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Dinka is a Western Nilotic language within the Nilo-Saharan family. There are over two million speakers (Gordon 2005). The Dinkas live along the banks of the White Nile and its tributaries in Southern Sudan. There are also communities elsewhere within Sudan, in particular in the capital Khartoum, and abroad. Cows play a key role in the Dinka economy, and also in the sociocultural system. Four major dialect areas are commonly distinguished: Padang, Rek, Agar, and Bor. The variety of Dinka represented here – Luanyjang or, as in Roettger & Roettger (1989), Luac – is part of the Rek dialect group. The term LUANYJANG ‘LUAC DINKA’ refers in the first place to a section within the Dinka ethnic group, and by extension also to their variety of the Dinka language. The main Luanyjang town is Wuncuei, located about 170 kilometers east of the city of Wau. Luanyjang has around 15000 speakers according to *Ethnologue* (Gordon 2005), although the current number is likely to be much higher.

Dinka is of particular interest because of its rich suprasegmental system, which includes independent distinctions of tone, length, and voice quality. A key publication on Dinka phonology is the description of Agar Dinka by Andersen (1987). The Agar dialect is geographically adjacent to Luanyjang. Other contributions on the Dinka sound system include Malou (1988), Gilley (2003), Edmondson & Esling (2006), Remijsen & Gilley (2008), and Remijsen & Ladd (2008); Remijsen & Macmartin (2008) is a collection of sound materials on Luanyjang Dinka, with the primary aim of documenting the rich inventory of suprasegmentals. In the following sections, we present a brief description of the sound system of Luanyjang Dinka. While this description may inform ongoing work on the development of Dinka orthography, it is not a proposal to modify the existing orthography. The passage transcribed in this Illustration is ‘The North Wind and the Sun’, recorded by the second author. A version of this article annotated with embedded sound files for all the Dinka examples is available on the journal website, as supplementary material to this article.

### Syllable structure and word structure

It is a defining characteristic of the Dinka language that inflected stems are mostly monosyllabic, like the corresponding lexical roots (Tucker 1981: 311, Andersen 1990: 6). That is, instead of being marked by affixes, nominal and verbal inflections are encoded predominantly by segmental changes in the nucleus and the coda, and by changes in vowel length, tone and voice quality. Consider, for example, the singular–plural pairs **wāal–wāl** ‘plant:S/P’, where number is marked by vowel length, voice quality, and tone, and **tiil–tjēel** ‘thistle:S/P’, where we find the same morphological distinction marked by breaking and

lowering of the vowel, in addition to tone.<sup>1,2</sup> The stem-internal nature of inflectional marking can also be seen from the glosses of content words throughout this paper: most content words are morphologically complex.

The segmental template of monosyllabic content-word stems – both with and without inflection – is presented in (1). The same template is proposed in Andersen (1993) for the Agar dialect.

(1) C (w) (j) V (V) (V) C

As seen from (1), syllables tend to be closed, and consonant clusters are limited to the onset, where one or two semivowels may follow an initial consonant. Open monosyllables are highly uncommon among content words. That is why we treat forms like **càa** ‘milk:S’ and **jàa** ‘daughter/girl:S’ as exceptions, instead of expanding the syllable template.<sup>3</sup> By contrast, many of the function morphemes are open syllables. Phonotactic constraints on consonants and the three-level vowel length distinction will be discussed in detail in the ‘Consonants’ and ‘Vowels’ sections below.

As for polysyllabic words, three categories can be distinguished. First, there are native monomorphemic nouns that consist of two syllables. The composition of such forms is highly constrained: the first syllable is invariably /a/, and the second syllable conforms to the template in (1) – examples are presented in table 1 (left). As noted by Storch (2005: 168), these forms are the only polysyllabic nouns in Dinka. Native verb stems are strictly monosyllabic. The remaining two categories of polysyllabic words are loan words and native compounds – cf. table 1 (middle and right, respectively).

**Table 1** Polysyllabic words in Luanyjang Dinka.

Simple	Loans	Compounds
<b>ajit</b> { ‘chicken.S’	<b>tukùul</b> (< Eng.) { ‘school.S’	<b>apaaràak</b> (< <b>pàal</b> ‘abstain.PST’ + <b>ràak</b> ‘milking.S’) { ‘adult.S’
<b>aṅàaat</b> { ‘cat.P’	<b>bidà</b> (< Lwo) { ‘fishhook.S’	<b>karàc</b> (< <b>ka-</b> ‘PLPRN’ + <b>ràc</b> ‘bad.P’) { ‘snake.P’
<b>alēet</b> { ‘cloth.P’	<b>mangàaa</b> { ‘mango.P’	<b>mikòɔɔr</b> (< <b>mí-</b> ‘ACTOR’ + <b>kóɔɔr</b> ‘commit adultery.PST’) { ‘adulterer.P’

## Consonants

Luanyjang Dinka has 20 consonant phonemes. Voiced and voiceless plosives, and nasals, come in five places of articulation. There are no fricative phonemes.

<sup>1</sup> In this Illustration, short, mid, and long vowels are transcribed with one, two, and three vowel characters, respectively. Tones and breathiness are represented as diacritics on the first vowel character. These conventions are adopted from Andersen (1987). Curly brackets { } are used to mark stem morphemes by themselves, without any inflection. A list of abbreviations used in example glosses will be found at the end of the present paper.

<sup>2</sup> Breaking and lowering of the vowel are familiar processes in Dinka morphology, in relation to both verbs (Andersen 1993) and nouns (Andersen 2002, Storch 2005).

<sup>3</sup> We know of five native content-word stems with a CV(V)(V) structure. One of these is **càa** ‘milk:S’ which has the plural form **càaak**. The other four are kinship terms. These turn into closed syllables as a result of inflection for inalienable possession. For example, **jàa** ‘daughter/girl:S’ becomes **jàan-** or **jàiir-** in all of the possessed inflections. The open-syllable base form only appears with the semantic extension ‘girl’. The same is true of **wàa** ‘brother/boy:S’, **màaa** ‘mother:1SPOS’, and **wàaa** ‘father:1SPOS’. In summary, these exceptional stems are brought in line with the syllable template in (1) as a result of morphophonological processes.

	Labial	Dental	Alveolar	Palatal	Velar
Plosive	p b	t̪ d̪	t d	c ɟ	k g
Nasal	m	n̪	n	ɲ	ŋ
Trill			r		
Approximant	w			j	ɥ
Lateral approximant			l		

(2)	<b>p̣aal</b> ‘knife.S’	<b>ḅaal</b> ‘neck tendon.S’	<b>ṃaal</b> ‘meat on hide.S’
	<b>ṭaal</b> ‘cook.PST’	<b>ḍaal</b> ‘have difficulty with.PST’	<b>ɲ̣aal</b> ‘knee.S’
	<b>ṭaap</b> ‘tobacco.S’	<b>ḍaal</b> ‘laugh.IMP’	<b>ṇaal</b> ‘cut.PST’
	<b>c̣aal</b> ‘be like.PST’	<b>ʝaal</b> ‘guest.S’	<b>ɲ̣aal</b> ‘girl.UNC’
	<b>ḳaal</b> ‘town.P’	<b>g̣aal</b> ‘wild dog.P’	<b>ɲ̣aap</b> ‘sycamore.S’
	<b>ṛaal</b> ‘lower back.P’	<b>ḷaal</b> ‘October’	
	<b>ẉaal</b> ‘grass.P’	<b>ʝaal</b> ‘yard.S’	<b>ɥ̣aal</b> ‘cough.IMP’

While the characteristic realisation of these phonemes is as implied by their IPA transcription, they may be produced differently in certain contexts. First, voiceless plosives may undergo weakening, either to their voiced counterparts or to a homorganic fricative or approximant. Examples are provided in (3) and (4).

(3) **ṭiik à-ɥ̣ɛɛc ṛaap [ṭiɥ̣àɥ̣ɛ̣:j.àp]**  
 woman.S AGRS-carry\_onhead.ZERO sorghum  
 ‘The woman carries dura on her head.’

(4) **c̣í ṛót kẉaāt / aḷaat-ìc [aḷaad-ìc]**  
 PST REFL wrap.PST / clothing.S-inside  
 ‘He had wrapped himself up in a coat.’

In (3), the phonemes /k/ and /c/ are realised as [ɥ] and [j], respectively. In (4), the coda /ṭ/ gets realised as [ḍ] when followed by a vowel. Second, the plosives may be produced without a release before a phrase boundary – a case in point is the final /p/ in example (3). The other consonants may also be underarticulated in the same context – that is, the nasals, /l/, and /r/ can be very short before a phrase boundary, to the point that their presence is to be inferred mainly from their effect on the formant transitions in the preceding vowel. Finally, the palatal /c/ – as in **piic** ‘stirring stick.S’ – has fricative [ç ç] and affricate [cc cç] variants (see Edmondson, Silva & Willis, to appear). The variation between these allophones and [c] is essentially free, even in the absence of contexts that induce weakening.

### Syllable structure and phonotactic constraints on consonants

Any consonant can appear in a simple onset. By contrast, when the onset is complex, its composition is severely constrained. The main limitation is that the initial onset consonant can only be followed by one or two semivowels – cf. the template in (1). Also, /ɥ/ does not appear in complex onsets at all, and onset /n/ tends to be followed by /j/. The only exceptions to this generalisation that we know of are **ṇòm** ‘head.S’ and **ɲ̣iim** ‘head.P’.

As for the coda, there are two restrictions. First, voicing in plosives is not distinctive in this slot. On the basis of their phonetic realisation in citation form and in phrase-final position, we represent coda plosives as underlyingly voiceless. Underlyingly, because unvoiced codas

may surface voiced intervocalically, as in (4). Second, the semivowel /ɥ/ does not appear in the coda slot, just as it is not found in complex onsets. We will return to this phoneme below.

In the analysis proposed here, vocalic sequences – in a phonetic sense – within the syllable are not treated as diphthong nuclei. Instead, we distinguish in them a nucleus vowel preceded and/or followed by semivowel consonants. For example, we transcribe ‘canoe.S’ as **rjɛej** rather than **riɛei**, even though, superficially, phonetic evidence does not rule out the latter option. There are several arguments that support the ‘consonantal’ analysis. First, if we were to interpret coda /j/ and /w/ as part of a diphthong nucleus instead, then we would predict that such sequences can be followed by a consonant, just like other vowels can. To the best of our knowledge, no such native forms exist. If we treat coda /j/ and /w/ as consonants, the exception disappears – they cannot be followed by a consonant because they themselves occupy the slot of the coda consonant. As for prevocalic /j/ and /w/, they have been analysed in Agar as part of diphthong nuclei in Andersen (1987), and as consonants in Andersen (1993). Under the diphthong analysis, the composition of the onset is reduced to a single consonant, but the number of vowel phonemes is greatly increased. Here again, as for the coda, we favour a consonantal interpretation. One argument is of a morphophonological nature. As seen from (5a), number can be marked on nouns by a change in vowel length, usually in combination with a change in tone. When forms with a prevocalic glide are involved, this prevocalic glide is not lengthened (see (5b, c)), suggesting that it is not part of the vowel. A second argument, relating to the alignment of tone patterns, will be presented in the section on tone, below.

- (5) a. **cɔ̃ɔ̃ɔ̃c** ‘end of rope.S’ vs. **cɔ̃ɔ̃c** ‘end of rope.P’  
 b. **ŋwàaar** ‘tongue.S’ vs. **ŋwár** ‘tongue.P’  
 c. **rjɔ̃ɔ̃p** ‘finger/toenail.S’ vs. **rjɔ̃p** ‘finger/toenail.P’

As seen in (6), sequences of semivowels only arise as a result of morphological processes that involve vowel breaking in forms that already have a semivowel.

- (6) **kwiiɫ** ‘eyetooth.S’ > **kwjɛɫ** ‘eyetooth.P’  
**wúɫ** ‘cattlecamp.S’ > **wwɔ̃ɔ̃t** ‘cattlecamp.P’

The phoneme /ɥ/ has three allophones: [ɥ], [h], and [zero]. [ɥ] is found before back vowels, and [h] before front vowels. Finally, /ɥ/ is not realised at all in non-emphatic realisations of function words like **ɥɛɛn** ‘1S’ and **ɥòok** ‘1P’. /ɥ/ is the phoneme most constrained in its distribution. First, there is a phonotactic constraint: /ɥ/ only appears in non-complex onsets. Because of this, it could be reinterpreted as a phonetic characteristic of syllables that do not have an onset. This is the analysis proposed by Duerksen (1989) on the basis of data from speakers of the Padang and Bor dialects, who do not realise /ɥ/ consistently. This analysis does not work in Luanyjang Dinka. In this dialect, /ɥ/ is systematically realised in the onset of monosyllabic words, but not at the start of words beginning with /a/. This means that the presence of /ɥ/ is not predictable: it is part of the lexical representation of particular morphemes.

## Vowels

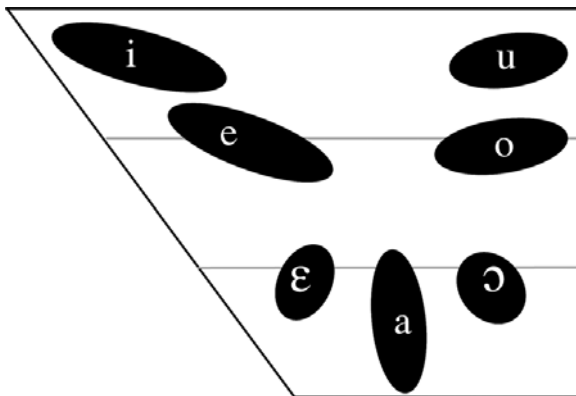
### Vowel quality

Luanyjang Dinka has seven vowel phonemes: /i e ɛ a ɔ o u/. These vowel phonemes combine fairly freely with the various suprasegmental distinctions – voice quality, vowel length, and tone. There are two restrictions. First, the high back vowel is invariably breathy. Second, the vowel /ɛ/ does not occur in the shortest level of vowel length. Morphological evidence

suggests that short /ɛ/ has merged with short /a/. As seen in (7a), a long stem vowel /e/ lowers to /ɛ/ in the second plural inflection of the verb. But when the stem vowel is a short /e/, as in (7b), it changes to /a/, presumably for lack of the short /ɛ/.<sup>4</sup>

- (7) a. **mìit**      **àa-tèet-kí**      vs.      **mìit**      **àa-tèet-kí**  
 child.P      AGRP-divulge.3P-2/3P      child.P      AGRP-divulge.2P-2/3P  
 ‘They/You are divulging the background of the children.’
- b. **láj**      **àa-tét-kí**      vs.      **láj**      **àa-tát-kí**  
 berry.P      AGRP-pick.3P-2/3P      berry.P      AGRP-pick.2P-2/3P  
 ‘They/You are picking the berries.’

The phonetic quality of the seven vowels is represented schematically in figure 1. The peripheral side of the ellipses represents the phonetic quality when it is realised saliently, i.e. when the vowel length is mid or long (cf. the section on vowel length below). As seen from figure 1, the distance between the high vowels /i u/ and the high-mid vowels /e o/ is smaller than that between the latter and the low-mid vowels /ɛ ɔ/. This means that the phonetic quality of /e/ is typically between [ɛ] and [æ], and that of /o/ between [ɔ] and [ɒ]. The centralised realisation of short vowels – represented by the central side of the ellipses in figure 1 – will be discussed below in the section on vowel length.



**Figure 1** Schematic representations of the vowel height and advancement of the seven vowel phonemes. Based on acoustic measurements in Remijsen & Gilley (2008).

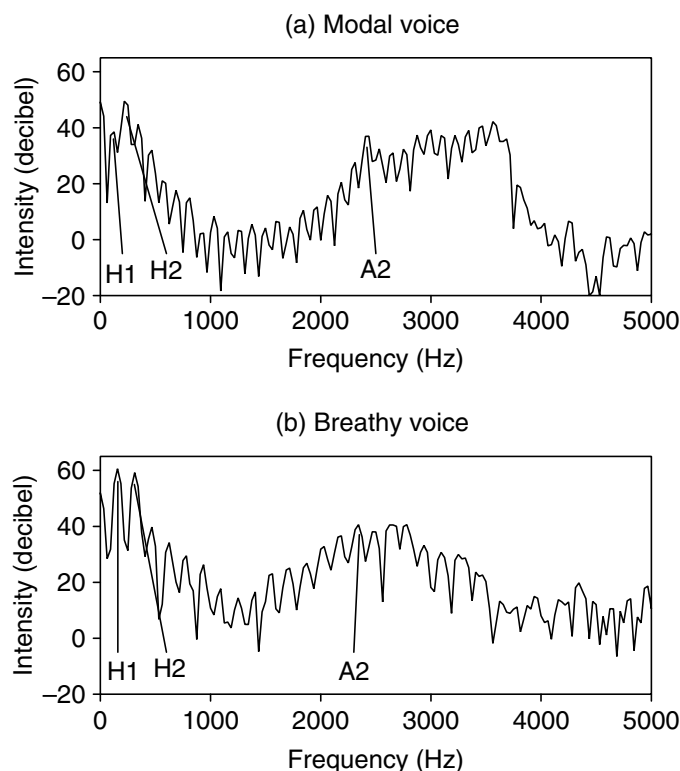
Near-minimal sets supporting the distinction between four levels of vowel height, both for the front and for the back vowels, are presented in (8).

- (8) **liil** ‘valley.S’      **rũuk** ‘bundle of sorghum.S’  
**léel** ‘provoke.IMP’      **ròok** ‘kidney.S’  
**lèel** ‘passage.P’      **rɔ̀ok** ‘fence.S’  
**lâal** ‘October’      **râak** ‘lulu tree.S’

### Voice quality

With the exception of /u/, the vowels appear in two voice qualities – modal and breathy. The breathy quality of the close back vowel is readily perceived by non-native speakers. As for the modal vowels, these often have a brassy or creaky quality. Exploratory measurements suggest that breathy vowels in Luanyjang Dinka are characterised by lower F1 values. The same

<sup>4</sup> Thanks to Torben Andersen for pointing this out to us.



**Figure 2** Spectrum representations calculated over a 30 ms window centered on the temporal mid point of the vowel /i/ in (a) modal-voiced **kiiir** 'big river.s', and (b) breathy-voiced **kiiir** 'kind of tree.s'.

finding is reported for Dinka in general by Malou (1988). In addition, there is relatively more energy at higher frequencies than at lower frequencies in the modal voice quality than in the breathy voice quality. This can be seen from the spectrum representations of /i/ in a minimal pair for voice quality in figure 2. The second harmonic (H2) has more energy than the first harmonic (H1) in panel (a) – impressionistically the vowel sounds creaky/brassy. When the same vowel is produced with breathy voice, H2 has about the same intensity as H1 (panel (b)). Similarly, the intensity of the harmonic boosted most by F2 (A2) is considerably weaker than H1 under breathy voice (panel (b)), but relatively less so under modal voice (panel (a)). A detailed acoustic investigation of voice quality in Luanyjang is in progress.

Near-minimal examples of each vowel phoneme except /u/ in each of the two voice qualities are presented in (9). Impressionistically, the mid vowels – /e/ vs. /ɛ/ and /o/ vs. /ɔ/ – are harder to tell apart when the vowel is breathy than when the vowel is modal, in particular when the vowel is not long (/VVV/).

- |                                |                               |
|--------------------------------|-------------------------------|
| (9) <b>kiiir</b> 'big river.s' | <b>kiiir</b> 'kind of tree.s' |
| <b>léeel</b> 'challenge.PST'   | <b>léeel</b> 'small hoe.s'    |
| <b>abéer</b> 'orphan.P'        | <b>béer</b> 'length'          |
| <b>páaat</b> 'tie up.PST'      | <b>páaat</b> 'bark of tree.s' |
| <b>tááɲ</b> 'spear.P'          | <b>tááɲ</b> 'bid goodbye.PST' |
| <b>ròoor</b> 'forrest.S'       | <b>ròoor</b> 'man.P'          |

### Vowel length

Luanyjang Dinka vowels can be short, mid, or long. Near-minimal sets – identical but for tone – are presented in (10). In sentence-medial context, short mid and long vowels have

average durations of about 70, 100, and 150 milliseconds, respectively (Remijsen & Gilley 2008). Vowel height and the presence of a following utterance boundary also weigh in at the phonetic level.

(10) a.	<b>lãŋ</b>	‘kind of berry.P’	<b>lãaŋ</b>	‘kind of berry.S’	<b>lãaaŋ</b>	‘slave.S’
b.	<b>cól</b>	‘mouse.S’	<b>còol</b>	‘charcoal.S’	<b>còool</b>	‘charcoal.P’
c.	<b>wùm</b>	‘pierce.IMP’	<b>wùum</b>	‘nose.S’	<b>wùuum</b>	‘nose.P’
d.	<b>tét</b>	‘pick.NEG’	<b>tëet</b>	‘pick.PST’		
			<b>tèet</b>	‘divulge.NEG’	<b>téet</b>	‘divulge.PST’
e.	<b>kól</b>	‘take out.NEG’	<b>kòol</b>	‘take out.PST’		
			<b>kòool</b>	‘adopt.NEG’	<b>kóool</b>	‘adopt.PST’

The short vowels additionally stand out from their mid and long counterparts in terms of their quality: i.e. when a vowel is short, its quality is audibly centralised. The quality of each vowel phoneme under centralisation is represented by the central side of the ellipses in figure 1. In addition to the examples in (10), consider the centralisation of /e/ in **ŋéŋ** ‘jawbone.S’ and **cèt** ‘excrement.P’. The vowel /ɔ/ is an exception to this trend – its quality remains constant across the three levels of vowel length. In summary, the limited time domain over which they are realised appears to affect the quality of the short vowels. It should not come as a surprise, then, that the vowel system is reduced here, from seven to six phonemes – /e/ does not occur as a short vowel. Further details on this centralisation phenomenon can be found in Remijsen & Gilley (2008).

As seen from the examples in (10), and also from those in (5), the vowel length distinction has both a lexical and a morphological function; that is there are short stems and long stems, and each of these can appear in a short grade and in long grade. In the example in (10d), short and long lexical stems are represented by {tet} ‘pick’ and {teet} ‘divulge’, respectively, and morphologically short and long grades are represented by the inflections for negation and past tense, respectively. The phonologically short vowels, now, are found in the short grade of lexically short stems – e.g. **tét** ‘pick.NEG’ in (10d). The phonologically long vowels are found in the long grade of lexically long stems – e.g. **téet** ‘divulge.PST’ in (10d). The mid level of vowel length is ambiguous between the long grade of a short stem and the short grade of a long stem. In this way, in the example in (10d), we find the mid level of vowel length both in the long grade of a short stem (**tëet** ‘pick.PST’), and also in the short grade of a long stem (**tèet** ‘divulge.NEG’).<sup>5</sup>

In certain nouns, the morphological grade distinction maps onto the short and long levels of phonological vowel length, i.e. skipping the mid level. Two sets of nouns can be distinguished in this context. First, there are noun stems ending in /r/. Vowel duration in the short grade of CVr stems – examples in the left column of (11a) – is as short as the short grade of short stems ending in another consonant – leftmost column in (10) above.

<sup>5</sup> In an analysis of the quantity system of the Dinka language as a whole, Gilley (2003) analyses the lexical quantity distinction – as illustrated by {tet} ‘pick’ vs. {teet} ‘divulge’ – as a binary vowel length distinction, and the morphological quantity distinction – e.g. the forms of these two verbs inflected for negation and past tense – as a separate phonological contrast, namely ‘stress’, with the short morphological grade being ‘+stress’. However, in an acoustic study of the quantity system of Luanyjang Dinka, Remijsen & Gilley (2008) find no evidence that morphological and lexical quantity have separate phonological interpretations. For example, the negation and past tense forms in (10d) differ from one another primarily in terms of duration, and to a lesser extent in terms of vowel quality, with the short grade of short stems being centralised. Crucially, Remijsen & Gilley do not find any significant phonetic difference between the long grade of short stems – forms such as **tëet** ‘pick:PST’ – and the short grade of long stems – forms such as **tèet** ‘divulge:NEG’. That is, ignoring tone, which is orthogonal to the quantity distinction. Given that phonological quantity serves two distinct functions in Dinka, it cannot be ruled out that Gilley’s stress hypothesis would hold for other dialects.

- |         |             |                  |               |                  |
|---------|-------------|------------------|---------------|------------------|
| (11) a. | <b>kír</b>  | ‘kind of tree.P’ | <b>kíiir</b>  | ‘kind of tree.S’ |
|         | <b>agòr</b> | ‘riverbank.S’    | <b>agôoor</b> | ‘riverbank.P’    |
|         | <b>wár</b>  | ‘shoe.P’         | <b>wâaar</b>  | ‘shoe.PS’        |
| b.      | <b>ajít</b> | ‘chicken.S’      | <b>ajíit</b>  | ‘chicken.P’      |
|         | <b>kàl</b>  | ‘town.S’         | <b>kâaal</b>  | ‘town.P’         |
|         | <b>nján</b> | ‘testicle.P’     | <b>njàaan</b> | ‘testicle.S’     |

Vowel duration in the long grade of CVr stems – examples in right column of (11a) – is as long as in the long grade of long stems ending in another consonant – rightmost column in (10). But while the vowels of CVr stems are short in the short grade and long in the long grade, there is no evidence for the third, intermediate pattern of vowel duration in such stems. Second, the same pattern is found in a small number of nouns ending in a consonant other than /r/. Examples are presented in (11b). Further details on the quantity system of Dinka can be found in Remijsen & Gilley (2008).

### Tone

Tone patterns distinguish both unrelated lexical items – cf. (12) – and inflections within inflectional paradigms – cf. (13).

- |      |              |                  |              |              |             |            |
|------|--------------|------------------|--------------|--------------|-------------|------------|
| (12) | <b>kwíil</b> | ‘kind of rope.P’ | <b>wéëer</b> | ‘river.S’    | <b>ròok</b> | ‘kidney.S’ |
|      | <b>kwíil</b> | ‘eyetooth.S’     | <b>wéëer</b> | ‘cow dung.S’ | <b>róok</b> | ‘kidney.P’ |

- |         |                                   |              |    |                                  |                |
|---------|-----------------------------------|--------------|----|----------------------------------|----------------|
| (13) a. | <b>adwòk</b>                      | <b>à-mèl</b> | b. | <b>adwòk</b>                     | <b>à-mèl</b>   |
|         | plate                             | AGRS-soil.2S |    | plate                            | AGRS-soil.PASS |
|         | ‘You are making the plate dirty.’ |              |    | ‘The plate is being made dirty.’ |                |

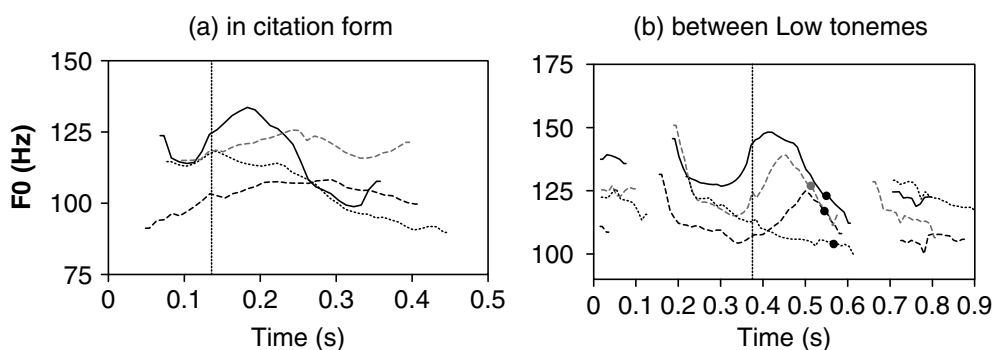
There are four distinctive tone patterns (tonemes) – Low, High, Rise, and Fall. Each morpheme carries one, irrespective of its number of syllables. This toneme associates with the rightmost syllable, which is usually the only syllable. In polysyllabic words, the penultimate syllable may have high pitch. This high pitch is not distinctive. Rather, it is predictable given the toneme on the final syllable.

F0 tracks illustrating the realisation of the four tonemes are presented in figure 3. As seen from figure 3, Low and Fall differ in F0 alignment and also in F0 height. The same is true of the distinction between High and Rise. This can be seen in figure 3b. In utterance-final context, the Rise is realised as a level tone in the middle of the speaker’s register (cf. figure 3a).

The string of underlyingly specified tonemes is distorted by contextual effects and by tone sandhi processes. The most notable contextual process affects the realisation of the Rise. While this toneme is realised with rising F0 in most contexts (cf. figure 3b, black dashed line), it is realised as mid level F0 in phrase-final position (cf. figure 3a, black dashed line). The most important sandhi process is Dissimilatory Lowering, which turns a High tone into Low when it is preceded by another High tone. The behaviour of the tonemes under Dissimilatory Lowering motivates an analysis whereby the contours – Rise and Fall – are interpreted as combinations of level tones, i.e. as LH and HL, respectively. That is, Dissimilatory Lowering is triggered by LH and H alike, and both H and HL undergo its effect. Finally, the application of tone processes is to some extent conditioned by the morphosyntax. For example, Dissimilatory Lowering does not apply in existential yes/no questions. Further details on the Luanyjang Dinka tone system can be found in Remijsen & Ladd (2008).

We have shown above that syllables vary considerably in their internal quantity, due to the three-level vowel length distinction. We could conceive of this vowel length distinction affecting the association of tones, with more complex tone patterns occurring in syllables





**Figure 3** FO tracks illustrating the four tonemes of Luanyjang Dinka on monosyllabic words with a mid or long vowel and a sonorant coda in two contexts, uttered by the same speaker. High: grey dashed; Rise: black dashed; Low: black dotted; Fall: black plain. The FO tracks are aligned on the start of the vowel of the target word, which is marked by a vertical line. In the utterance context (2b), the end of the target syllable is marked by a dot. From Remijsen & Ladd (2008).

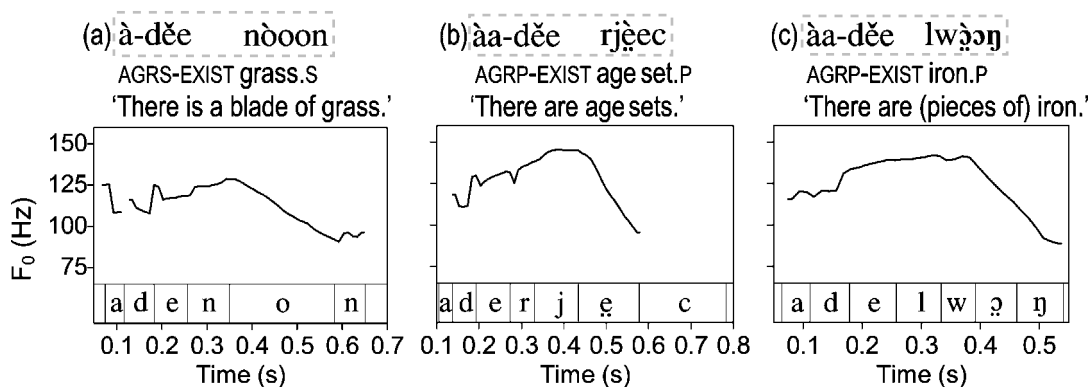
where the vowel is mid or long. As illustrated in the XTone Cross-Linguistic Tonal Database (Allison, Hyman & Mortensen 2006), this situation is familiar from many tone languages, and it can be accounted for in an autosegmental analysis by postulating that the mora (i.e. a language-specific syllable-internal weight unit) is the tone bearing unit (TBU). In Luanyjang Dinka, though, syllable-internal weight does not affect the association of tone patterns at all – level and contour tonemes alike are found on syllables with short, mid, and long vowels. Because of this, we postulate that the TBU in Luanyjang Dinka is the syllable. This hypothesis is supported by the minimal pair in (13) above, where a short vowel has a level toneme (L) in the 2nd singular inflection, and a contour toneme (HL) in the passive. In this way, the HL appears regularly in the paradigms of short transitive verb stems. Among nouns, the contour tones are attested but rare – examples include *bɪŋ* ‘cup.S’ and *mi-kwɛc* ‘BULL.P-spotted.P’. These noun and verb examples show that complex tone patterns are found on monomoraic vowels, falsifying a TBU = mora account.

The alignment of tonemes provides an opportunity to evaluate the hypothesis that prevocalic glides are consonants rather than initial elements of diphthong vowels (cf. the ‘Consonants’ section above). As stated above, the Low tone on the noun argument is realised as a fall in F0. The starting point of this fall is aligned with the boundary between the onset and the vowel. This early alignment distinguishes it from the Fall (HL), which dips well into the vowel – see figure 3 and figure 4a. Importantly, when the vowel is preceded by /j/ or /w/, as in figures 4b and 4c, the F0 fall sets in at the boundary between the glide and the following vowel, as predicted under a consonantal interpretation. If these glides were part of the vowel, the alignment patterns observed in figures 4b and 4c would lead us to infer that their toneme is the HL. Crucially, this is not the case. The behaviour of *rjɛc* ‘age set.P’ and *lwɔŋ* ‘iron.P’ in the tonal phonology is identical to that of *nɔon* ‘grass.S’

### Between-dialect variation

The segmental system reported here for Luanyjang Dinka corresponds closely to those found in descriptions of other dialects and Dinka in general (Tucker 1981, Andersen 1987, Malou 1988). By contrast, the suprasegmental system does show some between-dialect variation. That is, while all dialects appear to use voice quality, tone, and vowel length in the lexicon and in the morphology, the exact constellations vary.

In this way, the tone system of Luanyjang Dinka – with four tonemes – may well be more complex than that of at least some of the other dialects: Andersen (1987) reports only three tonemes for Agar Dinka (Low, High, Fall). Also, a more complex voice quality system has been postulated for the Bor dialect of Dinka (Denning 1989, Edmondson & Esling 2006).



**Figure 4** F0 tracks illustrating the realisation of the Low toneme on nouns without a prevocalic glide (a), and with a prevocalic glide (b, c).

Edmondson & Esling (2006) distinguish breathy, modal, creaky, and hollow as phonetically distinct patterns. As noted by Denning (1989: 151f.), voice quality distinctions tend to affect several vocalic and suprasegmental parameters. It would be interesting to know whether and how, in Bor Dinka, the richer voice quality system interacts with the rest of the phonology.

### Transcription of the recorded passage

Forward slashes in the transcription and in the translation mark major phrasing breaks in the recording, typically involving a pause.

‘The North Wind and the Sun’

Anyiköl Yom Tueŋ ku Aköl (Dinka orthography)

**anikɔl ɛ jòm twèeŋ kù akɔl** (phonemic transcription)

‘The story of the North Wind and the Sun’ (translation)

Yom tueŋ ku aköl aake tɛr e kamken / ku bik ŋic ye ŋa ril.

**jòm twèeŋ kù akɔl àa-kè téɛr ɛ kéem-kèen / kù bìi ŋiic eŋaa ril**

‘The North Wind and the Sun were contesting between themselves / so as to know which is more powerful.’

Etèn ke raan ken / bà ka cath / ci rot kuäth / alath yic / alanhdɛen / cen guöp mɔr thin.

**ɛ-tɛen kè raaan kéɛŋ / bá kà-càat / cí rɔt kwäat / aláat-ic / aláan-dèen / cén gwɔp mɔɔr tɪn**

‘At that time there was a traveller / he came walking by / he had wrapped himself up / in a cloth / his cloth / in which his body is warm.’

Gokè gam kamken na de raan / yen bi kɔŋ yen bi nyuëër kɔu bei / alath / ken e ran ci riɛl.

**gò-kɛ gâam ɛ kéem-kèen nàa dɛe raaan / uɛn bí kɔŋ uɛn bí ɲwɛɛr kɔw bèej / aláat / kèené raaan ci rjèel**

‘They agreed between themselves if there is a person / who will be the first to take off from the back / the cloth / this one would be the powerful one.’

Tĕĕnĕ aci yom tuĕŋ jɔŋɔ jɔk / bi jɔ puöt arĕdīt / je puöt-ĕ piu piu / kã puöt yen puöt / lõk ke met / alath / raan guöp / alath lõk ke met e raan guöp.

**ĕ-tĕĕnĕ à-cì jòom twéĕŋ jɔɔ jɔɔk / bí- jɔɔ pwòot arĕt dīt / jĕ pwòot ĕ-pjuuw-pjuuw / kã pwòot yĕen pwòot / lõk kĕ mĕĕt / aláat / ràaan gwòop / aláat lõk kĕ mĕĕt ĕ-ràaan gwòop**

‘Then the north wind suddenly started / to blow very hard / it suddenly blows whoow-whoow / but the more it blows / the more it attaches / the cloth / the man’s body / the cloth increasingly attaches to the man’s body.’

Na le dhal e themde / ka luĕcpiny.

**nàa lĕe dàl ĕ tĕĕm-dĕ / kã-lwĕĕc-pìŋ**

‘When his attempt failed / he gave it up [lit. he put it down].’

Etĕn aci Aköl jɔ ba jɔɔk / bi ruelde jɔ ba looi / je tuöc e ruelde je [luit] / je duitic arĕdīt ba tuöc apĕi.

**ĕ-tĕĕn Ā-cì akĕcl jɔɔ bà-jɔɔk / bí rwĕĕl-dĕ jɔɔ bà-lóooj / jĕ twòc ĕ-rwĕĕl-dĕ [luit] / jĕ dwiit-ic arĕt dīt bí twòc apĕĕj**

‘Then the Sun suddenly started / his shining to do / his shining was getting warm / getting to become extremely hot, to become very warm.’

Na la raan cath guöp tuöc / go alath [go] nyuĕĕr bei yekou.

**nàa làa ràaan cáat gwòop twòc / gòo aláat [gòo] nwĕĕr bĕej jĕ-kòow**

‘When the body of the person walking became warm / he untied the cloth from his back.’

Tĕĕnĕ aci yom tuĕŋ jɔl gam / lõn yenĕ aköl yenĕ ril tĕnĕ yĕen.

**ĕ-tĕĕnĕ à-cì [e] jòom twéĕŋ jɔɔl gãam / lõn jĕĕnĕ- akòol à-ril tĕnĕ- jĕen**

‘Then the North Wind accepted / that the sun was powerful of the two.’

Yene akan.

**jĕĕnĕ- akàan**

‘That is it.’

## Abbreviations

1	1st person	NEG	Negation
1SPOS	1st person singular possessor	P	Plural
2	2nd person	PASS	Passive present
3	3rd person	PLPRN	Indefinite plural pronoun
ACTOR	Derives actor noun	PST	Past
AGRS	Agreement with singular topic	REFL	Reflexive marker
AGRP	Agreement with plural topic	S	Singular
BULL	Male re. cattle colour term	UNC	Uncountable or collective
EXIST	Existential predicate marker	ZERO	Present
IMP	Imperative		

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