality, and (iv) the grammatical relation of the topic. The relevant distinctions are exemplified in (36) with the pronominal participants first person plural (1P) and third person singular (3S).

- (36) a. Preverbal subject
- 1P *ɣɔk áa-m̈iẗ ẅeŋ*
 1P D:PL-pull cow
 ‘We are pulling the cow’
- 3S *(j̈eŋ) à-m̈iẗ ẅeŋ*
 3S D-pull cow
 ‘He is pulling the cow’
- b. Preverbal object
- 1P *ɣɔk áa-m̈iɣ̈iẗ ẅeŋ*
 1P D:PL-pull:NTS cow:GEN
 ‘The cow is pulling us’
- 3S *(j̈eŋ) à-m̈iɣ̈iẗ ẅeŋ*
 3S D-pull:NTS cow:GEN
 ‘The cow is pulling him’

c. Postverbal non-topical subject with O-topic

1P *wɛŋ*
 cow
 'We are pulling the cow'

3S *wɛŋ ǎ-m̀it*
 cow D-pull:3S
 'He is pulling the cow'

d. Postverbal non-topical subject with C-topic

1P *juiɛn ǎ-m̀it yók wɛŋ*
 rope D-pull:NTS 1P:GEN cow
 'We are pulling the cow with the rope'

3S *juiɛn ǎ-m̀it jɛn wɛŋ*
 rope D-pull:NTS 3S:GEN cow
 'He is pulling the cow with the rope'

e. Postverbal topical subject

1P *m̀it-k̀i wɛŋ*
 pull-1P cow
 'Shall we pull the cow?'

3S *m̀it wɛŋ*
 pull:3S cow
 'Is he pulling the cow?'

f. Postverbal object

1P *wɛŋ ǎ-m̀it ô*
 cow D-pull 1P
 'The cow is pulling us'

3S *wɛŋ ǎ-m̀it ê*
 cow D-pull 3S
 'The cow is pulling him'

A preverbal (and, hence, topical) pronominal participant (whether a subject or an object, or a circumstantial for that matter), as in (36a-b), is expressed by a pronoun (in the absolutive case), but is normally zero if third person (singular or plural). A postverbal non-topical subject of a clause with an O-topic, as in (36c), is expressed in the verb (either by a suffix or in the verb stem), as is a postverbal topical subject, as in (36e). A postverbal non-topical subject of a clause with a C-topic, as in (36d), is expressed by a pronoun (in the genitive case). Finally, a

postverbal (and, hence, non-topical) object, as in (36f), is expressed by a (segmentally reduced) pronoun (in the absolutive case).

The facts outlined above imply that in declarative clauses a pronominal subject is expressed in the verb if the topic is an object, and that in non-declarative clauses a pronominal subject is expressed in the verb if the topic is either an object or the subject itself. This, again, means that if intransitive, the verb cannot be inflected for the subject in declarative clauses but only in non-declarative clauses. The full range of subject inflection is illustrated by the paradigms in (37) for each of the six derivational categories. The transitive categories are exemplified by means of declarative clauses, and the antipassive (and hence intransitive) category is exemplified by means of coordinative clauses.

(37)	Simple	Centrifugal
1S	à-mieĕet	à-mieĕet
2S	à-mĭit	à-mieĕet-ĕ
3S	à-mĭit	à-mĭit
1P	à-mĭit-kŭ	à-mĭit-kŭ
2P	à-mieĕet-kà	à-mieĕet-kà
3P	à-mĭit-kĕ	à-mĭit-kĕ
	'I/...am/...pulling it'	'I/...am/...pulling it thither'
	Centripetal	Benefactive
1S	à-mieĕet	à-mieĕet mōc
2S	à-mĭit	à-mieĕet-ĕ mōc
3S	à-mĭit	à-mĭit mōc
1P	à-mĭit-kŭ	à-mĭit-kŭ mōc
2P	à-mieĕet-kà	à-mieĕet-kà mōc
3P	à-mĭit-kĕ	à-mĭit-kĕ mōc
	'I/...am/...pulling it hither'	'I/...am/...pulling it for the man'
	Benefactive-antipassive	Antipassive
1S	à-mieĕet	kŭ mieĕet
2S	à-mieĕet-ĕ	kŭ mieĕet-ĕ
3S	à-mĭit	kŭ mĭit
1P	à-mĭit-kŭ	kŭ mĭit-kŭ
2P	à-mieĕet-kà	kŭ mieĕet-kà
3P	à-mĭit-kĕ	kŭ mĭit-kĕ
	'I/...am/...pulling for him'	'and I/...pulled'

As shown by the examples in (37) and as indicated in Table 2, the subject is sometimes expressed by a suffix, sometimes without. A plural subject is always expressed by a suffix, a second person singular subject is expressed by a suffix

unless the stem is either simple or centripetal, and a first or third person singular subject is never expressed by a suffix. In the absence of a suffix, the subject is expressed by the form of the verb stem, but suffixes may also affect the form of the stem. The tones of the plural suffixes are left unspecified in Table 2, the reason being that they vary according to the stem tone (cf. section 7.1 below).

Table 2. Verbal suffixes⁷

inflectional category	derivational category		
	simple	CP	CF B BAP AP
1S	∅		
2S	∅		-é
3S	∅		
1P	-k <u>u</u>		
2P	-k <u>a</u>		
3P	-k <u>e</u>		
PAS	∅		-è
PAS:CT	-è		

The non-finite form of a verb is the form taken by the main verb of a clause in which the finite verb is an auxiliary. In (38), which illustrates each of the six derivational categories, the auxiliary verb is /cɛ/, which indicates the perfect tense-aspect.

(38) a. Simple

d̥ɔk à-cɛ wɛŋ m̥ɪt
 boy D-PF cow pull:NF
 'The boy has pulled the cow'

b. Centrifugal

d̥ɔk à-cɛ wɛŋ miẽɛt
 boy D-PF cow pull:CF:NF
 'The boy has pulled the cow thither'

⁷ The third person plural suffix /-kɛ/ varies freely with /-kɪ/.

- c. Centripetal
d̪ɔ̌k ̱-c̪ w̪ɛŋ mie̪ɛt
 boy D-PF cow pull:CP:NF
 ‘The boy has pulled the cow hither’
- d. Benefactive
d̪ɔ̌k ̱-c̪ w̪ɛŋ mi̪ɛt m̪ɔc
 boy D-PF cow pull:B:NF man
 ‘The boy has pulled the cow for the man’
- e. Benefactive-antipassive
d̪ɔ̌k ̱-c̪ m̪ɔc mie̪ɛt
 boy D-PF man pull:BAP:NF
 ‘The boy has pulled for the man’
- f. Antipassive
d̪ɔ̌k ̱-c̪ mi̪ɛt
 boy D-PF pull:AP:NF
 ‘The boy has pulled’

The derivational information is carried by the main verb, and the inflectional information is carried by the auxiliary verb. The inflection of the auxiliary verb /c̪/ is shown in (39).

- (39) ∅ *d̪ɔ̌k ̱-c̪ w̪ɛŋ mi̪ɛt*
 boy D-PF cow pull:NF
 ‘The boy has pulled the cow’
- NTS *w̪ɛŋ ̱-c̪i d̪ɔ̌k mi̪ɛt*
 cow D-PF:NTS boy pull:NF
 ‘The boy has pulled the cow’
- 1S *w̪ɛŋ ̱-c̪ mi̪ɛt*
 cow D-PF:1S pull:NF
 ‘I have pulled the cow’
- 2S *w̪ɛŋ ̱-c̪ mi̪ɛt*
 cow D-PF:2S pull:NF
 ‘You have pulled the cow’
- 3S *w̪ɛŋ ̱-c̪ mi̪ɛt*
 cow D-PF:3S pull:NF
 ‘He has pulled the cow’

- 1P *wéŋ â-cùuk mîit*
 cow D-PF:1P pull:NF
 'We have pulled the cow'
- 2P *wéŋ â-câak mîit*
 cow D-PF:2P pull:NF
 'You have pulled the cow'
- 3P *wéŋ â-cîik mîit*
 cow D-PF:3P pull:NF
 'They have pulled the cow'
- PAS *wéŋ â-cîi mîit*
 cow D-PF:PAS pull:NF
 'The cow has been pulled'
- PAS:CT *juiêen â-cîin-è wéŋ mîit*
 rope D-PF-PAS:CT cow pull:NF
 'The cow has been pulled with the rope'

In summary, a verb is either finite or non-finite, and a finite verb is inflected for the grammatical relation of the topic and for either the presence/absence of a subject or the person and number of a postverbal pronominal subject. A verb form thus belongs to one of 11 inflectional categories as well as to one of (at least) 6 derivational categories.

4. Phonological classes of roots

The vowel length, the tone, and the voice quality of a verb stem with a transitive root are predictable from phonological properties of the root, but in rather intricate ways.

Within the set of simple stem forms that manifests a transitive root, the vowel alternates in length either between short (CVC) and half-long (CVVC) or between half-long (CVVC) and long (CVVVC). Synchronically, there seems to be no strong evidence that one of the two length alternants of a root is more basic than the other. Diachronically, however, as argued in Andersen [1990], the shorter alternants are in all likelihood the original ones. For convenience, then, I shall take the root vowels of the two length classes to be basically short and half-long, respectively.

Whether the root vowel is short or half-long, a simple stem can have any of the three tones. However, within the set of simple stems with a root of either length class, there is one and only one stem from which the tones of the other stems are predictable, viz. the non-finite stem. Hence, the tone of that stem can be taken to

be the tone of the root. In that way, either of the two length classes of roots falls into two tonal classes: The tone of a root with a short vowel is either F or L, and the tone of a root with a half-long vowel is either F or H.

The total of four length/tone classes of transitive verbal roots are exemplified by the pairs of simple stems in (40)-(43). The (a)-clauses contain the inflectionally unmarked stem, which manifests the basic length of the root vowel, but in which the tonal class distinction is neutralized. The (b)-clauses contain the non-finite stem, which manifests the non-basic length of the root vowel, but in which the tonal class of the root can be identified.

- (40) Root class: CVC/F
- a. *à-làt m̀òc*
 D-insult man
 ‘He is insulting the man’
- b. *à-cé m̀òc làat*
 D-PF man insult:NF
 ‘He has insulted the man’
- (41) Root class: CVC/L
- a. *à-nàj n̄ièem*
 D-plait hair
 ‘She is plaiting the hair’
- b. *à-cé n̄ièem n̄àaj*
 D-PF hair plait:NF
 ‘She has plaited the hair’
- (42) Root class: CVVC/F
- a. *à-jàaŋ l̄áj*
 D-skin animal
 ‘He is skinning the animal’
- b. *à-cé l̄áj jaàaŋ*
 D-PF animal skin:NF
 ‘He has skinned the animal’

(43) Root class: CVVC/H

- a. \dot{a} - $\eta\dot{a}a\eta$ $\dot{a}t\dot{i}\eta$
 D-open door
 'He is opening the door'
- b. \dot{a} - $c\acute{e}$ $\dot{a}t\dot{i}\eta$ $\eta\dot{a}\acute{a}\eta$
 D-PF door open:NF
 'He has opened the door'

There is no voice quality alternation within the set of simple stems that manifests a given root. The stems exemplifying the four length/tone classes of roots in (40)-(43) have the creaky voice quality, but all of these classes also contain roots with the breathy voice quality, as shown by examples (44)-(47).

(44) Root class: CVC/F

- a. \dot{a} - $gu\grave{a}r$ $r\grave{a}p$
 D-grind sorghum
 'She is grinding sorghum'
- b. \dot{a} - $c\acute{e}$ $r\grave{a}p$ $gu\grave{o}r$
 D-PF sorghum grind:NF
 'She has ground sorghum'

(45) Root class: CVC/L

- a. \dot{a} - $m\grave{e}r$ $t\grave{o}o\eta$
 D-decorate pot
 'She is decorating a pot'
- b. \dot{a} - $c\acute{e}$ $t\grave{o}o\eta$ $m\grave{e}r$
 D-PF pot decorate:NF
 'She has decorated a pot'

(46) Root class: CVVC/F

- a. \dot{a} - $k\grave{o}\grave{o}t$ $p\grave{i}\eta$
 D-scratch ground
 'He is scratching the ground'
- b. \dot{a} - $c\acute{e}$ $p\grave{i}\eta$ $k\grave{o}\grave{o}t$
 D-PF ground scratch:NF
 'He has scratched the ground'

- (47) Root class: CVVC/H
- a. \dot{a} -cu \dot{e} ec t \dot{o} oŋ
D-mould pot
'She is moulding a pot'
- b. \dot{a} -c \dot{e} t \dot{o} oŋ cue \dot{e} ec
D-PF pot mould:NF
'She has moulded a pot'

The relative distribution of the sampled roots among the eight length/tone/voice classes is shown in Table 3.

Table 3. Relative distribution of the sampled roots among the eight length/tone/voice classes.

Root class	%
C \dot{Y} C/F	26.4
C \dot{Y} C/F	14.1
C \dot{Y} C/L	10.1
C \dot{Y} C/L	3.2
C \dot{Y} VC/F	15.6
C \dot{Y} VC/F	9.5
C \dot{Y} VC/H	14.6
C \dot{Y} VC/H	6.5

Since the sampling was not based on phonological criteria, this distribution of approximately 500 roots is probably fairly representative of the total inventory of transitive verbal roots.

Given the length/tone/voice class of a root, the vowel length, the tone and the voice quality of any stem with that root are predictable as shown in Table 4.⁸

⁸ Certain entries of Table 4 exhibit tonal variation, as described in section 7 below. I am not aware of any exceptions to the specifications of the table as far as root classes CVC/F and CVC/L are concerned. However, a few roots of class CVVC/H have a half-long rather than a short vowel in the non-finite form of the antipassive stem, for instance the roots /t \dot{a} a/ 'to cook' and /m \dot{a} a/ 'to smoke'. Moreover, some roots of class CVVC/F with the breathy voice quality have a half-long rather than a long vowel in the antipassive, e.g. the roots /k \dot{o} ɔ/ 'to scratch' and /t \dot{i} eec/ 'to ask'.

Table 4. Vowel length, tone, and voice quality alternations.

length/ tone class	inflectional category	derivational category (and voice quality class)		
		simple	centrifugal	centripetal
cvc/F	Ø	c̀̀vc	ćvc	c̀̀vc
	NF	c̀̀vc	ćvc	c̀̀vc
	NTS	ćvc	ćvc	ćvc
	1S,3S	c̀̀vc	ćvc	c̀̀vc
	2S	c̀̀vc	c̀̀vc-́	ćvc
	1P,2P,3P	ćvc-c̀̀	ćvc-c̀̀	c̀̀vc-ć
	PAS PAS:CT	ćvc c̀̀vc-̀̀	c̀̀vc-̀̀ c̀̀vc-̀̀	c̀̀vc-̀̀ c̀̀vc-̀̀
cvc/L	Ø	c̀̀vc	c̀̀vc	c̀̀vc
	NF	c̀̀vc	c̀̀vc	c̀̀vc
	NTS	ćvc	ćvc	ćvc
	1S,3S	c̀̀vc	c̀̀vc	c̀̀vc
	2S	c̀̀vc	c̀̀vc-́	ćvc
	1P,2P,3P	ćvc-c̀̀	c̀̀vc-c̀̀	c̀̀vc-ć
	PAS PAS:CT	ćvc c̀̀vc-̀̀	c̀̀vc-̀̀ c̀̀vc-̀̀	c̀̀vc-̀̀ c̀̀vc-̀̀
cvvc/F	Ø	c̀̀vc	cv̀̀vc	cv̀̀vc
	NF	cv̀̀vc	cv̀̀vc	cv̀̀vc
	NTS	cv́vc	cv́vc	cv́vc
	1S,3S	cv̀̀vc	cv̀̀vc	cv̀̀vc
	2S	cv̀̀vc	cv̀̀vc-́	cv́vc
	1P,2P,3P	c̀̀vc-ć	cv̀̀vc-c̀̀	cv̀̀vc-ć
	PAS PAS:CT	cv̀̀vc cv̀̀vc-̀̀	cv̀̀vc-̀̀ cv̀̀vc-̀̀	cv̀̀vc-̀̀ cv̀̀vc-̀̀
cvvc/H	Ø	c̀̀vc	cv́vc	cv̀̀vc
	NF	cv́vc	cv́vc	cv̀̀vc
	NTS	cv́vc	cv́vc	cv́vc
	1S,3S	cv̀̀vc	cv́vc	cv̀̀vc
	2S	cv́vc	cv̀̀vc-́	cv́vc
	1P,2P,3P	c̀̀vc-ć	cv́vc-c̀̀	cv̀̀vc-ć
	PAS PAS:CT	cv́vc cv̀̀vc-̀̀	cv̀̀vc-̀̀ cv̀̀vc-̀̀	cv̀̀vc-̀̀ cv̀̀vc-̀̀

Table 4, continued.

length/ tone class	inflectional category	derivational category (and voice quality of class)			
		benefactive	benefactive- antipassive	antipassive	
				creaky root	breathy root
cvc/F	∅	cʏvc	cʔvc	cʏvc	
	NF	cʏvc	cʔvc	cʏvc	
	NTS	cʏvc	cʏvc	cʏvc	
	1S,3S	cʏvc	cʏvc	cʏvc	
	2S	cʏvc-ʏ	cʏvc-ʏ	cʏvc-ʏ	
	1P,2P,3P	cʏvc-cʏ	cʏvc-cʏ	cʏvc-cʏ	
	PAS PAS:CT	cʏvc-ʔ	cʏvc-ʔ	cʏvc-ʔ	
cvc/L	∅	cʔvc	cʔvc	cʔvc	
	NF	cʔvc	cʔvc	cʔvc	
	NTS	cʏvc	cʏvc	cʏvc	
	1S,3S	cʔvc	cʔvc	cʔvc	
	2S	cʏvc-ʏ	cʏvc-ʏ	cʏvc-ʏ	
	1P,2P,3P	cʔvc-cʏ	cʔvc-cʏ	cʔvc-cʏ	
	PAS PAS:CT	cʔvc-ʔ	cʔvc-ʔ	cʔvc-ʔ	
cvvc/F	∅	cʏvc	cvʔvc	cʏvc	cvʏvc
	NF	cʏvc	cvʔvc	cvʏvc	cvʏvc
	NTS	cʏvc	cvʏvc	cvʏvc	cvʏvc
	1S,3S	cʔvc	cvʔvc	cvʏvc	cvʏvc
	2S	cʏvc-ʏ	cvʏvc-ʏ	cvʏvc-ʏ	cvʏvc-ʏ
	1P,2P,3P	cʏvc-cʏ	cvʏvc-cʏ	cʏvc-cʏ	cvʏvc-cʏ
	PAS PAS:CT	cʏvc-ʔ	cvʔvc-ʔ	cvʔvc-ʔ	cvʔvc-ʔ
cvvc/H	∅	cʏvc	cʏvc	cʏc	
	NF	cʏvc	cʏvc	cʏc	
	NTS	cʏvc	cʏvc	cʏvc	
	1S,3S	cʏvc	cʏvc	cʏvc	
	2S	cʏvc-ʏ	cʏvc-ʏ	cʏvc-ʏ	
	1P,2P,3P	cʏvc-cʏ	cʏvc-cʏ	cʏc-cʏ	
	PAS PAS:CT	cʏvc-ʔ	cʏvc-ʔ	cʏvc-ʔ	

The table specifies the vowel length, the tone and the voice quality of a stem for all possible combination of root class, derivational category and inflectional category. Absence of a voice quality symbol in a stem in the table indicates that the voice quality of that stem is identical with the voice quality of the root.

The entries of Table 4 are exemplified in (48)-(51). Each length/tone class is exemplified with a creaky root, for which the total set of forms is given.

(48) *wɛc* /F 'to kick'

	simple	CF	CP	B	BAP	AP
∅	wɛc	wɛ̃c	wɛ̀c	wɛ̂c	wɛ̄c	wɛ̆c
NF	wɛ̃c	wɛ̃̃c	wɛ̀̃c	wɛ̂̃c	wɛ̄̃c	wɛ̆̃c
NTS	wɛ̃c	wɛ̃̃c	wɛ̀̃c	wɛ̂̃c	wɛ̄̃c	wɛ̆̃c
1S	wɛ̃c	wɛ̃̃c	wɛ̀̃c	wɛ̂̃c	wɛ̄̃c	wɛ̆̃c
2S	wɛ̀c	wɛ̀̃c-ɛ̃	wɛ̀̃c	wɛ̀̃c-ɛ̃	wɛ̀̃c-ɛ̃	wɛ̀̃c-ɛ̃
3S	wɛ̀c	wɛ̃̃c	wɛ̀̃c	wɛ̂̃c	wɛ̄̃c	wɛ̆̃c
1P	wɛ̃c-kù	wɛ̃̃c-kù	wɛ̀̃c-kù	wɛ̂̃c-kù	wɛ̄̃c-kù	wɛ̆̃c-kù
2P	wɛ̃c-kà	wɛ̃̃c-kà	wɛ̀̃c-kà	wɛ̂̃c-kà	wɛ̄̃c-kà	wɛ̆̃c-kà
3P	wɛ̃c-kè	wɛ̃̃c-kè	wɛ̀̃c-kè	wɛ̂̃c-kè	wɛ̄̃c-kè	wɛ̆̃c-kè
PAS	wɛ̃c	wɛ̃̃c-è	wɛ̀̃c-è	wɛ̂̃c-è	wɛ̄̃c-è	
PAS:CT	wɛ̃c-è	wɛ̃̃c-è	wɛ̀̃c-è	wɛ̂̃c-è	wɛ̄̃c-è	wɛ̆̃c-è

(49) *tɛŋ* /L 'to dust'

	simple	CF	CP	B	BAP	AP
∅	tɛŋ	tɛ̃ŋ	tɛ̀ŋ	tɛ̂ŋ	tɛ̄ŋ	tɛ̆ŋ
NF	tɛ̃ŋ	tɛ̃̃ŋ	tɛ̀̃ŋ	tɛ̂̃ŋ	tɛ̄̃ŋ	tɛ̆̃ŋ
NTS	tɛ̃ŋ	tɛ̃̃ŋ	tɛ̀̃ŋ	tɛ̂̃ŋ	tɛ̄̃ŋ	tɛ̆̃ŋ
1S	tɛ̃ŋ	tɛ̃̃ŋ	tɛ̀̃ŋ	tɛ̂̃ŋ	tɛ̄̃ŋ	tɛ̆̃ŋ
2S	tɛ̀ŋ	tɛ̀̃ŋ-ɛ̃	tɛ̀̃ŋ	tɛ̀̃ŋ-ɛ̃	tɛ̀̃ŋ-ɛ̃	tɛ̀̃ŋ-ɛ̃
3S	tɛ̀ŋ	tɛ̃̃ŋ	tɛ̀̃ŋ	tɛ̂̃ŋ	tɛ̄̃ŋ	tɛ̆̃ŋ
1P	tɛ̃ŋ-kù	tɛ̃̃ŋ-kù	tɛ̀̃ŋ-kù	tɛ̂̃ŋ-kù	tɛ̄̃ŋ-kù	tɛ̆̃ŋ-kù
2P	tɛ̃ŋ-kà	tɛ̃̃ŋ-kà	tɛ̀̃ŋ-kà	tɛ̂̃ŋ-kà	tɛ̄̃ŋ-kà	tɛ̆̃ŋ-kà
3P	tɛ̃ŋ-kè	tɛ̃̃ŋ-kè	tɛ̀̃ŋ-kè	tɛ̂̃ŋ-kè	tɛ̄̃ŋ-kè	tɛ̆̃ŋ-kè
PAS	tɛ̃ŋ	tɛ̃̃ŋ-è	tɛ̀̃ŋ-è	tɛ̂̃ŋ-è	tɛ̄̃ŋ-è	
PAS:CT	tɛ̃ŋ-è	tɛ̃̃ŋ-è	tɛ̀̃ŋ-è	tɛ̂̃ŋ-è	tɛ̄̃ŋ-è	tɛ̆̃ŋ-è

(50) *lɛr* /F 'to roll'

	simple	CF	CP	B	BAP	AP
∅	lɛr	lɛ̃r	lɛ̀r	lɛ̂r	lɛ̄r	lɛ̆r
NF	lɛ̃r	lɛ̃̃r	lɛ̀̃r	lɛ̂̃r	lɛ̄̃r	lɛ̆̃r
NTS	lɛ̃r	lɛ̃̃r	lɛ̀̃r	lɛ̂̃r	lɛ̄̃r	lɛ̆̃r
1S	lɛ̃r	lɛ̃̃r	lɛ̀̃r	lɛ̂̃r	lɛ̄̃r	lɛ̆̃r
2S	lɛ̀r	lɛ̀̃r-ɛ̃	lɛ̀̃r	lɛ̀̃r-ɛ̃	lɛ̀̃r-ɛ̃	lɛ̀̃r-ɛ̃
3S	lɛ̀r	lɛ̃̃r	lɛ̀̃r	lɛ̂̃r	lɛ̄̃r	lɛ̆̃r
1P	lɛ̃r-kù	lɛ̃̃r-kù	lɛ̀̃r-kù	lɛ̂̃r-kù	lɛ̄̃r-kù	lɛ̆̃r-kù
2P	lɛ̃r-kà	lɛ̃̃r-kà	lɛ̀̃r-kà	lɛ̂̃r-kà	lɛ̄̃r-kà	lɛ̆̃r-kà
3P	lɛ̃r-kè	lɛ̃̃r-kè	lɛ̀̃r-kè	lɛ̂̃r-kè	lɛ̄̃r-kè	lɛ̆̃r-kè
PAS	lɛ̃r	lɛ̃̃r-è	lɛ̀̃r-è	lɛ̂̃r-è	lɛ̄̃r-è	
PAS:CT	lɛ̃r-è	lɛ̃̃r-è	lɛ̀̃r-è	lɛ̂̃r-è	lɛ̄̃r-è	lɛ̆̃r-è

(51) *tɛem* /H 'to cut'

	simple	CF	CP	B	BAP	AP
∅	<i>tɛem</i>	<i>teɛem</i>	<i>teɛem</i>	<i>tɛem</i>	<i>tɛem</i>	<i>tɛm</i>
NF	<i>teɛem</i>	<i>teɛem</i>	<i>teɛem</i>	<i>tɛem</i>	<i>tɛem</i>	<i>tɛm</i>
NTS	<i>teɛem</i>	<i>teɛem</i>	<i>teɛem</i>	<i>tɛem</i>	<i>tɛem</i>	<i>tɛem</i>
1S	<i>teɛem</i>	<i>teɛem</i>	<i>teɛem</i>	<i>tɛem</i>	<i>tɛem</i>	<i>tɛem</i>
2S	<i>tɛem</i>	<i>teɛem-ɛ</i>	<i>teɛem</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>
3S	<i>teɛem</i>	<i>teɛem</i>	<i>teɛem</i>	<i>tɛem</i>	<i>tɛem</i>	<i>tɛem</i>
1P	<i>tɛem-kú</i>	<i>teɛem-kú</i>	<i>teɛem-kú</i>	<i>tɛem-kú</i>	<i>tɛem-kú</i>	<i>tɛm-kú</i>
2P	<i>tɛem-ká</i>	<i>teɛem-ká</i>	<i>teɛem-ká</i>	<i>tɛem-ká</i>	<i>tɛem-ká</i>	<i>tám-ká</i>
3P	<i>tɛem-kɛ</i>	<i>teɛem-kɛ</i>	<i>teɛem-kɛ</i>	<i>tɛem-kɛ</i>	<i>tɛem-kɛ</i>	<i>tɛm-kɛ</i>
PAS	<i>tɛem</i>	<i>teɛem-ɛ</i>	<i>teɛem-ɛ</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>
PAS:CT	<i>teɛem-ɛ</i>	<i>teɛem-ɛ</i>	<i>teɛem-ɛ</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>	<i>tɛem-ɛ</i>

In spite of the extensive utilization of the contrasts in voice quality, vowel length and tone for expressing morphological distinctions, morphologically distinct forms may be homonymous, the actual homonymy depending on the length/tone/voice class of the root. This homonymy may give rise to ambiguity, as in (52) and (53), whose verb belongs to root class CVC/F.

(52) a. *à-pɿik*

D-push:AP

'He is pushing'

b. *à-pɿik*

D-push:BAP:3S

'He is pushing for him'

(53) a. *à-pɿik* *dɔ̀ɔk*

D-push:NTS boy

'The boy is pushing him'

b. *à-pɿik* *dɔ̀ɔk*

D-push:CF boy

'He is pushing the boy thither'

c. *à-pɿik* *dɔ̀ɔk*

D-push:CF:NTS boy

'The boy is pushing him thither'

d. *à-pɿik* *dɔ̀ɔk*

D-push:CP:NTS boy

'The boy is pushing him hither'

- e. \hat{a} - $p\acute{r}ik$ $d\grave{d}ok$
 D-push:BAP:NTS boy
 'The boy is pushing for him'

The two clauses in (52) are grammatically distinct but phonetically identical, and so are the five clauses in (53). Thus, the intended reading of the examples given in this article, as indicated in the gloss, is not always the only possible reading.

In the following sections, the alternations in voice quality, vowel length and tone will be spelt out, and their respective contributions to derivation and inflection will be unravelled.

5. Voice quality alternation

In simple stems and in centrifugal stems, the voice quality is identical with the voice quality inherent in the root. Centripetal stems, benefactive stems and benefactive-antipassive stems, on the other hand, invariably have the breathy voice quality whether the voice quality of the root is breathy or creaky. Hence, if the root has the creaky voice, it exhibits voice quality alternation, as in (54).

(54) $b\bar{a}r$ /F 'to take along'

- a. $w\acute{e}\eta$ \hat{a} - $b\grave{e}er$
 cow D-take.along:3S
 'He is taking the cow along'
- b. $w\acute{e}\eta$ \hat{a} - $b\grave{e}er$
 cow D-take.along:CF:3S
 'He is taking the cow along (going away)'
- c. $w\acute{e}\eta$ \hat{a} - $b\grave{e}er$
 cow D-take.along:CP:3S
 'He is bringing the cow along'
- d. $w\acute{e}\eta$ \hat{a} - $b\grave{e}er$ $m\grave{o}c$
 cow D-take.along:B:3S man
 'He is taking the cow along to the man'
- e. $m\grave{o}c$ \hat{a} - $b\grave{e}er$
 man D-take.along:BAP:3S
 'He is taking something along to the man'

If, on the other hand, the root has the breathy voice, it does not exhibit any voice quality alternation, see example (55), which parallels example (54).

- (55) *ṭar* /F ‘to spear’
- a. *láj* *à-ṭɛ̣ɛr*
 animal D-spear:3S
 ‘He is spearing an animal’
 - b. *ṭɔ̣ŋ* *à-ṭɛ̣ɛr*
 spear D-spear:CF:3S
 ‘He is throwing a spear thither’
 - c. *ṭɔ̣ŋ* *à-ṭɛ̣ɛr*
 spear D-spear:CP:3S
 ‘He is throwing a spear hither’
 - d. *ṭɔ̣ŋ* *à-ṭɛ̣ɛr* *ṃɔ̣c*
 spear D-spear:B:3S man
 ‘He is throwing a spear for the man’
 - e. *ṃɔ̣c* *à-ṭɛ̣ɛr*
 man D-spear:BAP:3S
 ‘He is spearing for the man’

With antipassive stems, the situation is more complex. In (56)-(59) below, (a)-(b) contain simple stems which identify the length/tone class of the root in question, and (c)-(d) contain the inflectionally corresponding antipassive stems with that root, viz. the inflectionally unmarked form in (c), which is representative of all finite forms with respect to voice quality, and the non-finite form in (d). To a certain extent, antipassive stems are characterized by having the breathy voice. Thus all stem forms have the breathy voice in the antipassive if the root belongs to class CVVC/F, as in (56).

- (56) a. *à-ḷɛ̣ɛr ṭɔ̣ŋ*
 D-roll pot
 ‘He is rolling the pot’
- b. *à-c̣ɛ̣ ṭɔ̣ŋ ḷɛ̣ɛr*
 D-PF pot roll:NF
 ‘He has rolled the pot’
- c. *à-ḷɛ̣ɛr*
 D-roll:AP
 ‘He is rolling (something)’

- d. *à-cẹ leęer*
 D-PF roll:AP:NF
 'He has rolled (something)'

However, if the root belongs to class CVC/F, as in (57), or to class CVVC/H, as in (58), then the non-finite stem retains the voice quality inherent in the root.

- (57) a. *à-węc dđok*
 D-kick ball
 'He is kicking a ball'
- b. *à-cẹ dđok węc*
 D-PF ball kick:NF
 'He has kicked a ball'
- c. *à-węc*
 D-kick:AP
 'He is kicking'
- d. *à-cẹ węc*
 D-PF kick:AP:NF
 'He has kicked'
- (58) a. *à-tẹm tịm*
 D-cut tree
 'He is cutting a tree'
- b. *à-cẹ tịm teęem*
 D-PF tree cut:NF
 'He has cut a tree'
- c. *à-tẹm*
 D-cut:AP
 'He is cutting'
- d. *à-cẹ tẹm*
 D-PF cut:AP:NF
 'He has cut'

Moreover, if the root belongs to class CVC/L, then all forms of the antipassive stem retain the voice quality inherent in the root, as in (59).

- (59) a. \dot{a} - $t\dot{e}\eta$ $\dot{a}l\dot{a}a\dot{t}$
 D-dust cloth
 ‘She is dusting the cloth’
- b. \dot{a} - $c\acute{e}$ $\dot{a}l\dot{a}a\dot{t}$ $t\dot{e}\eta$
 D-PF cloth dust:NF
 ‘She has dusted the cloth’
- c. \dot{a} - $t\acute{e}\eta$
 D-dust:AP
 ‘She is dusting’
- d. \dot{a} - $c\acute{e}$ $t\acute{e}\eta$
 D-PF dust:AP:NF
 ‘She has dusted’

The distribution of voice qualities is summarized in Table 5.

Table 5. Voice quality alternation.

root class	derivational (and inflectional) categories			
	simple, centrifugal	centripetal, benefactive, benefactive- antipassive	antipassive	
			finite	non-finite
CVC/F	inherent	breathy	breathy	inherent
CVC/L	inherent	breathy	inherent	inherent
CVVC/F	inherent	breathy	breathy	breathy
CVVC/H	inherent	breathy	breathy	inherent

As can be seen in the table, some morphological categories are characterized by the breathy voice, whereas no morphological categories are characterized by the creaky voice. Thus, although the voice quality inherent in the root is either creaky or breathy, we only find alternation between inherently creaky voice and breathy voice, and no alternation between inherently breathy voice and creaky voice. In fact, this state of affairs extends to all parts of the morphology. Clearly, therefore, the breathy voice is the marked member of the voice quality opposition. Since this opposition is a binary one, the creaky voice quality can be analysed as unspecified voice quality in the phonological representation of the root. Given this analysis, the morphological categories characterized by the

breathy voice specify the voice quality as [+breathy]. If neither the root nor any morphological category specifies the voice quality, then the latter gets the default value [-breathy], i.e., creaky, in the phonetic representation. This analysis implies that the phonological representation is stratified into a root layer and a derivational layer such that the voice quality parameter may be specified at either of them, at both of them, or at neither of them. All of these possibilities are exemplified in (61), which represents the word forms in (60).

- (60) a. *wɛ̣ɛc* ‘Is he kicking it?’ (kick:3S) (CVC/F)
 b. *tɛ̣ɛr* ‘Is he spearing it?’ (spear:3S) (CVC/F)
 c. *wɛ̣ɛc* ‘Is he kicking it hither?’ (kick:CP:3S) (CVC/F)
 d. *tɛ̣ɛr* ‘Is he throwing it hither?’ (spear:CP:3S) (CVC/F)

(61)	a.	b.	c.	d.
	<u>phonetic representation</u>			
	[-breathy]	[+breathy]	[+breathy]	[+breathy]
	derivational layer		[+breathy]	[+breathy]
	root layer	[+breathy]		[+breathy]

As we shall see in the following sections, a similarly stratified representation is also suggested by alternations in the other phonological parameters.

6. Vowel length alternation

6.1. Vowel length in simple stems. In simple stems, as mentioned in section 4, the vowel length alternates between short and half-long (root classes CVC/F and CVC/L) or between half-long and long (root classes CVVC/F and CVVC/H). The alternation between short and half-long stem vowels is exemplified in (62), that between half-long and long stem vowels in (63).

- (62) ∅ *â-dòm wɛ̣ɛŋ* ‘He is catching a cow’
 NF *â-cɛ̣ wɛ̣ɛŋ dɔ̣ɔm* ‘He has caught a cow’
 NTS *â-dɔ̣ɔm dɔ̣ɔk* ‘The boy is catching it’
 1S *â-dâam* ‘I am catching it’
 2S *â-dòm* ‘You are catching it’
 3S *â-dɔ̣ɔm* ‘He is catching it’
 1P *â-dɔ̣ɔm-kù* ‘We are catching it’
 2P *â-dɔ̣ɔm-kâ* ‘You are catching it’
 3P *â-dɔ̣ɔm-kɛ̣* ‘They are catching it’
 PAS *â-dɔ̣ɔm* ‘It is being caught’
 PAS:CT *â-dɔ̣ɔm-ɛ̣ wɛ̣ɛŋ* ‘The cow is being caught with it’

(63)	∅	à-cḡol mèt	‘He is calling the child’
	NF	à-cḡ mèt cḡḡol	‘He has called the child’
	NTS	à-cḡḡol ṡik	‘The woman is calling him’
	1S	à-caḡal	‘I am calling him’
	2S	à-cḡḡol	‘You are calling him’
	3S	à-cḡḡol	‘He is calling him’
	1P	à-cḡḡol-kṡ	‘We are calling him’
	2P	à-cḡal-kḡ	‘You are calling him’
	3P	à-cḡḡol-kḡ	‘They are calling him’
	PAS	à-cḡḡol	‘He is being called’
	PAS:CT	à-cḡḡol-ḡ mèt ṡin	‘The child is being called there’

In both cases, the shorter alternant occurs when the inflectional category is ∅, 2S, 1P, 2P, 3P or PAS, and the longer alternant occurs when the inflectional category is NF, NTS, 1S, 3S or PAS:CT. Therefore, the following generalization seems obvious: Whatever the root class, one subset of inflectional categories occurs with a stem vowel that is one degree longer than the stem vowel occurring with the complementary subset of inflectional categories. If the shorter alternants are taken as basic, then the longer alternants can be analysed as resulting from the addition of one degree of length (one mora) to the length of the root vowel. Thus, the inflectional categories NF, NTS, 1S, 3S and PAS:CT contribute one mora to the skeletal tier.

6.2. Vowel length in transitive derived stems. While vowel length is an exponent of inflection in simple stems, there is no length alternation within the set of forms that manifests a derived stem, unless the latter is antipassive. That is, centrifugal stems, centripetal stems, benefactive stems, and benefactive-antipassive stems are inflected without vowel length alternation. In such stems, as we shall see, vowel length is an exponent of derivation.

The vowels of centrifugal stems and of centripetal stems are one degree longer than the corresponding root vowels. That is, they are either half-long, as in (64), or long, as in (65).

(64)	Simple		
	∅	à-pḡk wḡḡ	‘He is pushing a cow’
	NF	à-cḡ wḡḡ pḡk	‘He has pushed a cow’

Centrifugal

∅	à-píik wẹ̀n	'He is pushing a cow thither'
NF	à-cẹ̀ wẹ̀n piéek	'He has pushed a cow thither'
NTS	à-píik dḍòk	'The boy is pushing it thither'
1S	à-piék	'I am pushing it thither'
2S	à-pièek-ẹ̀	'You are pushing it thither'
3S	à-píik	'He is pushing it thither'
1P	à-píik-kù	'We are pushing it thither'
2P	à-pièek-kà	'You are pushing it thither'
3P	à-píik-kẹ̀	'They are pushing it thither'
PAS	à-pḥik-ẹ̀	'It is being pushed thither'

Centripetal

∅	à-píik wẹ̀n	'He is pushing a cow hither'
NF	à-cẹ̀ wẹ̀n pièek	'He has pushed a cow hither'
NTS	à-píik dḍòk	'The boy is pushing it hither'
1S	à-pièek	'I am pushing it hither'
2S	à-píik	'You are pushing it hither'
3S	à-píik	'He is pushing it hither'
1P	à-píik-kù	'We are pushing it hither'
2P	à-pièek-ká	'You are pushing it hither'
3P	à-píik-kẹ̀	'They are pushing it hither'
PAS	à-pḥik-ẹ̀	'It is being pushed hither'

(65) Simple

∅	à-tḥoc mèt	'He is sending a child'
NF	à-cẹ̀ mèt toḥoc	'He has sent a child'

Centrifugal

∅	à-toḥoc mèt	'He is sending a child thither'
NF	à-cẹ̀ mèt tuḥḥoc	'He has sent a child thither'
NTS	à-toḥoc bān	'The chief is sending him thither'
1S	à-tuḥḥoc	'I am sending him thither'
2S	à-tuḥḥoc-ẹ̀	'You are sending him thither'
3S	à-toḥoc	'He is sending him thither'
1P	à-toḥoc-kù	'We are sending him thither'
2P	à-tuḥḥoc-kà	'You are sending him thither'
3P	à-toḥoc-kẹ̀	'They are sending him thither'
PAS	à-toḥoc-ẹ̀	'He is being sent thither'

Centripetal

∅	à-tuùuc mèt	'He is sending a child hither'
NF	à-cé mèt tuoòoc	'He has sent a child hither'
NTS	à-tuúuc bən	'The chief is sending him hither'
1S	à-tuoòoc	'I am sending him hither'
2S	à-tuúuc	'You are sending him hither'
3S	à-tuùuc	'He is sending him hither'
1P	à-tuùuc-kú	'We are sending him hither'
2P	à-tuoòoc-ká	'You are sending him hither'
3P	à-tuùuc-ké	'They are sending him hither'
PAS	à-tuùuc-è	'He is being sent hither'

Centrifugal and centripetal stems thus involve the same phenomenon as that which is involved in the inflection of simple stems, viz. that one mora is added to the root. But this time the additional mora is contributed by the derivational categories in question and not by inflectional categories.

It might be suggested that no stem can have a vowel length that is more than one degree longer than the length of the root vowel, and that this is the reason why no additional length for inflectional categories shows up in centrifugal and centripetal stems. It is true, of course, that no length can be added to a long vowel, at least phonetically, since no vowel can be more than three morae long in Dinka. However, stems whose vowel is two degrees longer than the root vowel do actually occur, though not with any of the derivational categories dealt with in this article. For instance, multiplicative stems and causative stems with CVC/F roots have a long vowel, as in (66) and (67), respectively.

(66) Simple

∅	dòok	à-bòk	dièet
	boy	D-throw	birds

NF	dòok	à-cé	dièet	bòok
	boy	D-PF	birds	throw:NF
	'The boy is throwing/has thrown at the birds'			

Multiplicative

∅	dòok	à-boóok	dièet
	boy	D-throw:M	birds

NF	dòok	à-cé	dièet	boóok
	boy	D-PF	birds	throw:M:NF
	'The boy is throwing/has thrown repeatedly at the birds'			

(67) Simple

∅ *d̀̀̀ok à-d̀̀ek wáal*
boy D-drink medicine

NF *d̀̀̀ok à-cé wáal d̀̀̀ek*
boy D-PF medicine drink:NF
'The boy is drinking/has drunk medicine'

Causative

∅ *m̀̀oc à-dè̀ek d̀̀̀ok è wáal*
man D-drink:C boy PREP medicine

NF *m̀̀oc à-cé d̀̀̀ok dè̀ek è wáal*
man D-PF boy drink:C:NF PREP medicine
'The man is making/has made the boy drink medicine'

Therefore, there is no evidence that inflectional categories make any contribution to the vowel length parameter in centrifugal and centripetal stems, not even underlyingly.

Benefactive stems invariably have a half-long vowel whether the root vowel is short, as in (68), or half-long, as in (69).

(68) Simple

∅ *à-b̀̀ut̃ ɣ̀̀ot̃* 'He is building a house'
NF *à-cé ɣ̀̀ot̃ b̀̀ut̃* 'He has built a house'

Benefactive

∅ *à-b̀̀ut̃ t̃ik ɣ̀̀ot̃* 'He is building a house for the woman'
NF *à-cé t̃ik bù̀ot̃ ɣ̀̀ot̃* 'He has built a house for the woman'
NTS *à-b̀̀ut̃ máriáal ɣ̀̀ot̃* 'Marial is building a house for her'
1S *à-bù̀ot̃ ɣ̀̀ot̃* 'I am building a house for her'
2S *à-bù̀ot̃ -é ɣ̀̀ot̃* 'You are building a house for her'
3S *à-b̀̀ut̃ ɣ̀̀ot̃* 'He is building a house for her'
1P *à-b̀̀ut̃ -k̀̀u ɣ̀̀ot̃* 'We are building a house for her'
2P *à-bù̀ot̃ -k̀̀a ɣ̀̀ot̃* 'You are building a house for her'
3P *à-b̀̀ut̃ -k̀̀e ɣ̀̀ot̃* 'They are building a house for her'
PAS *à-b̀̀ut̃ -è ɣ̀̀ot̃* 'A house is being built for her'

(69) Simple

∅ *à-kù̀en ɣ̀̀ok̃* 'He is counting cows'
NF *à-cé ɣ̀̀ok̃ kuè̀en* 'He has counted cows'

Benefactive

∅	à-kuɛ̃n ɣɔk mɔ̃c	'He is counting cows for the man'
NF	à-cɛ̃ ɣɔk kuɛ̃n mɔ̃c	'He has counted cows for the man'
NTS	áa-kuɛ̃n dɔ̃ɔk mɔ̃c	'The boy is counting them for the man'
1S	áa-kuɛ̃n mɔ̃c	'I am counting them for the man'
2S	áa-kuɛ̃n-ɛ̃ mɔ̃c	'You are counting them for the man'
3S	áa-kuɛ̃n mɔ̃c	'He is counting them for the man'
1P	áa-kuɛ̃n-kù mɔ̃c	'We are counting them for the man'
2P	áa-kuɛ̃n-kà mɔ̃c	'You are counting them for the man'
3P	áa-kuɛ̃n-kɛ̃ mɔ̃c	'They are counting them for the man'
PAS	áa-kuɛ̃n-ɛ̃ mɔ̃c	'They are being counted for the man'

The half-long vowel of a benefactive stem with a short root vowel could be analysed as resulting from the addition of one mora to the root. However, this analysis would miss the generalization that benefactive stems are always half-long. The only way of making this generalization explicit is to let the benefactive category *per se* provide the half-long vowel length and to let this length suppress the length of the root vowel.

In benefactive-antipassive stems, the vowel length is dependent on the length/tone class of the root, but not in the same way as with centrifugal and centripetal stems. If the benefactive-antipassive stem is derived from a root with a short vowel, then its vowel is half-long whether the root belongs to tone class F, as in (70), or to tone class L, as in (71).

(70) Simple

∅	à-jɔ̃t ùim	'He is lifting the wood'
NF	à-cɛ̃ ùim jɔ̃t	'He has lifted the wood'

Benefactive-antipassive

∅	à-jɔ̃t ùik	'He is lifting for the woman'
NF	à-cɛ̃ ùik jɔ̃t	'He has lifted for the woman'
NTS	à-jɔ̃t dɔ̃ɔk	'The boy is lifting for her'
1S	à-jɔ̃t	'I am lifting for her'
2S	à-jɔ̃t-ɛ̃	'You are lifting for her'
3S	à-jɔ̃t	'He is lifting for her'
1P	à-jɔ̃t-kù	'We are lifting for her'
2P	à-jɔ̃t-kà	'You are lifting for her'
3P	à-jɔ̃t-kɛ̃	'They are lifting for her'
PAS	à-jɔ̃t-ɛ̃	'She is being lifted for'

(71) Simple

∅	à-nàj àt iɔl	'She is plaiting a net'
NF	à-cẹ àt iɔl nàaj	'She has plaited a net'

Benefactive-antipassive

∅	à-nɛɛj mɔc	'She is plaiting for the man'
NF	à-cẹ mɔc nàaj	'She has plaited for the man'
NTS	à-nɛɛj t̩ik	'The woman is plaiting for him'
1S	à-nàaj	'I am plaiting for him'
2S	à-nàaj-ẹ	'You are plaiting for him'
3S	à-nɛɛj	'He is plaiting for him'
1P	à-nɛɛj-kù	'We are plaiting for him'
2P	à-nàaj-kà	'You are plaiting for him'
3P	à-nɛɛj-kẹ	'They are plaiting for him'
PAS	à-nɛɛj-ẹ	'He is being plaited for'

However, if the root vowel is half-long, then the vowel of the benefactive-antipassive stem is long if the root belongs to tone class F, as in (72), but half-long if the root belongs to tone class H, as in (73).

(72) Simple

∅	à-ràak wɛŋ	'She is milking a cow'
NF	à-cẹ wɛŋ raàak	'She has milked a cow'

Benefactive-antipassive

∅	à-reɛɛk mɛt̩	'She is milking for the child'
NF	à-cẹ mɛt̩ raàak	'She has milked for the child'
NTS	à-reɛɛk t̩ik	'The woman is milking for him'
1S	à-raàak	'I am milking for him'
2S	à-raàak-ẹ	'You are milking for him'
3S	à-reɛɛk	'He is milking for him'
1P	à-reɛɛk-kù	'We are milking for him'
2P	à-raàak-kà	'You are milking for him'
3P	à-reɛɛk-kẹ	'They are milking for him'
PAS	à-reɛɛk-ẹ	'He is being milked for'

(73) Simple

∅	à-lɔɔk àlâat	'She is washing the cloth'
NF	à-cẹ àlâat lɔɔk	'She has washed the cloth'

Benefactive-antipassive

∅	à-lòok mòc	'She is washing for the man'
NF	à-cẹ̀ mòc lóok	'She has washed for the man'
NTS	à-lòok ùik	'The woman is washing for him'
1S	à-lóok	'I am washing for him'
2S	à-lòok-ẹ̀	'You are washing for him'
3S	à-lòok	'He is washing for him'
1P	à-lòok-kù	'We are washing for him'
2P	à-lóok-kà	'You are washing for him'
3P	à-lòok-kẹ̀	'They are washing for him'
PAS	à-lòok-ẹ̀	'He is being washed for'

With this distribution of vowel lengths, no full-scale generalization is possible. What seems to be the case, therefore, is that for each individual length/tone class of roots the benefactive-antipassive category provides a particular vowel length, which suppresses the length of the root vowel, and which happens to be the same for three of the four root classes.

6.3. Vowel length in antipassive stems. With antipassive stems, the situation is more complex. According to the length/tone class and to some extent the voice quality of the root, the set of finite antipassive stems with that root is either constant with respect to vowel length like other derived stem categories or exhibits vowel length alternation of the same type as in simple stems. Moreover, the vowel length of the nonfinite antipassive stem follows separate rules.

With roots belonging to class CVC/F, all finite antipassive stems have a half-long vowel, whereas the non-finite stem has a short vowel:

(74) Simple

∅	à-mòc láj	'He is shooting an animal'
NF	à-cẹ̀ láj mòc	'He has shot an animal'

Antipassive

∅	à-mùuc	'He is shooting'
NF	à-cẹ̀ mòc	'He has shot'
NTS	à-mùuc màkêr	'Maker is shooting with it'
1S	muòoc	'Shall I shoot?'
2S	muòoc-ẹ̀	'Shoot!'
3S	mùuc	'Is he shooting?'
1P	mùuc-kù	'Shall we shoot?'
2P	muòoc-kà	'Shoot!'
3P	mùuc-kẹ̀	'Are they shooting?'
PAS:CT	à-mùuc-ẹ̀	'It is being shot with'

The other length/tone class of roots with a short vowel, class CVC/L, behaves in the same way, except that the non-finite stem also has a half-long vowel.

(75) Simple

∅	à-bùṭ ɣòṭ	'He is building a house'
NF	à-cḗ ɣòṭ bùṭ	'He has built a house'

Antipassive

∅	à-buòṭ	'He is building'
NF	à-cḗ bùṭ	'He has built'
NTS	à-bùṭ màkḗer	'Maker is building with it'
1S	buòṭ	'Shall I build?'
2S	buòṭ-ḗ	'Build!'
3S	bùṭ	'Is he building?'
1P	bùṭ-kù	'Shall we build?'
2P	buòṭ-kà	'Build!'
3P	bùṭ-kḗ	'Are they building?'
PAS	à-bùṭ-ḗ	'It is being built with'

With roots belonging to class CVVC/F, the vowel length of antipassive stems is dependent on the voice quality of the root. If the latter is creaky, the vowel of the antipassive stem is either half-long or long, depending on the inflectional category. As shown in (76), the vowel is half-long if the inflectional category is ∅, 1P, 2P, or 3P, and long if the inflectional category is NF, 1S, 2S, 3S or PAS:CT.

(76) Simple

∅	à-ràak wḗŋ	'She is milking a cow'
NF	à-cḗ wḗŋ raàak	'She has milked a cow''

Antipassive

∅	à-rḗɔk	'She is milking'
NF	à-cḗ rḗɔk	'She has milked'
NTS	à-rḗɔk ṭik	'The woman is milking with it'
1S	raàak	'Shall I milk?'
2S	raàak-ḗ	'Milk!'
3S	rḗɔk	'Is she milking?'
1P	rḗɔk-kù	'Shall we milk?'
2P	ràak-ká	'Milk!'
3P	rḗɔk-kḗ	'Are they milking?'
PAS:CT	à-rḗɔk-ḗ	'It is being milked with'

Breathy roots of the same length/tone class are realized with a long vowel throughout the inflection of the antipassive stem, as in (77).

(77)	Simple		
	∅	à-lòom r̄ij̄	'He is taking the meat'
	NF	à-c̄é r̄ij̄ loòom	'He has taken the meat'
	Antipassive		
	∅	à-loóom	'He is taking'
	NF	à-c̄é loòom	'He has taken'
	NTS	à-loóom ũik	'The woman has taken with it'
	1S	lòóom	'Shall I take?'
	2S	lòóom-é	'Take!'
	3S	loóom	'Is he taking?'
	1P	loóom-k̄ù	'Shall we take?'
	2P	lòóom-k̄à	'Take!'
	3P	loóom-k̄è	'Are they taking?'
	PAS:CT	à-loòom-è	'It is being taken with'

With roots belonging to class CVVC/H, finally, the vowel length of antipassive stems again depends on the inflectional category. As shown in (78), the vowel is short if the inflectional category is ∅, NF, 1P, 2P or 3P, and half-long if the inflectional category is 1S, 2S, 3S or PAS:CT.

(78)	Simple		
	∅	à-lòok m̄èt̄	'She is washing the child'
	NF	à-c̄é m̄èt̄ lòóok	'She has washed the child'
	Antipassive		
	∅	à-lòk	'She is washing'
	NF	à-c̄é lòk	'She has washed'
	NTS	à-lóok ũik	'The woman is washing with it'
	1S	lòok	'Shall I wash?'
	2S	lòok-é	'Wash!'
	3S	lòk	'Is he washing?'
	1P	lòk-k̄ù	'Shall we wash?'
	2P	lòk-k̄à	'Wash!'
	3P	lòk-k̄è	'Are they washing?'
	PAS:CT	à-lòok-è	'It is being washed with'

The vowel length alternation illustrated by (76) and (78) above is of the same type as that of simple stems: With some inflectional categories the vowel is one degree longer than the vowel of the other inflectional categories. Moreover, the distribution of the two length alternants is almost the same in simple stems and antipassive stems: In both of these derivational categories the shorter alternant occurs if the inflectional category is ∅, 1P, 2P, or 3P, and the longer alternant occurs if the inflectional category is NTS, 1S, 3S, or PAS:CT. Disagreement

between the two derivational categories exists only for the inflectional categories 2S and NF. 2S takes the shorter alternant in simple stems, but the longer alternant in antipassive stems. This difference, however, is evidently related to the fact that 2S is expressed by a suffix in antipassive forms but not in simple forms. What remains is NF, but this inflectional category is aberrant on all phonological parameters in antipassive stems and must therefore be treated separately anyway.

The similarities between vowel length alternation in antipassive stems and simple stems suggest that a distinction must be made between a derivational layer and an inflectional layer with respect to vowel length in antipassive stems. At the derivational layer the antipassive category provides a particular vowel length, which is dependent on the root class, and which suppresses the length of the root vowel. And at the inflectional layer some inflectional categories provide an additional mora to the vowel length provided by the antipassive category.

Notice, furthermore, that liability to vowel length alternation within the set of finite antipassive forms of a given root correlates with tone. Thus, vowel length alternation occurs when the tone of, for instance, the inflectionally unmarked form is L, as in (76) and (78), but not when the tone of that form is H or F, as in (74), (75), and (77). This correlation is hardly a coincidence, since simple transitive stems also have L on the unmarked form, and, in fact, the correlation also seems to hold for non-antipassive intransitive stems, which are not dealt with in this article. Hence, the possibility for inflectional categories to provide an extra mora in antipassive stems seems to be conditioned by the presence of an L tone, which—as we shall see in the next section—is itself provided by the antipassive category as such. On this analysis, then, the presence versus absence of vowel length alternation in antipassive stems is actually not dependent on the root class, although, at first sight, it might appear to be.

6.4. Morphological representation of vowel length. In conclusion, the length of the stem vowel of a given verb form is the product of a particular configuration of vowel length at three morphological layers, viz. the root layer, the derivational layer, and the inflectional layer. Symbolizing vowel length with an integer that indicates the number of morae, the vowel length inherent in a root is either 1 or 2. At the derivational layer, as indicated in Table 6, a derivational morpheme either provides an additional mora, +1, or it provides a value from the set {1,2,3}, which takes precedence over the value of the root layer in terms of phonetic realization. At the inflectional layer, as indicated in Table 7, an inflectional morpheme may provide an additional mora, so that, in the phonetic representation, the vowel length is one degree longer than that of the root layer in case of a simple stem or than that of the derivational layer in case of an antipassive stem.

Table 6. Derivational vowel length

Root class	Derivational category					
	CF	CP	B	BAP	AP	AP:NF
CVC/F	+1	+1	2	2	2	1
CVC/L	+1	+1	2	2	2	2
CVVC/F	+1	+1	2	3	2	3
CVVC/F	+1	+1	2	3	3	3
CVVC/H	+1	+1	2	2	2	1

Table 7. Inflectional vowel length

Inflectional category	Derivational category	
	∅	AP L-toned
∅		
NF	+1	
NTS	+1	+1
1S	+1	+1
2S		+1
3S	+1	+1
1P		
2P		
3P		
PAS		
PAS:CT	+1	+1

The morphological stratification of vowel length is exemplified in (80), which represents the word forms in (79).

- (79) a. *leɕer* 'Is he rolling?' (roll:AP:3S) (CVVC/F)
 b. *lɕer* 'Roll it!' (roll:2S) (CVVC/F)
 c. *leɕer* 'Is he rolling it?' (roll:3S) (CVVC/F)
 d. *leɕer* 'Is he rolling it thither?' (roll:CF:3S) (CVVC/F)
 e. *tɕem* 'Is he cutting for him?' (cut:BAP:3S) (CVVC/H)

(80)

	a.	b.	c.	d.	e.
phonetic representation	3	2	3	3	2
inflectional layer	+1		+1		
derivational layer	2			+1	2
root layer	2	2	2	2	2

7. Tone alternation

Looking at the distribution of tones as displayed in Table 4 above, no clear pattern immediately emerges. What is clear is the negative fact that tone does not correlate uniquely with any of the three morphological parameters: root class, derivational status, or inflectional status. Thus, no root class is characterized by a particular stem tone across derivational categories and across inflectional categories, and no derivational category is characterized by a particular stem tone across root classes and across inflectional categories. Similarly, nine of the eleven inflectional categories do not have invariant stem tones across root classes and across derivational categories. Tonal constancy occurs only with the inflectional categories NTS, which always has a H stem tone, and PAS:CT, which always has a F stem tone. In these two cases, then, the tone is clearly inflectional rather than derivational or radical, but in all other cases the function of tone is not immediately clear. However, as shown in the following subsections, a closer examination of the facts reveals that each instance of a surface tone can actually be attributed to a particular morphological layer.

7.1 Contextually determined tones. Some tones of some verb forms can be analysed as being determined by the context. Four types of contextually determined tones will be distinguished below, but common to all of them is that the determining context is partly phonological and partly grammatical.

Consider first the tonal behaviour of finite verb forms in clauses in which the topic is a subject noun phrase. If the verb has a short vowel, its tone is variable, as can be observed in (81), where the stem is simple, and in (82), where the stem is antipassive. Thus, the tone is L in the positive declarative (a)-clauses, but H in the negative declarative (b)-clauses and in the (positive) non-declarative (c)-clauses.

- (81) a. *màriàal à-nàk t̀òk*
 Marial D-kill goat
 'Marial is killing a goat'
- b. *màriàal à-cè nàk t̀òk*
 Marial D-NEG kill goat
 'Marial is not killing a goat'
- c. *nàk màriàal t̀òk*
 kill Marial:GEN goat
 'Is Marial killing a goat?'

- (82) a. *t̥ik* *à-t̥àt*
 woman D-cook:AP
 ‘The woman is cooking’
- b. *t̥ik* *à-c̥è* *t̥át*
 woman D-NEG cook:AP
 ‘The woman is not cooking’
- c. *t̥át* *t̥ik*
 cook:AP woman
 ‘Is the woman cooking?’

Notice that negative declarative clauses and non-declarative clauses share another formal property which distinguishes them from positive declarative clauses, viz. the absence of a declarative particle immediately before the finite verb. In negative declarative clauses the negation particle intervenes between the declarative particle and the verb, and in non-declarative clauses there is no declarative particle at all. Thus, it is possible to analyse the tonal alternation as being a contextually determined variation rather than as reflecting two distinct inflectional categories: The tone is L when the verb is immediately preceded by a declarative particle, and H otherwise. This analysis is supported by the fact that the tonal alternation is restricted to verbs with a short vowel. Thus, for instance, the tone is invariably L in (83), where the vowel is half-long.

- (83) a. *t̥ik* *à-t̥àal* *r̥iɪŋ*
 woman D-cook meat
 ‘The woman is cooking meat’
- b. *t̥ik* *à-c̥è* *t̥àal* *r̥iɪŋ*
 woman D-NEG cook meat
 ‘The woman is not cooking meat’
- c. *t̥àal* *t̥ik* *r̥iɪŋ*
 cook woman meat
 ‘Is the woman cooking meat?’

However, it should also be noted that the presence of a short stem vowel is not a sufficient condition for the occurrence of the L ~ H variation: The verb must belong to the inflectionally unmarked category. Thus, no variation occurs with the second person singular /CVC/ form in (84), whose tone is invariably L, and with the passive /CVC/ form in (85), whose tone is invariably H.

- (84) a. $t\grave{\text{ɔ}}k \grave{\text{a}}-n\grave{\text{a}}k$
 goat D-kill:2S
 'You are killing the goat'
- b. $n\grave{\text{a}}k t\grave{\text{ɔ}}k$
 kill:2S goat
 'Kill the goat!'
- (85) a. $t\grave{\text{ɔ}}k \grave{\text{a}}-n\acute{\text{a}}k$
 goat D-kill:PAS
 'The goat is being killed'
- b. $t\grave{\text{ɔ}}k \grave{\text{a}}-c\grave{\text{e}} n\acute{\text{a}}k$
 goat D-NEG kill:PAS
 'The goat is not being killed'

Given the contextual determination of the L ~ H variation in inflectionally unmarked verb forms with a short vowel, the next question is what the basic or underlying tone of such verb forms is, if any. This question cannot be answered conclusively unless we extend our attention to verb forms with intransitive roots. Here we find that the variation L ~ H contrasts with H, i.e., there are inflectionally unmarked verb forms with a short vowel that have H in all contexts. One example is shown in (86).

- (86) a. $t\grave{\text{i}}k \grave{\text{a}}-l\grave{\text{ɔ}}$
 woman D-go
 'The woman is going'
- b. $t\grave{\text{i}}k \grave{\text{a}}-c\grave{\text{e}} l\grave{\text{ɔ}}$
 woman D-NEG go
 'The woman is not going'
- c. $l\grave{\text{ɔ}} t\grave{\text{i}}k$
 go woman
 'Is the woman going?'

The verb stem in (86) lacks a final consonant, and, in fact, so do all other verb stems with a short vowel and an invariable H tone in the unmarked form. Therefore, it might be suggested that the invariable H tone is due to this property. However, there is at least one verb which also lacks a stem-final consonant but which does exhibit the L ~ H variation, viz. the verb shown in (87).

- (87) a. *ṭik* *à-ṭò*
 woman D-be present
 ‘The woman is present’
- b. *ṭik* *à-c̣è* *ṭò*
 woman D-NEG be present
 ‘The woman is not present’
- c. *ṭò* *ṭik*
 be present woman
 ‘Is the woman present?’

Hence, the underlying tone of L ~ H stems must be L rather than H, since if it were H, it would be indistinguishable from the tone of stems that do not exhibit the L ~ H variation. That is the reason why, in Table 4 above, L rather than H was chosen as the tone characterizing the forms in question.

Another type of contextually determined tone is constituted by the stem tones that occur in verb forms with the second person singular H-toned suffix /-*ẹ́*/ or the passive L-toned suffix /-*ẹ̀*/. Whenever second person singular is expressed by the suffix /-*ẹ́*/, the stem tone is L. This is illustrated by the centrifugal stems in (88) for each of the four length/tone classes of roots.

(88) CF-2S

CVC/F	<i>ẉẹ̀ec-ẹ́</i>	‘Kick it thither!’
CVC/L	<i>ṭẹ̀eŋ-ẹ́</i>	‘Dust it thither!’
CVVC/F	<i>lẹẹ̀er-ẹ́</i>	‘Roll it thither!’
CVVC/H	<i>tẹẹ̀em-ẹ́</i>	‘Cut it thither!’

Similarly, whenever the passive is expressed by the suffix /-*ẹ̀*/, the stem tone is F, as illustrated by the centrifugal stems in (89).

(89) CF-PAS

CVC/F	<i>à-ẉẹ̀ec-ẹ̀</i>	‘It is being kicked thither’
CVC/L	<i>à-ṭẹ̀eŋ-ẹ̀</i>	‘It is being dusted thither’
CVVC/F	<i>à-lẹẹ̀er-ẹ̀</i>	‘It is being rolled thither’
CVVC/H	<i>à-tẹẹ̀em-ẹ̀</i>	‘It is being cut thither’

In these cases the stem tone can readily be analysed as determined by the suffix. Note, however, that there are phonologically identical but grammatically different suffixes which do not determine the stem tone. Thus, as shown by the nouns

in (90)-(91), the demonstrative suffix /-ɛ́/ 'that' can combine with either L or F, and the demonstrative suffix /-ɛ̀/ 'this' can combine with any of the three tones.

- | | | | |
|------|---|-----------------|---------------|
| (90) | L | <i>ṭim-ɛ́</i> | 'that tree' |
| | F | <i>ḷan-ɛ́</i> | 'that animal' |
| (91) | L | <i>ṭim-ɛ̀</i> | 'this tree' |
| | F | <i>ḷan-ɛ̀</i> | 'this animal' |
| | H | <i>ḍɔɔŋ-ɛ̀</i> | 'this boy' |

Hence, the context that determines the stem tones in (88)-(89) is not purely phonological.

A third type of contextually determined tones occurs on the plural subject suffixes /-ḳɹ/, /-ḳa/, /-ḳɛ/. The tone of these suffixes is H if the stem tone is L, and L if the stem tone is H or F. This correlation is exemplified by the first person plural forms in (92)-(93).

(92) 1P

CVC/F	<i>à-wɛ́c-ḳɹ</i>	'We are kicking it'
CVC/L	<i>à-ṭɛ̀ŋ-ḳɹ</i>	'We are dusting it'
CVVC/F	<i>à-ḷɛ̀er-ḳɹ</i>	'We are rolling it'
CVVC/H	<i>à-ṭɛ̀em-ḳɹ</i>	'We are cutting it'

(93) BAP-1P

CVC/F	<i>à-ẉɛ́ec-ḳɹ</i>	'We are kicking for him'
CVC/L	<i>à-ṭɛ̀eŋ-ḳɹ</i>	'We are dusting for him'
CVVC/F	<i>à-lẹɛ̀er-ḳɹ</i>	'We are rolling for him'
CVVC/H	<i>à-ṭɛ̀eem-ḳɹ</i>	'We are cutting for him'

Since the suffix tones are predictable from the stem tones, while the reverse is not true, the suffix tones must be analysed as determined by the stem tones. Note again, however, that the determining context is not purely phonological. Thus, the demonstrative suffixes /-ḳá/ 'those' and /-ḳà/ 'these', which are homonymous with the 2P suffix /-ḳa/ 'you', are tonally distinct, and, as shown in (94)-(95), /-ḳá/ can combine with either L or F, and /-ḳà/ can combine with any of L, F, and H.

- | | | | |
|------|---|------------------|----------------|
| (94) | L | <i>ḳɹur-ḳá</i> | 'those stones' |
| | F | <i>ḳɔɔc-ḳá</i> | 'those people' |

- (95) L *kùur-kà* ‘these stones’
 F *kḡoc-kà* ‘these people’
 H *rúun-kà* ‘these years’

The last type of contextually determined tone occurs in verb forms with the skeletal shape /CVC-CV/, i.e., in forms with a short stem vowel and a plural subject suffix. The stem tone of such forms is always H (and the suffix tone, hence, always L, cf. the preceding paragraph). In general, a verb form with a plural subject suffix has the same stem tone as the corresponding first person singular and third person singular forms. This fact is illustrated in (96)-(98), where the stem tones are H, L, and F, respectively.

(96) Centrifugal

- 3S *à-wḡec* ‘He is kicking it thither’
 1P *à-wḡec-kù* ‘We are kicking it thither’

(97) Centripetal

- 3S *à-wḡec* ‘He is kicking it hither’
 1P *à-wḡec-kù* ‘We are kicking it hither’

(98) Benefactive-antipassive

- 3S *à-wḡec* ‘He is kicking for him’
 1P *à-wḡec-kù* ‘We are kicking for him’

/CVC-CV/ forms constitute an exception to the tonal constancy exemplified in (96)-(98), as can be observed in (99)-(100).

(99) Simple

- 3S *à-wḡec* ‘He is kicking it’
 1P *à-wḡec-kù* ‘We are kicking it’

(100) Antipassive

- 3S *kù tḡem* ‘and he cut’
 1P *kù tḡem-kù* ‘and we cut’

In (99)-(100) the 1P forms have a H stem tone, while the 3S forms have a L stem tone. It may, therefore, be suggested that, although /CVC-CV/ forms surface with H on the stem, their underlying stem tone is L, the H surface tone being due to

Table 8, continued.

Inflectional category	Root class and derivational category													
	CVVC/F							CVVC/H						
	Ø	CF	CP	B	BAP	AP ₁	AP ₂	Ø	CF	CP	B	BAP	AP	
Ø	L	F	L	F	F	L	H	L	H	L	H	H	L/(H)	
NF	F	F	L	F	F	H	L	H	H	L	H	H	L	
NTS	H	H	H	H	H	H	H	H	H	H	H	H	H	
1S	L	F	L	F	F	L	H	L	H	L	H	H	L	
2S	F	(L)	H	(L)	(L)	(L)	(L)	H	(L)	H	(L)	(L)	(L)	
3S	L	F	L	F	F	L	H	L	H	L	H	H	L	
1P	L	F	L/H	F	F	L	H	L	H	L/H	H	H	(H)	
2P	L	F	L/H	F	F	L	H	L	H	L/H	H	H	(H)	
3P	L	F	L/H	F	F	L	H	L	H	L/H	H	H	(H)	
PAS	F	(F)	(F)	(F)	(F)			H	(F)	(F)	(F)	(F)		
PAS:CT	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	(F)	

AP₁=AP with creaky root. AP₂=AP with breathy root.

7.2. Tones of simple stems. Consider now the tones of simple stems, disregarding the contextually determined tones. Since simple stems are non-derived, only the root class and the inflectional category can be relevant to the analysis of their tones. The problem is, then, to what extent the tone of a given stem form can be attributed to either the root or the inflectional category.

In section 4 it was stated that the tones of the set of simple stems that manifests a given root are predictable from the tone of the non-finite form. The latter tone, which is either F, L, or H, is shown for each of the four length/tone classes of roots by the examples in (102).

(102) NF

CVC/F	à-cẹ wẹec	'He has kicked it'	(D-PF:3S kick:NF)
CVC/L	à-cẹ tẹeŋ	'He has dusted it'	(D-PF:3S dust:NF)
CVVC/F	à-cẹ leëer	'He has rolled it'	(D-PF:3S roll:NF)
CVVC/H	à-cẹ teëem	'He has cut it'	(D-PF:3S cut:NF)

As can be seen by examining Table 8, there is no other form from which the whole set of tones is predictable. That is why, in section 4, the root classes were named after the tones of the non-finite forms. The lexical representation of a root must, of course, contain information as to its tonal class, but the question is whether this information should be posited in terms of an arbitrary label or in

terms of an actual underlying tone. In other words, should the tones of the non-finite forms be considered root tones? Before answering this question, let us look at the tones of the other forms with simple stems.

Some inflectional categories are characterized by a particular tone irrespective of the length/tone class of the root. The unmarked form, the first person singular form and the third person singular form always have L, as in examples (103)-(105), where "X" symbolizes an overt noun phrase.

(103) Ø

CVC/F	à-wèc X	'He is kicking X'
CVC/L	à-tèŋ X	'He is dusting X'
CVVC/F	à-lèer X	'He is rolling X'
CVVC/H	à-tèem X	'He is cutting X'

(104) 1S

CVC/F	à-wèec	'I am kicking it'
CVC/L	à-tèeŋ	'I am dusting it'
CVVC/F	à-leèer	'I am rolling it'
CVVC/H	à-teèem	'I am cutting it'

(105) 3S

CVC/F	à-wèec	'He is kicking it'
CVC/L	à-tèeŋ	'He is dusting it'
CVVC/F	à-leèer	'He is rolling it'
CVVC/H	à-teèem	'He is cutting it'

L also characterizes stems with plural subject suffixes, provided that the H stem tone of /CVC-CV/ forms is contextually determined, as argued in the previous subsection. The following examples are third person plural forms.

(106) 3P

CVC/F	à-wèc-kè	'They are kicking it'
CVC/L	à-tèŋ-kè	'They are dusting it'
CVVC/F	à-lèer-ké	'They are rolling it'
CVVC/H	à-tèem-ké	'They are cutting it'

Similarly, the NTS form always has a H tone, as shown in (107).

(107) NTS

CVC/F	à-wḡec X	'X is kicking it'
CVC/L	à-tḡeŋ X	'X is dusting it'
CVVC/F	à-leḡer X	'X is rolling it'
CVVC/H	à-teḡem X	'X is cutting it'

In these cases, obviously, the tone cannot be an exponent of the root, but must be an exponent of the inflectional categories in question.

The remaining inflectional categories, 2S and PAS, have L and H, respectively, if the root vowel is short, and both of them have F in root class CVVC/F and H in root class CVVC/H. This situation is exemplified in (108)-(109).

(108) 2S

CVC/F	à-wḡec	'You are kicking it'
CVC/L	à-tḡeŋ	'You are dusting it'
CVVC/F	à-leḡer	'You are rolling it'
CVVC/H	à-teḡem	'You are cutting it'

(109) PAS

CVC/F	à-wḡec	'It is being kicked'
CVC/L	à-tḡeŋ	'It is being dusted'
CVVC/F	à-leḡer	'It is being rolled'
CVVC/H	à-teḡem	'It is being cut'

In stems with a short root vowel the tone of these two inflectional categories is independent of the tonal class of the root and must, therefore, be inflectional. In stems with a half-long root vowel, on the other hand, the tone is dependent on the tonal class of the root, and, moreover, it is identical with the tone of the non-finite form. This identity could be considered coincidental, of course, but it could also be considered noncoincidental and hence something to be explained. In the latter case the only obvious explanation is that the tones of the forms in question are root tones rather than inflectional tones. This is the analysis that will be adopted here.

7.3. Tones of derived stems. Consider next the tones of derived stems, again disregarding contextually determined tones. As can be observed in Table 8, two inflectional categories exhibit tonal constancy. One is the NTS category, which, as

already noticed, is characterized by H throughout the morphological system. The other is the 2S category, which will be dealt with below. All other inflectional categories are not tonally constant, their tones varying according to the derivational category and the root class. Notice, however, that apart from the non-finite category of antipassive stems, all inflectional categories have the same tone for any given combination of derivational category and root class. That is, their tones characterize the derivational category *cum* root class, and hence they cannot be inflectional. Observe, furthermore, that these tones are often different from the root tones as defined in section 7.2 above. Hence, they must be derivational rather than radical. The derivational tones and their dependence on the root class are illustrated in (110)-(117) below. Unless otherwise indicated, the examples are 3S forms.

In centrifugal stems the tone is H if the root class is CVC/F or CVVC/H, and F if the root class is CVC/L or CVVC/F.

(110) Centrifugal

CVC/F	à-wḙec	‘He is kicking it thither’
CVC/L	à-tḙeŋ	‘He is dusting it thither’
CVVC/F	à-leḙer	‘He is rolling it thither’
CVVC/H	à-teḙem	‘He is cutting it thither’

With benefactive stems the distribution of tones is the same as with centrifugal stems.

(111) Benefactive

CVC/F	à-wḙec mḙc	‘He is kicking it for the man’
CVC/L	à-tḙeŋ mḙc	‘He is dusting it for the man’
CVVC/F	à-lḙer mḙc	‘He is rolling it for the man’
CVVC/H	à-tḙem mḙc	‘He is cutting it for the man’

In benefactive-antipassive stems the tone is H if the root class is CVVC/H, and F otherwise.

(112) Benefactive-antipassive

CVC/F	à-wḙec	‘He is kicking for him’
CVC/L	à-tḙeŋ	‘He is dusting for him’
CVVC/F	à-leḙer	‘He is rolling for him’
CVVC/H	à-tḙem	‘He is cutting for him’

Centripetal stems differ tonally from the other categories of derived stems in three principled ways. First, the derivational tone of centripetal stems is always L and, thus, independent of the root class.

(113) Centripetal

CVC/F	à-wèec	‘He is kicking it hither’
CVC/L	à-tèeŋ	‘He is dusting it hither’
CVVC/F	à-leèer	‘He is rolling it hither’
CVVC/H	à-teèem	‘He is cutting it hither’

Second, centripetal stems exhibit some tonal variation. Thus, if the stem is followed by a plural suffix, its tone varies freely between L and H, as in (114).

(114) à-wèec-ké ~ à-wéec-kè ‘They are kicking it hither’

Third, the 2S form of a centripetal stem lacks the suffix /-é/, and hence its stem tone is not contextually determined. In this case the stem tone is invariably H.

(115) Centripetal

CVC/F	wéec	‘Kick it hither!’
CVC/L	téeŋ	‘Dust it hither!’
CVVC/F	leéer	‘Roll it hither!’
CVVC/H	teéem	‘Cut it hither!’

This H tone must be inflectional, since it is different from the derivational L tone that otherwise characterizes centripetal stems.

In the antipassive, the stem tone of finite forms is F in classes CVC/F and CVC/L, L in the creaky subclass of class CVVC/F, H in the breathy subclass of class CVVC/F, and L in class CVVC/H.

(116) Antipassive

CVC/F	kù wèec	‘and he kicked’
CVC/L	kù tèeŋ	‘and he dusted’
C̣VVC/F	kù leèer	‘and he rolled’
C̣VVC/F	kù peéen	‘and he refused to give’
CVVC/H	kù tèem	‘and he cut’

The non-finite forms of antipassive stems exhibit a different distribution of tones.

In class CVC/F the tone is L, in class CVC/L it is F, in the creaky subclass of class CVVC/F it is H, in the breathy subclass of CVVC/F it is L, and in class CVVC/H it is L.

(117) Antipassive

CVC/F	à-cẹ wẹc	'He has kicked'
CVC/L	à-cẹ tẹeŋ	'He has dusted'
CVVC/F	à-cẹ leẹer	'He has rolled'
CVVC/F	à-cẹ peẹen	'He has refused to give'
CVVC/H	à-cẹ tẹm	'He has cut'

In the antipassive the non-finite form thus differs from the finite forms on all of the three parameters of alternation considered here, viz. voice quality, vowel length, and tone.

7.4. Morphological representation of tones. In the previous subsections the tones of verb stems were variously attributed to the root, the derivational category, the inflectional category, or the context. The distribution of the stem tones in terms of these morphological parameters is shown in Tables 9 and 10.

Table 9. Root tones and derivational tones

Root class		Derivational category					
		∅	CF	CP	B	BAP	AP
CVC/F		F	H	L	H	F	F
CVC/L		L	F	L	F	F	F
CVVC/F	CVVC	F	F	L	F	F	L
	CVVC						H
CVVC/H		H	H	L	H	H	L

Table 10. Inflectional tones and contextually determined tones

Inflectional category	Derivational category and root class					
	∅		CF	CP	B	BAP
	CVC	CVVC				
∅	L/(H)	L	—	—	—	—
NF	—	—	—	—	—	—
NTS	H	H	H	H	H	H
1S	L	L	—	—	—	—
2S	L	—	(L)	H	(L)	(L)
3S	L	L	—	—	—	—
1P	(H)	L	—	—	—	—
2P	(H)	L	—	—	—	—
3P	(H)	L	—	—	—	—
PAS	H	—	(F)	(F)	(F)	(F)
PAS:CT	(F)	(F)	(F)	(F)	(F)	(F)

Inflectional category	Derivational category and root class				
	AP				
	CVC/F	CVC/L	CVVC/F	CVVC/F	CVVC/H
∅	—	—	—	—	—/(H)
NF	L	F	H	L	L
NTS	H	H	H	H	H
1S	—	—	—	—	—
2S	(L)	(L)	(L)	(L)	(L)
3S	—	—	—	—	—
1P	—	—	—	—	(H)
2P	—	—	—	—	(H)
3P	—	—	—	—	(H)
PAS	—	—	—	—	—
PAS:CT	(F)	(F)	(F)	(F)	(F)

*Tone symbols in parentheses indicate contextually determined tones.

From Table 9, which shows the root tones and the derivational tones, it is clear that, in general, the derivational tones are dependent on the root class. Table 10 shows the inflectional tones and the contextually determined tones. As can be seen, inflectional categories are not always characterized tonally, while roots and

derived derivational categories always are. Only two inflectional categories, NTS and PAS:CT, always provide their own tones. For all other inflectional categories the presence or absence of a tone is dependent on the derivational status and/or the root class of the stem.

The analysis summarized in Tables 9 and 10 implies that some stems have more than one tone underlyingly, although only one tone is realized phonetically. Thus, all stems have a root tone, and all derived stems also have a derivational tone. In addition, some stems have an inflectional tone and/or a contextually determined tone. Assume that these four types of tones are stratified as in (118).

(118) Tonal layers

- 4 Contextually determined tone
- 3 Inflectional tone
- 2 Derivational tone
- 1 Root tone

Given this model of tonal stratification, with the root tone at the deepest layer, the tone that is realized phonetically is the most shallow one among those actually present underlyingly. The model is illustrated by the examples in (119).

- (119)
- | | | | | |
|---|---------------------|----------------------------|-------------------|--------------|
| | a. | b. | c. | d. |
| | <i>l̥ɛr</i> | <i>wɛ̃ɛc</i> | <i>wɛ̃ɛc</i> | <i>wɛ̃ɛc</i> |
| 4 | — | — | — | — |
| 3 | — | — | H | L |
| 2 | — | H | L | — |
| 1 | F | F | F | F |
| | roll:2S | kick:CF:1S | kick:CP:2S | kick:2S |
| | C̣VC/F | C̣VC/F | C̣VC/F | C̣VC/F |
| | ‘Roll it!’ | ‘Shall I kick it thither?’ | ‘Kick it hither!’ | ‘Kick it!’ |
| | | | | |
| | e. | f. | | |
| | <i>wɛ̃ɛc-ḳù</i> | <i>tɛ̃m-ḳù</i> | | |
| 4 | H L | H L | | |
| 3 | L — | — — | | |
| 2 | — | L | | |
| 1 | F | H | | |
| | kick-1P | cut:AP-1P | | |
| | C̣VC/F | C̣VC/H | | |
| | ‘Shall we kick it?’ | ‘Shall we cut?’ | | |

The stem tone that is realized phonetically is radical in (119a), derivational in (119b), inflectional in (119c-d), and contextually determined in (119e-f).

The non-finite forms of antipassive stems do not have the tones that otherwise characterize antipassive forms, but tones that are directly dependent on the root class. Thus, they appear not to distinguish between inflectional tone and derivational tone. This is not surprising, however, since these forms behave in the same way with respect to voice quality and vowel length, as we saw in sections 5 and 6.

In summary, alternations in the phonological parameters of voice quality, vowel length, and tone all suggest a model of morphological stratification that has separate layers for radical, derivational, and inflectional information. Using this model of morphological stratification, the example in (120) will have the underlying phonological representation shown in (121) as far as the parameters of voice quality, vowel length and tone are concerned.

(120) *wɛ́ec*
kick:CP:2S
'Kick it hither!'

(121)		<i>voice</i>	<i>length</i>	<i>tone</i>
inflectional layer	(2S)	—	—	H
derivational layer	(CP)	[+breathy]	+1	L
root layer	('kick')	—	1	F

The phonetic realization of (121) will be a half-long vowel (whose two morae are provided by the root and the derivational morpheme, respectively) with a breathy voice quality (provided by the derivational morpheme) and a H tone (which is provided by the inflectional morpheme, and which suppresses the tone provided by the derivational morpheme, that tone itself suppressing the tone provided by the root).

8. Conclusion

Although monosyllabic verb forms in Dinka are morphologically complex units, the morphemes that make them up have no linear order. Instead, such words can be analysed as consisting of a set of morphological layers, each of which represents a morpheme by means of a set of phonological parameter values. The phonological parameters that may be involved in this representation are vowel quality, final consonant, vowel length, voice quality, and tone, although only the last three of these have been dealt with in the present article. The morphological layers are simultaneous but "vertically" ordered, with the root as the "deepest" layer, optionally followed by a derivational layer, followed by an inflectional layer. This configuration of layers constitutes the underlying phono-

logical representation of the word.

Some phonological parameters may have a value at more than one layer simultaneously, in which case the most "shallow" value is the one that is realized phonetically. In the case of the vowel length parameter, the phonetic realization may alternatively be cumulative. The voice quality parameter may have no value at all, in which case a default value is realized phonetically. As for the tone parameter, the context may induce a value which suppresses any morphologically provided value.

A parameter value involved in expressing a derivational or inflectional morpheme may be dependent on parameter values at a deeper layer. Thus, a derivational or inflectional morpheme may exhibit phonologically conditioned allomorphy. This conditioning may hold between a derivational morpheme and the root, between an inflectional morpheme and a derivational morpheme, and between an inflectional morpheme and the root of a non-derived stem, but apparently not between an inflectional morpheme and the root of a derived stem if the non-finite forms of antipassive stems are disregarded. Thus, there may be a principle to the effect that no conditioning can hold across the derivational layer. The nonfinite forms of antipassive stems are an exception to this principle, but since these forms often differ from the corresponding finite forms on several phonological parameters, they should probably be analysed as having merged derivation and inflection into one morphological layer, and in that case the principle may be exceptionless after all.

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Institut for Kommunikation
Aalborg Universitet
Langagervej 8
9220 Aalborg Øst
Denmark

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