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ILLUSTRATIONS OF THE IPA

Nuer

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Nuer (ISO 6393: nus/Glottocode: nuer1246) is a Nilo-Saharan language (Nilo-Saharan, Eastern Sudanic, Nilotic, Western, Dinka-Nuer). The sound system of Nuer is of particular interest because the language has a rich inventory of vocalic and suprasegmental distinctions, including a large number of vowel phonemes, a voice quality contrast (modal versus breathy), three levels of vowel length, and a tonal inventory that interacts with the voice quality contrast.

Nuer, or Thok Nath (lit. 'language of people'), is spoken by around 1.7 million people (Eberhard, Simons & Fennig 2021), who refer to themselves as Naath (lit. 'people'), in the Republic of South Sudan and in the Gambella region of Ethiopia (see Figure 1). Within Nuer, three dialect clusters can be distinguished – Western, Central, and Eastern. Western Nuer is spoken to the west of the White Nile. Central Nuer is spoken on the eastern side of the White Nile in the adjacent area. Eastern Nuer is spoken elsewhere in South Sudan and in Ethiopia. The Eastern cluster includes three dialects: Lou and Nasir Jikany, both of which are spoken in South Sudan, and the Ethiopian Jikany dialect. Here I report exclusively on the South Sudanese Nuer and for most part on the system of one of the Eastern dialects - Lou Nuer, although the description of the vowel system and voice quality is based on data from speakers of Western and Lou Nuer, and the description of tone is based on the data from speakers of Lou, Nasir Jikany and Western dialects. The North Wind and the Sun story is narrated by a speaker of Nasir Jikany.

The audio recordings in this paper come from three speakers. All speakers lived in the Nuer-speaking area until well into their late teens. At the time of the recordings, all speakers resided in Nairobi, Kenya. They all use Nuer daily and attend Nuer-medium churches. The first speaker is Rebecca Nyawany Makwach (RNM) – a female speaker of the Lou (Eastern) dialect. Most of the recordings in this paper come from this speaker. Rebecca was in her early to mid-forties when the recordings took place (between 2016–2022). Her family comes from the Lou territory, and she grew up in the Waat town. In 2000 she came to Kenya where she has resided since. She makes frequent trips to South Sudan, usually to the country's capital Juba. Rebecca speaks KiSwahili and English as L2. The second speaker is Jimma Kir Guicwang (JKG) – a male speaker of the Nasir Jikany (Eastern) Nuer dialect. This speaker narrated the North Wind and the Sun story, provided the Nuer orthographic version of it, and contributed the data for the study of tone. Jimma was in his mid-thirties

Figure 1. (Colour online) Map of the Nuer-speaking territories showing the distribution of the three Nuer dialect clusters – Western, Central and Eastern; and the three Eastern dialects – Lou and Nasir Jikany of South Sudan and the Ethiopian Jikany.

at the time the recordings were made (2018–2020). He is originally from the Nasir town in South Sudan. At the age of six he moved to the Gambella region in Ethiopia populated by the Ethiopian Jikany Nuer speakers. Jimma came to Kenya in 2011 where he has resided since. He speaks English, Amharic and Anyuak as L2. The third speaker is a male speaker of Western Nuer dialect, Peter Gatkuoth Makun (PGM), who was twenty-nine years of age at the time of the recording (in 2018). This speaker contributed the data for the study of vowel quality, voice quality and tone. Peter is originally from the Leer community which is one of the Nuer sections that speak the Western Nuer dialect. He lived in South Sudan until 2010 when he came to Kenya to conduct his studies. He has recently returned to South Sudan for employment. Peter speaks English, KiSwahili and Arabic as L2.

The data for this study were recorded using a solid-state recorder (Marantz PMD661) and a dynamic headset-mounted microphone (Shure SM10A). When eliciting the data, between two and three repetitions were recorded as a rule in order to maximise the chances of getting good quality recordings suitable for phonetic analysis. Reported measurements were obtained by measuring only one repetition per speaker. Usually, the first repetition was measured, unless there were obvious problems (for example, the speaker hesitated, unclear formant tracks, background noise, etc.), in which case one of the subsequent repetitions was used for the measurements instead.

Consonants

The consonantal inventory that is common to all Nuer dialects consists of twenty consonants. These include voiceless plosives, voiced plosives and nasals at five places of articulation. In addition, there are the liquids /l/ and /r/, and the three approximants /w, j, ɰ/.

Fricative phonemes, shown in the consonantal chart, are attested in the Lou and Western Nuer dialects. They appear in parenthesis to indicate that their distribution is restricted to morpheme-final position (specifically, in morphologically complex words), as will be described below. Lou Nuer has a voiceless glottal fricative phoneme. Western Nuer has voiceless fricative phonemes that occur at labial, dental, alveolar, palatal and velar places of articulation, and a voiced dental fricative phoneme (Baerman & Monich 2021). This paper presents the consonantal data as it occurs in the speech of a Lou Nuer speaker. As such, only one fricative phoneme will be exemplified.[1]

	Labial	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	p b	t̪ d̪	t d	c ɟ	k g	
Nasal	m	n̪	n	ɲ	ŋ	
Fricatives	(f)	(θ) (ð)	(ɹ̥)	(ç)	(x)	(h)
Lateral			l			
Trill			r			
Approximant	w			j	ɰ w	

/p/ pá̤t [pă̤͡tç] ‘clap’	**/b/** bá̤ːn [bă̤ːn] ‘fold (1)’	**/m/** má̤t [mă̤t̚] ‘fold (2)’
/t̪/ t̪á̤t [t̪͡θă̤t̚] ‘cook’	**/d̪/** d̪àːŋ ‘loft bed’	**/n̪/** n̪óːɰ [n̪ôːɰ] ‘love’
/t/ tá̤ːːɰ [tă̤ːːɰ] ‘plait’	**/d/** dà̤ːːɰ ‘separate’	**/n/** náːc [nâːc̚] ‘heifer’
/c/ cá̤ːm [çă̤ːm] ‘eat’	**/ɟ/** ɟā̤ːːɲ ‘late’	**/ɲ/** ɲā̤ːːt̪ [ɲā̤ːːθ] ‘plaster’
/k/ kál [kâl] ‘fence’	**/g/** gàt [gàt̚] ‘child’	**/ŋ/** ŋá̤t [ŋă̤t̚] ‘peel’

[1] Examples of sound recordings exemplifying the Western Nuer dialect cluster are available online as part of the Nuer Lexicon database (Bond et al. 2020).

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/r/	rā::n [rǎ::n]	**/l/**	ᵘ́lát̪ [lâð̪ˡ][2]			
	‘person’		‘cotton’			
/w/	wā̤::n [wǎ̤::n]	**/j/**	já:ŋ [jâ:ŋ]	**/ɰ/**	ɰɔ̄:w	ɰá̤::m [ɦǎ̤::m]
	‘steal’		‘cow’		‘earth’	‘thighs’

Examples above show Nuer consonants in morpheme-initial position.[3] The fricative phonemes do not occur in this context. The items that exemplify the phoneme /ɰ/ show two allophones conditioned by the vowel quality of the adjacent vowel. The phoneme /ɰ/ can be realised as a glottal fricative (either voiced [ɦ] or voiceless [h]) mostly in the context of low vowels, and as [ɰ] elsewhere. The glottal realisation is attributed to a coarticulatory effect of the maximal opening required in the production of the low vowels. In addition, /ɰ/ can also be realised as a fricative phrase initially before /ə̤/. This is evident from the examples of *ɰə̤́n* ‘I’ in Figure 11 and in (5a). The examples in Figure 11 show that /ɰ/ is realised as either a voiced (Panel A) or voiceless (Panel B) glottal fricative. The first example in (5a) shows that it can also be realised as a velar fricative [x]. The fricative realisation in the phrase-initial context is attributed to particularly strong prosodic strengthening condition.

Spectrograms for the labiovelar and velar approximants are presented in Figure 2. The labiovelar /w/ is exemplified in word-initial position in *wā̤::n* ‘steal’ (Panel A) and in word-final position in *ɰɔ̄:w* ‘earth’ (Panel B). The velar approximant /ɰ/ is exemplified in word-initial position in *ɰɔ̄:w* ‘earth’ (Panel B) and in word-final position in *tá̤::ɰ* ‘plait’ (Panel C). The velar approximant has relatively high F2 and F4 compared to the labiovelar approximant. As a result, the F1 and F2 as well as F3 and F4 are closer together for /w/ than for /ɰ/. In phrase-initial position, the velar is also preceded by pre-aspiration, as is evident from the spectrogram in Panel B.

Voiceless and voiced plosives contrast only in morpheme-initial position (this will be justified in the discussion of the intervocalic voicing below). The voiceless plosives are aspirated, and the voiced plosives are prevoiced.

Table 1 shows measurements of the voice onset time (VOT) for Nuer plosives. All the measured items – 430 in total – came from onsets of monosyllabic words uttered in isolation by a single speaker (RNM).

The relatively high VOT for /c/ in Table 1 is due to its variable realisation as either a fricative, an affricate or a plosive. As a fricative, it can be realised either as the alveolo-palatal or palatal. The following phonetic realisations are attested: the alveolo-palatal [ɕ] in the context of high vowels, as can be seen from the auxiliary verbs *cí̤kɛ̀* in (1a); the palatal [ç], as in the word *cə̤́ŋ* ‘sun’ in (1a); the affricate [c͡ç], as in the auxiliary *cɛ̀* in (1c); and a stop [c], as in the auxiliary *cà:* in (1d).

[2] Here and throughout the paper, (ᵘ́) represents the underlying floating constituent (FC), consisting of a mora and a High tone, that occurs at the left edge of some nouns, and which surfaces only with addition of some context but never in isolation (Reid 2019, 2021a,b). This phenomenon has also been mentioned by a number of authors in the past, including Crazzolara (1933) who refers to it as ‘tone supporter/shifter’, Gjersøe (2019) who analyses it as ‘differential object marking’, and Monich (2021) who postulates a floating mora.

[3] A typical Nuer morpheme is a monosyllable of the following structure (C)V(:)(:)(C) (see the section on syllable structure).

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Table 1 Mean VOT and one standard deviation around the mean for voiceless and voiced plosives rounded to the nearest millisecond. Data from a single speaker (RNM).

	Voiceless plosives				Voiced plosives		
	Mean VOT (ms)	sd (ms)	No. of items		Mean VOT (ms)	sd (ms)	No. of items
/p/	45	15	45	/b/	−85	17	44
/t̪/	52	14	42	/d̪/	−78	17	39
/t/	44	19	58	/d/	−80	15	25
/c/	87	19	18	/ɟ/	−80	22	43
/k/	61	19	80	/g/	−76	18	36

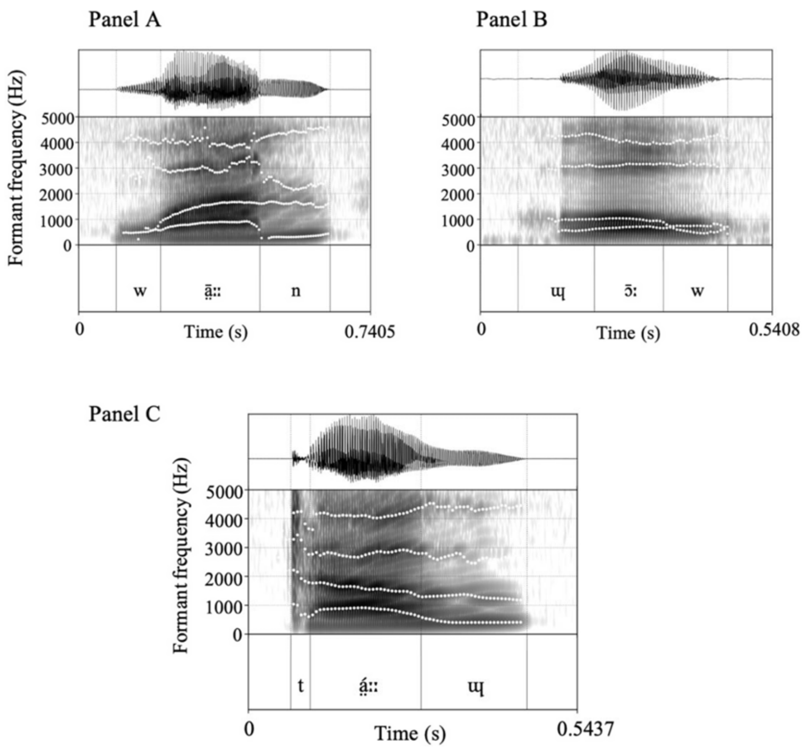

Figure 2. Spectrograms showing the labiovelar /w/ and velar /ɰ/ approximants in word-initial and word-final positions. Panel A: *wā̤ːːn* ‘steal’, Panel B: *ɰɔ̄ːw* ‘earth’, Panel C: *tá̤ːːɰ* ‘plait’.

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(1) a. [**tárgjâw** ɰɛ́nɛ̀ **ç̤ə̤́ŋ** **ɕḭ̤́kɛ̀** tḛ̤́ **gɛ̄**ː ɰá^ɰnɔ̀m] [4]

tárgjáw	kɛ́nɛ̀	**cə̤̤́ŋ**	**cḭ̤́kɛ̀**	ṱ̤é	**kɛ̀**	^µ́ŋáknɔ̀m
wind	CONJ	sun	PFV.3PL	have.NF	PREP	argument

'The North Wind (lit. fence turner) and the Sun have been arguing.'

b. [ç̤ṳ́ **rāːmə̀ jə̀** lǎːr bṳ́m nḛ̄ ɰə̤̀n kə̤̀ ɟḭ̤̀]

cṳ́	**rāːm-ɔ̀**	**ɛ̀**	láːr	bṳ́m	nḭ̤̄	ɰə̤́n	kə̤́	ɟḭ̤̄
COLL	person-MED	COP.SG	say.TR.NF	strong.OBL	COMP	1SG	PREP	2SG

'... and one of them was saying: "I am stronger than you".'

c. [ḭ̤́ **c͡ɕɛ̀ pɔ̤̀d** ɛ̀ lɔ̤́ŋ]

mḭ̤́	**cɛ̀**	**pɔ̤̀ɔ̤t**	ɛ̀	lɔ̤́ŋ
then.DIST	PFV.3SG	blow.IN.NF	PREP	well

'When it blew hard...'

d. [**cā**ː ɟjɵ̂ː ɰɔ̤̀ː ə̀ wér **târgjàw**]

càː	ɛ́	ɟjɵ̄ː	ɰɔ̤̀ː	wér	**tárgjáw**
PASS	3SG	tell.TR.NF	OK	go.IMPER	wind

And he was told: "Ok North Wind, go!".

Other plosives can also be realised as fricatives or affricates word-initially. The labial /p/ can be realised as [ɸ] or [p͡ɸ] in fluent speech, as is evident from the word *pwɔ̤́ːɲdɛ̀* 'his body' in the two examples in (2a). The dental /t̪/ can be realised as [s], [t̪] or [t̪͡θ]. The example (2b) shows the [s] realisation in the speech of PGM. The example (2c) shows the [t̪] realisation in the speech of RNM. The affricate [t̪͡θ] realisation appears in the word *t̪ḭ̤́n* 'in the middle of' in (2d) spoken by JKG, and in the word *t̪ə̤́t* 'cook' in Panel A of Figure 3 spoken by RNM.

(2) a.

^µ́bḭ̤ː-dɛ̀	kə̤̀m	ráːr	**pwɔ̤́ːɲ-dɛ̀**	→	[**ɸɔ̤́ːɲdɛ̀**]
cloth-SG.3SG.POSS	remove.TR.NF	out	body-SG.3SG.POSS		

'... remove the cloak from his body.'

làː	kṳ́l-ɛ́	nḭ̤́	^µ́bḭ̤ː-dɛ̀	**pwɔ̤́ːɲ-dɛ̀**	→	[**p͡ɸɔ̤́ːɲdɛ̀**]
HAB	wrap.TR-3SG	FOC	cloth-SG.3SG.POSS	body-SG.3SG.POSS		

'...wrapped his cloak around his body.'

b.

ɟḭ̤́n	**t̪ɛ́ːɰ-ḭ̤́**	kwə̤́n	→	[**sɛ̂ːɰḭ̤̀**]
2SG	abstain.from.TR-2SG	food.SG		

'You are abstaining from food.'

[4] Sentences in (1), (2a,d), (3) and (8) come from 'The North Wind and the Sun' story narrated by JKG.

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c.

ɰə̤́n	**t̪ō̤t-ə̤́**	jāːŋ	→	**[t̪ō̤də̤́]**
1SG	pull.TR-1SG	cow		

‘I am pulling the cow.’

d. [kə̤́ njɛ̂ gwá̤ːð ɛ̀ té̤ **ɰɛ̄**ː ŋáŋnɔ̀m **t̪͡θí̤n**]

kə̤́	njɛ́	gwá̤ːt̪ ɛ̀	té̤	**kɛ̀**	ᵑ́ŋáknɔ̀m	**t̪í̤n**	
PREP	only	time COP.SG	have.NF	PREP	argument	in.the.middle.of	

‘As they were in the middle of the argument...’

Figure 3 shows spectrograms for the dental and alveolar stops in word-initial position. The alveolar plosives (Panels C, D) are characterised by the relatively higher F2 at the point of the transition into the vowel compared to the dentals (Panels A, B).

The palatal /ɟ/ can be realised as [͡ɟʑ], as in (3a). The velar /k/ can be realised as [͡kx] in fluent speech, as is evident from *kɔ̤̀ɔ̤lí̤* (glossed as wrap-PL) ‘wrapping’ in (3b). The alveolar /d/, is typically realised as a stop [d], as can be seen from the 3sg possessive suffix in the word *ᵐ́bḭː-dɛ̀* ‘his cloth’ in (3c). In fast speech it can be additionally realised as either an affricate [͡dʑ] or a tap [ɾ], as in the two renditions of the same word in (3b).

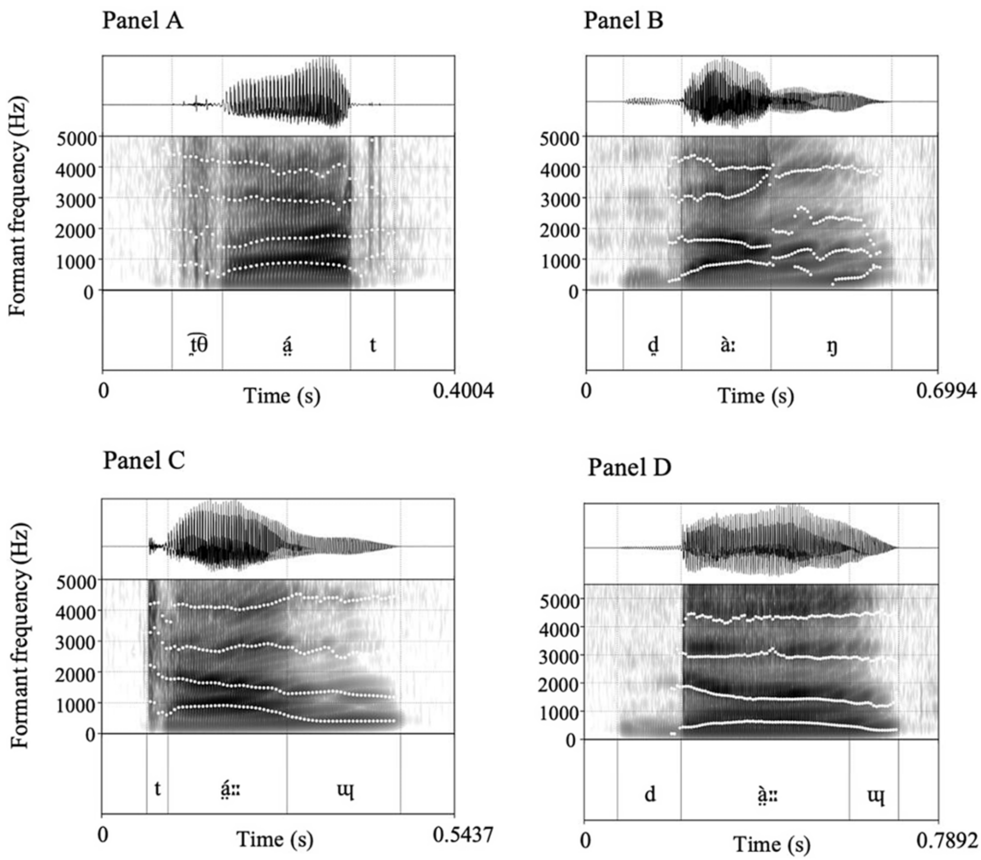

Figure 3. Spectrograms showing the dental plosives /t̪/ and /d̪/ (Panels A, B) and alveolar plosives /t/ and /d/ (Panels C, D) in word-initial position. Panel A: *t̪á̤t* ‘cook’, Panel B: *d̪àːŋ* ‘loft bed’, Panel C: *tá̤ːːɰ* ‘plait’, Panel D: *dá̤ːːɰ* ‘separate’. The annotation tier shows phonetic transcription.

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(3) a. [kə̤́ çwə̀ tḛ́ gɛ̀ **ɟ͡ʑə̤́ːːl** mḛ̀ **ɟ͡ʑə̤́l**]

kə̤́	cṳ́	ɛ̀	tḛ́	kɛ̀	**ɟə̤́ːːl**	mì̤	**ɟə̤́l**
PREP	COLL	3SG	have.NF	PREP	traveller	REL.SG	travel

‘There was a traveller travelling...’

b. [brāːmɔ̀ **k͡xɔ̤̀lḭ́** **bì̤ːd͡ʑɛ̀** bə̀ wə̤̄ mə́ kwɔ̂ kɔ̤̀lḛ́ **bì̤ːrɛ̀** pɔ̤́ːɲdɛ̀]

bì̤	rāːm-ɔ̀	**kɔ̤̀ɔ̤l-ḭ́**	**$^{\acute{\mu}}$bì̤ː-dɛ̀**	bɛ̀	wə̤́	mḭ́
FUT	person-MED	wrap-PL	cloth-SG.3SG.POSS	FUT.3SG	go.NF	then.DIST
kṳ́	ɛ̀	kɔ̤̀ɔ̤l-ḭ́	**$^{\acute{\mu}}$bì̤ː-dɛ̀**	pwɔ̤́ːɲ-dɛ̀		
COLL	3SG	wrap-PL	cloth-SG.3SG.POSS	body-SG.3SG.POSS		

‘...the person will be wrapping the cloak more tightly around himself.’

c. [ɛ̀ **mə̤̌ːːð** ɛ̀ **mə̤̄ːːθ** çṳ́ rāːːn **bì̤ːdɛ** wə̤̀ː mə́ kə̤́mɛ̀ ɟɛ̀ rāːr ɛ̀ **mə̤̄ːːs**]

ɛ̀	**mə̤̄ːːt̪**	ɛ̀	**mə̤̄ːːt̪**	cṳ́	rāːːn	**$^{\acute{\mu}}$bì̤ː-dɛ̀**	wə̤̀ː	méː
COP.SG	slow	COP.SG	slow	COLL	person	cloth-SG.3SG.POSS	go.NF	when.PST
kə̤́m-ɛ́	ɟɛ̄	ráːr	ɛ̀	**mə̤̄ːːt̪**				
remove.TR-3SG	3SG	out	COP.SG	slow				

‘Slowly, the person started to unwrap his cloak.’

In the majority of Nuer dialects, the phoneme /ɰ/ can occur only morpheme-initially. In Lou Nuer as well as in the Western Nuer it can additionally occur morpheme-finally. In their investigation of Western Nuer, Monich & Baerman (2019) attribute the occurrence of this phoneme (as well as the fricative phonemes) morpheme-finally to consonantal lenition as a function of morphology. Consonantal lenition is also the likely source of the phoneme /h/ in Lou Nuer. This phoneme occurs only morpheme-finally (and more specifically, in certain morphological contexts). The morpheme-final /ɰ/ and /h/ in Lou Nuer both originate from /k/ which is found in the corresponding lexical items in the non-leniting Nuer dialects.[5] At least in Lou Nuer, the contrast between /k/ - /ɰ/ - /h/ is phonemic in morpheme-final position, as is evident from the examples in (4).

(4)	t̪íeːːk [t̪îeːːk]	tíeːːɰ [tîeːːɰ]	cìeːh
	‘raft’	‘of necklace’	‘metal bracelet’

Voicing in plosives is not contrastive in morpheme-final position. The examples of the verb ‘catch’ in (5) show that plosives are voiced when followed by a vowel (5a) or a sonorant (5b), and voiceless before another plosive (5c) or in the pre-pausal position (5d) where they are often unreleased. There is no good reason to assume that the morpheme-final plosives are either voiced or voiceless underlyingly. Here I make an arbitrary decision to represent them as voiceless underlyingly, and subject to voicing when followed by a vowel or a sonorant consonant.

[5] The narrator of ‘The North Wind and the Sun’ story speaks the Nasir Jikany (Eastern) dialect that does not have morphological lenition. However, a purely phonetic lenition occurs in fast speech for this speaker. A lenited realisation of /k/ can be observed in the word *$^{\acute{\mu}}$ŋáknɔ̀m* and in the preposition *kɛ̀* in the first sentence of the story. Note also that the nasal /ŋ/ is realised as [*ɰ*] in the words *$^{\acute{\mu}}$ŋáknɔ̀m* and *ŋṳ̀ɵːt* in sentences 1 and 8 of the story, respectively. I have not found this to be a regular phenomenon.

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(5) a. [**xə̤̆n ká̤ːbə̤** rǎːːn]

ɰə̤́n ká̤ːp-ə̤́ rāːːn

1SG catch.TR-1SG person

'I am catching the person.'

ɰə̤́n cə̤́ rāːːn **kə̤́ːp** **ɛ́** wɛ̀nɛ̄ → **[kə̤́ːb ə̀]**

1SG PFV.1SG person catch.TR.NF PREP here

'I was catching the person here.'

b. [**kǎ̤b** **lē̤j**]

kā̤p **lē̤j**

catch.IMPER animal

'Catch the animal!'

c. kɛ́n **kā̤ːp-kɛ̄** rāːːn → **[kā̤ːpkɛ̀]**

3PL catch.TR-3PL person

'They are catching the person.'

d. ɰə̤́n cə̤́ rāːːn **kə̤́ːp** → **[kə̤́ːp̚]**

1SG PFV.1SG person catch.TR.NF

'I was catching the person.'

The voicing alternation is morphologically conditioned. Specifically, the status of the consonant as either morpheme-initial versus final is important here. Example (6) shows that /k/ occurs in the intervocalic position in syllable onsets in the words *ɟɛ́ːk-ɛ̀* and *té̤t-nı̤̀-kə̤́*. Despite the phonologically identical environments, the intervocalic voicing occurs only in the morpheme-final position, but not suffix-initially.

(6) lə̀ːt̪ té̤t-nı̤̀-**k**ə̤́ ɟɛ́ː**k**-ɛ̀ → [té̤d.nı̤̄.**k**ə̤́ ɟɛ́ː.**g**ɛ̀]

dirt.SG hand.PL-OBL-PL.1SG.POSS be.bad.IN-3SG

'The dirt of my hands is bad.'

In fast speech there are also apparent exceptions to this generalisation, as is evident from the realisation of /k/ in the preposition *kɛ̀* as either [g] in (1a) or [ɰ] in (2d).

The behaviour of the dental plosive in the pre-pausal context provides another exception to the voicing generalisation. It can be realised as a voiced fricative [ð] when preceded by the short low vowel. This is shown by the example for 'cotton' in (7a). Furthermore, the voiced fricative can have a lateral release [ðˡ], as can be seen in another rendition of 'cotton' given under the consonantal chart. Compare this to the voiceless realisation with the nasal release when the dental plosive follows a high vowel in (7b). Voicing does not occur in the pre-pausal context when the preceding low vowel is overlong, as is seen from the example for 'plaster' *ɲā̤ːːt̪* [ɲā̤ːːθ] under the consonantal chart.

(7) a. [lâð]

ᴴᴸlát̪

'cotton'

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b. [kí̤t̪^{n}]
   kí̤t̪
   ‘traditional bag’

In addition, the following realisations have been attested in morpheme-final position: the dental plosive is realised as a voiced fricative [ð] intervocalically and as voiceless fricatives [θ] or [s] pre-pausally, as seen from the three repetitions of the word *mə̤̄ːːt̪* ‘slowly’ in (3c); and the alveolar plosive can be realised as an affricate [t͡ɕ] pre-pausally, as in the example *pá̤t* ‘clap’ under the consonantal chart.

Utterance and morpheme boundaries condition the realisation of the phoneme /r/. It tends to be realised as a trill utterance-initially or utterance-finally, i.e. under particularly strong prosodic strengthening conditions, although it can also be realised as a trill phrase-medially, as in the word *ráːr* ‘outside’ in (8a), and even at a morpheme boundary, as in the word *tárgjáw* in (1d) which literally translates as ‘shield turner’, consisting of *tár* ‘turn inside out’ and *gjáw* ‘shield’. Saying that, the medial context usually renders the realisation of the phoneme as a tap [ɾ], as can be seen from the word *tárgjáw* in (1a). In addition, the voiceless realisation [r̥] is attested morpheme-finally at the utterance boundary, as can be seen from the word *ráːr* in (8b).

(8) a. [**brāːmə̀** ɟɛ́ bɛ̄ kà̤m **râːr**]

bì̤	**rāːm-ɔ̀**	ɟɛ́	bɛ̄	kà̤m	**ráːr**
FUT	person-MED	3SG	FUT.3SG	remove.TR.NF	out

‘that person, he will remove...’

b.

cṳ́	ɛ́	kà̤m	**ráːr**	→	[**ráːr̥**]
COLL	3SG	remove.TR.NF	out		

‘... and [he] removed it.’

Consonantal clusters are rare in Nuer. They mostly occur when suffixal morphology is added to stems that end in a consonant. Both the stem-final and suffix-initial consonants are realised in such cases (e.g. in (5c)), with the exception of identical or homorganic consonants which do not geminate but are realised as a singleton consonant instead.[6] Other than at the morpheme boundaries, consonantal clusters can occur in fluent speech through deletion of the intervening vowels, as is exemplified by the realisation of *bì̤ rāːm-ɔ̀* in (8a).

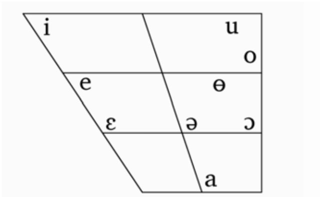
Vowel quality and voice quality

Nuer vowels contrast in terms of vowel quality and voice quality. Overall, there are twenty-two vowel phonemes in Nuer – fourteen monophthongs /i, i̤, e, e̤, ɛ, ə̤, a, a̤, ɔ, ɔ̤, ɵ, ɵ̤, o, ṳ/ and eight diphthongs /ie, i̤e̤, ea, e̤a̤, oɔ, o̤ɔ̤, ɔa, ɔ̤a̤/. Here I transcribe the vowels on the basis of their phonetic properties. In the recent literature on the South Sudanese Nuer dialects (Baerman, Monich & Reid 2019; Reid 2019; Bond et al. 2020; Monich 2020; Baerman & Monich 2021) these vowels are represented as /ɪ, i̤, e, e̤, ɛ, ʌ̤, a, a̤, ɔ, ɔ̤, o, o̤, ʊ, ṳ, ɪe, i̤e̤, ɛa, e̤a̤(ɛ̤a̤), ʊɔ, ṳɔ̤, ɔa, ɔ̤a̤/ based on their behaviour in morphophonology. Somewhat different vowel inventories are proposed for the Ethiopian Jikany Nuer (Faust

[6] Irina Monich (p.c.) notes that sequences of identical sonorant consonants can be realised either as geminates or as singletons depending on the rate of speech and deliberation. From my own observations, whereas the speakers would indeed have gemination in repetitions when asked to speak slowly, I have not noted any gemination in fluent speech.

& Grossman 2015; Faust 2017; Gjersøe 2019), most notably, the diphthongs /ea, e̤a̤(ɛ̤a̤)/ are not reported for this dialect.

The combinations of backness and height are shown in the Nuer vowel quadrilateral. Note that the symbol used to transcribe the phonetically central vowel [a̠] throughout this document is /a/.



The voice quality contrast is binary: vowels are either modal or breathy. The monophthongs and diphthongs are split into two equal sets of eleven phonemes: the modal vowels /i, e, ɛ, a, ɔ, ɵ, o, ie, ea, oɔ, ɔa/ and the breathy vowels /i̤, e̤, ə̤, a̤, ɔ̤, ɵ̤, ṳ, i̤e̤, e̤a̤, o̤ɔ̤, ɔ̤a̤/. Voice quality contrast does not occur for all vowel qualities. For example, the vowel /ɛ/ does not have a breathy counterpart, and the phoneme /ə̤/ does not have a modal counterpart. Because the vowel quality and voice quality are not symmetrical, both contrasts are treated together in this section.

The Nuer vowel phonemes are exemplified in (9). The breathy schwa /ə̤/ phoneme is a full vowel which, just like all other Nuer vowels, appears in three levels of vowel length. In addition, a schwa can occur as a result of vowel reduction (for example, in fast speech). The sentence in (1b) exemplifies this for a short suffix /-ɔ/ in *rāːm-ɔ̀* and for the copula ɛ̀.

(9)	/i/	tíːk [tîːk˺] 'necklace'	/i̤/	tī̤k [tī̤k˺] 'chin'
	/e/	téːt [têːt˺] 'hand'	/e̤/	té̤t [té̤t˺] 'hands'
	/ɛ/	tɛ̀ːt 'claimed back something'	/ə̤/	tə̤̄ːːt̪ [tə̤̌ːːθ] 'moulded'
	/a/	tāp [tāp˺] 'tobacco'	/a̤/	tā̤ːt 'be aroused'
	/ɔ/	tɔ́ːːj [tɔ̂ːːj] 'seeds of date tree'	/ɔ̤/	tɔ̤̄ːːj 'sleep'
	/ɵ/	$^{\acute{H}}$tɵ́ːːɲ [tɵ̂ːːɲ] 'of a pipe'	/ɵ̤/	$^{\acute{H}}$tɵ̤́ɲ 'pipe'
	/o/	tóːl [tôːl] 'smoke'	/ṳ/	tṳ́ːŋ 'horn'
	/ie/	tíeːːɰ [tîeːːɰ] 'of necklace‘	/i̤e̤/	tí̤e̤h 'chins'

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/ea/	tèa::	/e̤a̤/	té̤a̤::
	'dry branch'		'secret'
/ɔa/	tɔ̄a:j	/ɔ̤a̤/	tɔ̤̀a̤::j
	'seed of date tree'		'made someone sleep'
/oɔ/	tóɔ::l [tôɔ::l]	/o̤ɔ̤/	tò̤ɔ̤:t
	'of smoke'		'of young bull'

Diphthongs can be realised as monophthongs under various conditions (Reid 2019: 69–75). The resulting monophthong usually corresponds to the second component of the diphthong. This is particularly true of the diphthongs /oɔ, o̤ɔ̤/ preceded by labial consonants, as is shown by the realisation of *pò̤ɔ̤t* as [*pɔ̤̀d*] in (1c). Short diphthongs can be realised as monophthongs in fast speech, as is evident from the realisation of *kò̤ɔ̤l-ḭ́* as [*k͡xɔ̤̀lḭ́*] in (3b).

The remainder of this section deals separately with the monophthongs and diphthongs, respectively.

Monophthongs

An instrumental analysis of Nuer monophthongs was carried out to investigate vowel quality and voice quality. The data for the study came from two Nuer speakers: RNM – a female speaker of the Lou (Eastern) Nuer dialect, and PGM – a male speaker of the Western Nuer dialect.

The data set is exemplified by selected examples in (10). The full data set, supplemented by audio recordings, is available in the Appendix. All items were embedded in carrier sentences where the target word occurred in phrase-medial position. All vowels came from the verb stems shown in bold. Many of the items were near-minimal pairs. Note that in all examples, the High toneme with modal vowels is realised as a falling contour (as per section on tone); the preposition /ɛ/ is often realised as [ə] here and throughout the paper (as per section on vowel and voice quality).

(10)

ɟḭ́n	**tɛ́::t**-ḭ́	dwɔ̀::r	
2SG	claim.back.TR-2SG	thing	

'You are claiming back the thing.'

ɰə̤́n	**tē:t**-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	claim.back.AP-1SG	PREP	here

'I am claiming back here.'

ɟḭ́n	**tḛ̄:t**-ḭ́	ɛ́	wɛ̀nɛ̄
2SG	claim.back.AP-2SG	PREP	here

'You are claiming back here.'

The data added up to 151 items across the two speakers. Seventy-four items came from RNM and seventy-seven items from PGM. An item stands for an individual word; no repetitions were used in this study. Each phoneme occurred in between seven to fifteen items across the two speakers. Each speaker uttered between three to eight items for each vowel.

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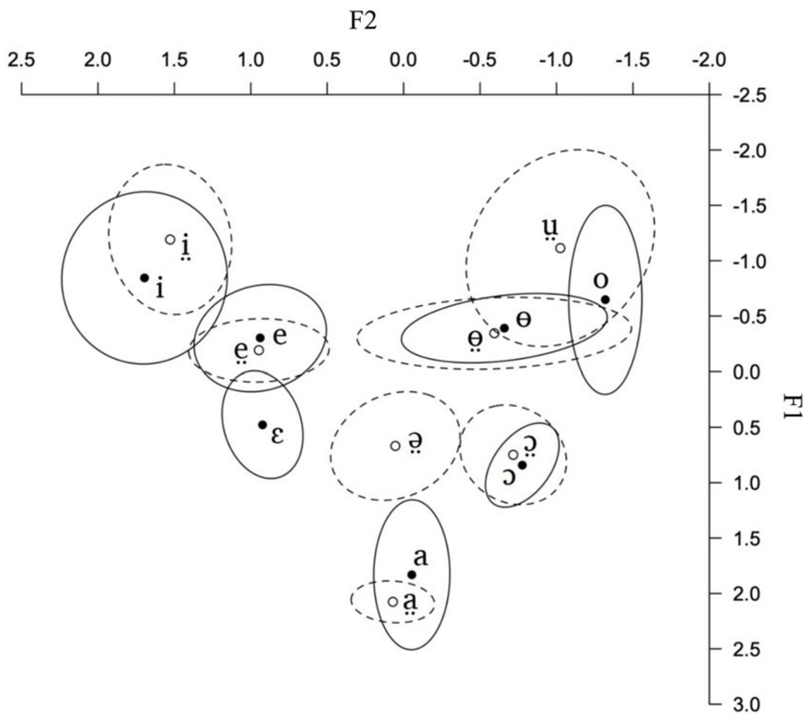

Figure 4. z-transformed F1 and F2 values for the fourteen Nuer monophthong vowel phonemes: means (dots) and one standard deviation around the mean (ellipses). Breathy vowels are marked by empty dots and interrupted line ellipses. Modal vowels are marked by filled dots and solid line ellipses. The data come from two speakers: a female speaker RNM (Lou, Eastern Nuer) and a male speaker PGM (Western Nuer).

The data was analysed using Praat software (Boersma & Weenink 2005). Vowel onsets and offsets were segmented in line with the segmentation guidelines in Turk, Nakai & Sugahara (2006) with one divergence: the burst phase of the voiceless stops was not included into the vowel portion.

In order to investigate the vowel quality contrast, the acoustic measurements of F1 and F2 were obtained and analysed. For the voice quality study, measurements of the energy distribution across the frequency range were obtained and analysed. I report the procedures and findings in turn, starting with the vowel quality study.

In processing the data for the vowel quality study, a Praat script (Remijsen 2015) was used to measure the first two formants (F1 and F2) of the target vowels at the temporal mid point. The formants for each file were also checked manually. R (R Core Team 2021) was used to process the data and the package phonR (McCloy 2016a,b) was used to plot the vowel charts. The measurements were z-transformed by speaker (Lobanov 1971) to normalise for between-speaker variation.

Figure 4 shows that there is a considerable overlap in the phonetic vowel quality between some of the vowel phonemes, as seen from the standard deviations. This is especially true for the pairs of vowels that differ with respect to voice quality (e.g. /e/ and /e̤/; /i/ and /i̤/, etc.). Vowels with the same voice quality do not tend to overlap in their formants. The exceptions are the vowels /o/ and /ɵ/, /i/ and /e/, /e/ and /ɛ/, and /ṳ/ and /ɵ̤/, all of which show some overlap in the formants, as is evident by considering their ellipses. These vowel pairs can sometimes be difficult to tell apart (at least for a non-native speaker).

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For the voice quality study, a range of measurements of energy distribution across the frequency range were made. Here I report the results for two of them: Cepstral Peak Prominence (CPP) and Spectral Emphasis (SE) (Traunmüller & Eriksson 2000).

The CPP measure – a measure of dysphonia – measures the difference in the amplitude between the harmonic and inharmonic components of the source spectrum (Garellek 2019: 84). This measure is employed to differentiate between the modal and non-modal voice qualities since the breathy and creaky phonation types are expected to have a smaller difference between harmonic and inharmonic components than the modal phonation. Thus, the CPP measure is expected to be higher with modal vowels than with breathy and creaky vowels.

The SE measure was chosen over other spectral tilt measures (e.g. H1–H2, H2–H4, etc.) on the basis of the linear discriminant analysis (Garellek 2020) according to which the SE measure has the highest correlation ($r = -1.2$) out of all measures used (of which the next highest were H1*–A2* $r = 0.26$, and H2*–H4* $r = 0.09$). The SE measure was also shown to be the most reliable spectral tilt measure for another West Nilotic language, Shilluk (Remijsen, Ayoker & Mills 2011).

The SE reflects the relative contribution of the energy in the high frequency band (above 1.5 times the fundamental frequency) to the overall intensity (Traunmüller & Eriksson 2000; Remijsen et al. 2011). It is expected that the non-breathy vowels will have more energy in the higher frequency band than the breathy vowels, and thus we expect higher values for the non-breathy vowels and lower values for the breathy vowels according to this measure.

In sum, the CPP measure indicates the contrast between the modal and non-modal phonation types; the SE measure indicates the contrast between breathy and non-breathy phonation types. Taken together, these measures can be used to disambiguate modal and creaky voice qualities.

The measurements for the voice quality study were made using Praat scripts. CPP was measured by a script provided as part of Praatsauce (Kirby 2018), which is based on the suite of scripts by Mills (2010). The SE measure was calculated using an implementation of a procedure within the same suite of scripts by Mills (2010). The measurements were taken from the middle of the segmented vowel portion.

The measurements were analysed and graphically represented in R (R Core Team 2021) using the tidyverse package (Wickham et al. 2019). In order to normalise for between-speaker variation, the measurements were z-transformed. For the CPP measure, the non-normalised results were used.

The results for the CPP measure are shown in Figure 5. The means for the perceptually breathy vowels are consistently lower than for the corresponding modal vowels. At the same time, there is a lot of overlap in the standard deviations for all of the vowel pairs, suggesting the absence of contrast according to this measure. Because CPP differentiates between the modal and non-modal phonation types, the absence of contrast in Figure 5 may indicate that there are no phonetically modal vowels in Nuer. Alternatively, the breathy tokens might not be very noisy (i.e. more ‘slack’), and this could make them look similar to modal vowels in terms of their noise profile.

Figure 6 shows the means and standard deviations for the SE measure. The vowels /i, e, ɛ, a, ɔ, ɵ, o/ have higher means than the vowels /i̤, e̤, ə̤, a̤, ɔ̤, ɵ̤, ṳ/. This supports the perceived voice quality contrast between the two vowel sets, with the latter set being more breathy than the former set.

With the exception of the two vowel pairs (/i/ and /i̤/, and /ɔ/ and /ɔ̤/) for which some overlap in the standard deviations is found, the vowel pairs with the same vowel quality do not show any overlap. This constitutes the evidence that the voice quality contrast in Nuer is categorical.

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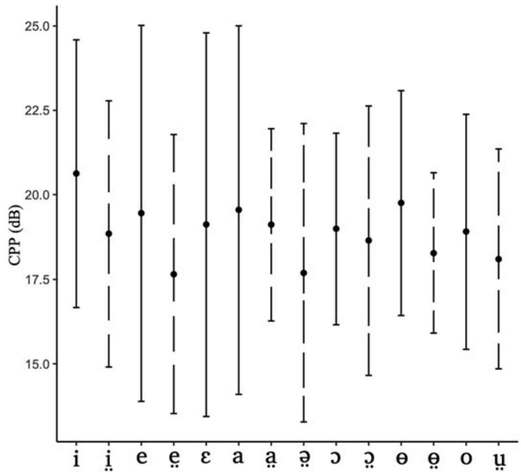

Figure 5. Cepstral Peak Prominence (CPP) measure (a measure of harmonics-to-noise ratio) showing results for the fourteen Nuer monophthong vowel phonemes: means (dots) and one standard deviation around the mean (wickers). Solid line – modal vowels, dashed line – breathy vowels. The data come from two speakers: a female speaker RNM (Lou, Eastern Nuer) and a male speaker PGM (Western Nuer).

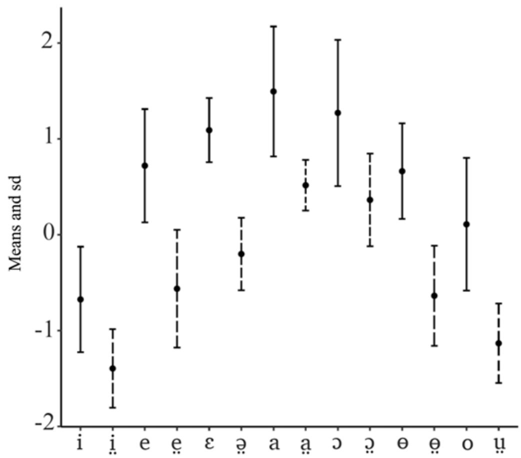

Figure 6. z-transformed spectral emphasis values (dB) showing results for the fourteen Nuer monophthong vowel phonemes: means (dots) and one standard deviation around the mean (wickers). Solid line – modal vowels, dashed line – breathy vowels. The data come from two speakers: a female speaker RNM (Lou, Eastern Nuer) and a male speaker PGM (Western Nuer).

A configuration where (i) the noise component in the spectra is about the same as with the breathy phonation (as is evident by the CPP results), and (ii) the energy in the higher frequency band is greater than with the breathy phonation (as is evident by SE) is indicative of the creaky phonation type (Garellek 2019: 90). Therefore, I conclude that, on the basis of the data from two Nuer speakers, the vowels that fall into the modal category in Nuer are phonetically creaky.[7]

[7] Perceptual creakiness of the non-breathy vowels has also been reported for the closely related languages Dinka (Andersen 1987) and Reel (Reid 2010).

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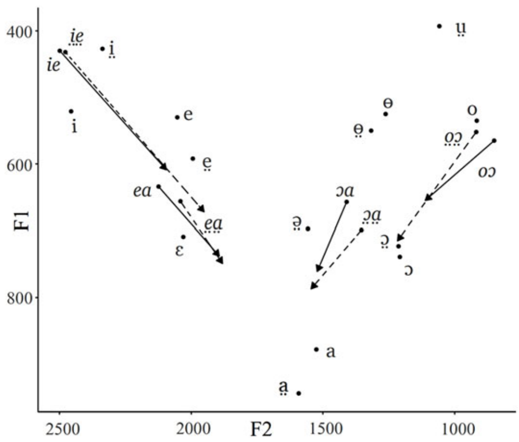

Figure 7. Formant trajectories of the Nuer diphthongs. Data from a female speaker RNM (Lou, Eastern Nuer). Diphthongs (in italics) are shown as trajectories with means corresponding to the first component represented as dots, and means corresponding to the second component as arrow heads. Solid line – modal diphthongs, dashed line – breathy diphthongs. The non-normalised means for the monophthongs for RNM are presented as dots for reference and signposted with the non-italicised vowel graphemes.

Diphthongs

The eight Nuer diphthongs /ie, i̤e̤, ea, e̤a̤, oɔ, o̤ɔ̤, ɔa, ɔ̤a̤/ are all opening diphthongs, with the second element of a diphthong being more open than the first element. Both components of any given diphthong are of roughly equal duration and have the same voice quality.

Nuer diphthongs were measured to study vowel quality. The data was obtained from a single speaker RNM who speaks the Lou (Eastern) Nuer dialect. For each diphthong, seven different words (items) were recorded. The total number of items for all diphthongs was thus fifty-six. The recording and segmentation procedure for diphthongs was the same as for the monophthongs (described above). A Praat script (Remijsen 2015) was used to measure the first two formants (F1 and F2). The values for F1 and F2 of a diphthong were obtained at 25 per cent and at 75 per cent into the vowel following the procedure outlined in Reid (2010: 60–62). The results were processed and represented in R (R Core Team 2021) using the R package tidyverse (Wickham et al. 2019) following the procedure outlined in Stanley (2018).

Figure 7 presents mean diphthong trajectories for the eight Nuer diphthongs together with the means for the Nuer monophthongs. Because the data for diphthongs come from the speaker RNM, the means for the monophthongs plotted in Figure 7 are the non-normalised values for this speaker alone.

Figure 7 shows that some of the diphthongs start and end around the mean points for the corresponding monophthongs, whilst others do not. Specifically, the diphthongs that end in the low vowels have higher F1 than the monophthongs /a, a̤/. In addition, the first components of the diphthongs /ɔa/ and /ɔ̤a̤/ are more centralised than the monophthongs /ɔ, ɔ̤/.

The modal and breathy diphthongs /oɔ/ and /o̤ɔ̤/ have the same vowel quality. In particular, the formants of the first component correspond to the formants of the monophthong /o/. I represent these diphthongs uniformly as containing the high-mid vowel, in spite of the fact that there is no corresponding breathy monophthong */o̤/ in the language.

The transcription of the diphthongs that start or end in the front mid vowels requires some justification. Figure 4, which presents means and standard deviations around the mean for the Nuer monophthongs, shows that there is some overlap in the formants of the monophthongs /e̤/, /e/ and /ɛ/. The four Nuer diphthongs containing the mid front vowel /ie, i̤e̤/ and /ea, e̤a̤/ start and end, respectively, within the range of that overlap. For the sake of uniformity, I represent them as containing the vowels /e/ and /e̤/ notwithstanding the fact that the modal /e/ monophthong has a somewhat higher F1 mean.

The above observations show that, unlike the monophthongs, the diphthongs involve only three levels of height – high, mid and low.

Vowel length

The Nuer vowels come in three degrees of vowel length: short (e.g. /i/, /ie/), long (e.g. /iː/, /ieː/) and overlong (e.g. /iːː/, /ieːː/).[8] This contrast is phonemic in Nuer and the distinction is found in monophthongs (11) and diphthongs (12) alike. The two components of the diphthongs are roughly of equal duration.

(11) a. ɰ̤ə̤́n cə̤́ rāːːn **lèp** báːp
1SG PFV.1SG person open.APPL.NF door
'I was opening the door for the person.'

tì̤rí̤ kɛ̀ **lēːp** tì̤ gɔ̀ːw
DEM.PL.PROX COP.PL tongue.PL REL.PL good.PL
'These are good tongues.'

kɔ̄n cákɔ̀ nāːːt̪ **lēːːp** bāːp-ní̤
1PL PFV.1PL people open.MUL.APPL.NF door-PL
'We were opening doors for people (many times).'

b. kɔ̄n **tə̤́t̪** kɔ̄n
1PL mould.AP.FIN 1PL
'We are moulding.'

kɔ̄n cákɔ̀ $^{\acute{\mu}}$dā̤ːːr-í̤ **tə̤́ːt̪** ɛ́ wɛ̀nɛ̄
1PL PFV.1PL pot-PL mould.TR.NF PREP here
'We were moulding the pots here.'

ɟɛ̄n cɛ̀ **tə̤̄ːːt̪** ɛ́ wɛ̀nɛ̄
3SG PFV.3SG mould.AP.NF PREP here
'S/he was moulding here.'

[8] Studies by Baerman et al. (2019), Reid (2019), Bond et al. (2020), Monich (2020), Baerman & Monich (2021) represent the vowel length by adding extra graphemes as follows: short /ɔ, ɔa/, long /ɔɔ, ɔaa/, and overlong /ɔɔɔ, ɔaaa/. Gjersøe (2019) represents the three-way vowel length contrast as short /ɔ/, half-long /ɔˑ/, and long /ɔː/.

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(12)

ɰə̤́n	cə̤́	rāːːn	**pì̤e̤m**	bɵ́ːl
1SG	PFV.1SG	person	serve.punches.APPL.NF	Bool

'I was punching Bool for the person.'

ɰə̤́n	cə̤́	**pī̤e̤ːm**	ɛ́	wɛ̀nɛ̄
1SG	PFV.1SG	serve.punches.AP.NF	PREP	here

'I was serving punches here.'

ɰə̤́n	cáːːr-ə̤̀	**pī̤e̤ːːm**	ɛ́	wɛ̀nɛ̄
1SG	think.about.TR-1SG	serve.punches.VN.PL	PREP	here

'I am thinking about serving punches here.'

The durations of the monophthongs and diphthongs were subject to an instrumental study. The dataset came from RNM (Lou, Eastern Nuer). It was recorded, segmented and processed using the same procedure as in the study of vowel quality. Vowel durations were obtained from the stem syllables of disyllabic (stem+suffix) finite verbs, presented in bold in (13). All the words occurred in sentence-medial context. The measured data included both monophthongs and diphthongs.

(13) a. Short vowels

ɰə̤́n	**bīl**-ə̤́	dwɔ̀ːːr
1SG	taste.TR-1SG	thing

'I am tasting the thing.'

ɰə̤́n	**māt**-ə̤́	nàːːt̪
1SG	unite.TR-1SG	people

'I am uniting people.'

ɰə̤́n	**ŋām**-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	yawn.IN-1SG	PREP	here

'I am yawning here.'

ɰə̤́n	**dōɔl**-ə̤́	nàːːt̪	kɛ̀ːːl
1SG	bring.together.TR-1SG	people	together

'I am bringing people together.'

b. Long vowels

ɰə̤́n	**tɵ̀ːl**-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	break.AP-1SG	PREP	here

'I am breaking here (of maize or long straw-like objects).'

ɰə̤́n	**níeːn**-ə̤́	ɛ́	wɛ̀n̄ɛ
1SG	sleep.IN-1SG	PREP	here

'I am sleeping here.'

c. Overlong vowels

ɰə̤́n	**ŋá̤**ːː**m**-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	yawn.MUL.IN-1SG	PREP	here

‘I am yawning repeatedly here.’

ɰə̤́n	**dīe**ːː**r**-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	worry.IN-1SG	PREP	here

‘I am worrying here.’

Table 2 and Figure 8 present the descriptive statistics for duration of short, long and overlong monophthongs and diphthongs. The means and the standard deviations are well separated for the vowels of the same type, i.e. comparing separately the durations of monophthongs and that of diphthongs. Diphthongs are on average longer than the monophthongs of the corresponding vowel length, so that shorter diphthongs are about as long as the longer monophthongs.

Vowel durations can vary as a function of vowel quality with the high vowels having shorter durations than the non-high vowels (e.g. the vowel /i/ in the stem syllable of ‘taste’ in (13a) is 81 ms and the vowel /a/ in the stem syllable of ‘unite’ in (13a) is 104 ms).

Vowel durations can also vary as a function of context. Vowels are longer in phrase-final position (or in words uttered in isolation) than in phrase-medial position due to phrase-final lengthening (Reid 2019: 49).

Tone

Nuer is a tonal language. Word-level stress is not attested in Nuer.

There are three tonemes in the South Sudanese Nuer dialects: High, Mid and Low (Reid 2019).[9] The tonemes have a variety of phonetic realisations as a function of syllable properties. The realisation of the tonemes is primarily conditioned by the voice quality of the vowel and, to a lesser extent, by vowel length (Reid 2019; Monich 2020).

With respect to voice quality, the realisation of the High and the Mid tonemes appears to serve as one of the perceptual cues of the phonation contrast. This is exemplified in Figure 9 which shows the realisation of the three tonemes on the modal (Panel A) and breathy (Panel B) vowels. The data set for Figure 9 came from a near-minimal set for tone. The tonemes occur in the initial syllables of disyllabic verbs embedded into carrier sentences. The data come from a speaker RNM (Lou, Eastern Nuer); each sentence was uttered once. The f0 from the initial syllable was measured and time-normalised using a Praat script (Remijsen 2004), and plotted in R (R Core Team 2021) using the package tidyverse (Wickham et al. 2019).

Figure 9 shows that the High toneme (black lines) is realised with a falling trajectory in a syllable with the modal vowel (Panel A) and as level high in a syllable with the breathy vowel (Panel B). The Mid toneme (grey lines) is realised as mid level with the modal vowel (Panel A) and as a rise with the breathy vowel (Panel B). The Low toneme (light grey lines) has a uniform low level realisation with both phonation categories, although the f0 is relatively higher with the modal vowel (Panel A) than with the breathy vowel (Panel B).[10]

[9] See also Monich (2020) who postulates a system of High, Low and Rise for the South Sudanese dialects; and Gjersøe (2019) for a description of the Ethiopian Jikany dialect with a four-toneme inventory: High, Fall, Mid and Low.

[10] F0 traces presented in Figure 9 correspond to the results of an instrumental study by Gjersøe (2019: 55–56) based on the data from six native speakers of the Ethiopian Jikany dialect, and by Monich (2020) who shows f0 traces in disyllabic words based on the data from speakers of the South Sudanese Nuer dialects.

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Table 2 Summary of duration measurements. Nuer monophthongs and diphthongs as spoken by RNM – a female speaker of Lou (Eastern) Nuer dialect.

	Monophthongs			Diphthongs		
Vowel length	Means (ms)	sd (ms)	Number of items	Means (ms)	sd (ms)	Number of items
Short	90	14	29	119	16	14
Long	137	10	22	169	12	11
Overlong	177	15	16	216.5	17	14

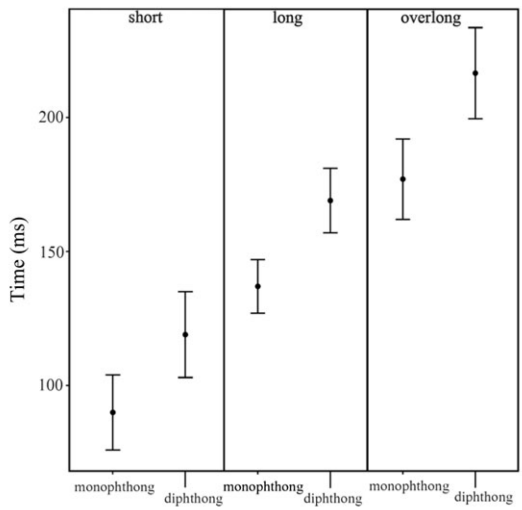

Figure 8. Duration measurements showing means and standard deviations (one sd around the mean) for short, long and overlong monophthongs and diphthongs in Nuer. Data came from stem syllables of disyllabic verbs in phrase-medial context uttered by RNM – a female speaker of Lou (Eastern) Nuer dialect.

The difference in the realisation of the High and Mid tonemes over vowels that differ in phonation type is akin to the contrast observed in the voice register languages (e.g. Henderson 1952; Huffman 1976; Wayland 1997; Tạ, Brunelle & Nguyễn 2019; Brunelle & Kirby 2016). There is, however, an important difference: the breathy phonation in Nuer is associated with the relatively higher pitch compared to the modal phonation. This is the opposite of what occurs in the voice register languages where the breathy phonation is associated with the relatively lower pitch than the modal phonation.

Within the same voice quality category, the Nuer tonemes can have a nearly identical f0 height in certain contexts, which often makes it difficult to tell them apart (at least for a non-native speaker). This is true of the Mid and Low tonemes in syllables with modal vowels and of the Mid and High tonemes in syllables with breathy vowels. The contrast in f0 height between the Mid and Low tonemes with the modal vowels is often small. Reid (2019: 143–144) reports a 15Hz difference between the levels of the Mid and the Low tonemes. The overlap in the realisations of the Mid and the High tonemes in syllables with breathy vowels is illustrated in Figure 10 where the target Mid is represented by a dashed line and the target High is represented by a solid line. As with the previous examples, the data comes from disyllabic words (verb stem+suffix); both sentences were uttered once by three speakers of

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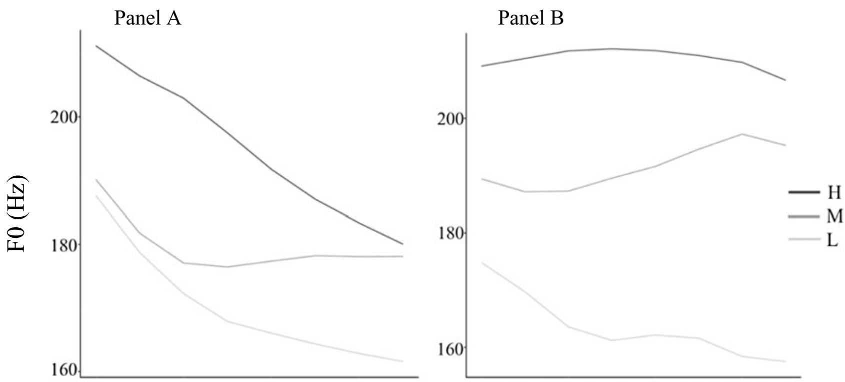

	[**mê.**də̤̀]		*(black line)*
ɯə̤́n	**mét**-ə̤́	rāːːn	dwɔ̀ːːr
1SG	taste.APPL-1SG	person	thing

‘I am tasting the thing for the person.’

	[**mé̤.**dì̤]		*(black line)*
ɟí̤n	**mé̤t**-í̤	rāːːn	dwɔ̀ːːr
2SG	taste.APPL-2SG	person	thing

‘You are tasting the thing for the person.’

	[**mē**ː**.**də̤́]	*(grey line)*
ɯə̤́n	**mē**ːt-ə̤́	ŋwàːːní̤
1SG	taste.MUL.TR-1SG.	thing.PL

‘I am tasting things (many times).’

	[**mě̤**ː**.**dí̤]	*(grey line)*
ɟí̤n	**mē̤**ːt-í̤	ŋwàːːní̤
2SG	taste.MUL.TR-2SG	thing.PL

‘You are tasting things (many times).’

	[**mè**ː**.**də̤́]		*(light grey line)*
ɯə̤́n	**mè**ːt-ə̤́	ɛ́	wɛ̀nɛ̄
1SG	taste.AP-1SG	PREP	here

‘I am tasting here.’

	[**mè̤**ː**.**dí̤]		*(light grey line)*
ɟí̤n	**mè̤**ːt-í̤	ɛ́	wɛ̀nɛ̄
2SG	taste.AP-2SG	PREP	here

‘You are tasting here.’

Figure 9. Normalised f0 patterns in syllables with modal vowels (Panel A) and breathy vowels (Panel B). High – black line; Mid – grey line; Low – light grey line.

Nuer: a speaker of the Lou dialect RNM, a speaker of the Western dialect PGM, and a speaker of the Nasir Jikany dialect JKG. The target tone occurs in the first syllable to the left of the vertical line, and the second syllable occurs after the vertical line. Figure 10 shows that the two tonemes in the first syllable (before the vertical line) start off and end at about the same f0 level. The main difference is in the alignment: the Mid tone (dashed line) is realised as a rise, and the High tone (solid line) is level high for most of the portion of the syllable. The underlying High tone in the suffixes (after the vertical line), however, is saliently different: it is level high after the Mid (dashed line), and it has a falling f0 after the High (solid line).[11] In this case, the difference in the f0 alignment in the first syllable is less salient than the difference in the suffix. As such, tone in the suffix can be used as a diagnostic of the tone in the stem syllable.

Vowel length can also be a factor that affects the realisation of the tonemes. For example, the realisation of the Mid and High tonemes over breathy vowels can differ depending on vowel length. The rising realisation tends to occur more frequently with long and overlong vowels than with short vowels. With short modal vowels, the High toneme can have a level

[11] The suffix in both verb forms in Figure 10 is analysed as High-toned underlyingly but is subject to a dissimilatory lowering process that occurs in this environment and that turns the High into a Low tone following another High, but not following a Mid (or Low) tonemes (Reid 2019: 152; Reid 2021a). In Figure 10 then, there is a High stem followed by a Low suffix (solid line) and a Mid stem followed by a High suffix (dashed line). A different analysis has been proposed by Gjersøe (2019) and by Monich (2021) who treat the suffixes as toneless underlyingly and subject to polar tone assignment that depends on the tone in the preceding syllable. Because in Nuer dissimilatory lowering occurs across several contexts, it is favoured as an explanation of the behaviour of the suffixes in Figure 10 for reasons of parsimony.

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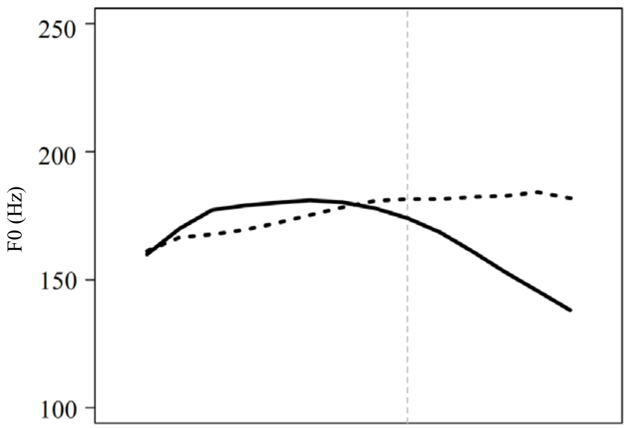
Table 3 Variation in the realisation of the tonemes as a function of voice quality and vowel length in stem syllables of disyllabic verbs, where the stem vowel is preceded and followed by a plosive.

Underlying toneme		Phonetic realisation Short vowel V	 Long vowel Vː	 Overlong vowel Vːː
High	Breathy vowel	high [H]	high [H] rising [LH]	
	Modal vowel	falling [HL] high [H]	falling [HL]	
Mid	Breathy vowel	rising [LH] relatively high mid [M] high [H]		
	Modal vowel	relatively low mid [M]		
Low	Breathy vowel	low [L]		
	Modal vowel			



[gɔ̤́ːːrɪ̤̀] (solid line)
ɟɪ̤́n gɔ̤́ːːr-ɪ̤́ bōk
2SG write.TR-2SG book
'You are writing a book.'

[gɔ̤̌ːrɪ̤́] (dashed line)
ɟɪ̤́n gɔ̤̄ːr-ɪ̤́ ɛ́ wɛ̀nɛ̄
2SG write.AP-2SG PREP here
'You are writing here.'

Figure 10. The normalised f0 tracks showing the realisation of the High and Mid tonemes in stems of dissyllabic words. The target syllable (verb stem) occurs before the vertical line. High stem – solid line, Mid stem – dashed line. Data from three speakers: a female speaker RNM (Lou, Eastern Nuer) and two male speakers PGM (Western Nuer) and JKG (Nasir Jikany, Eastern Nuer). Each sentence was uttered once.

high realisation in addition to a more-common falling realisation. These observations are especially relevant in instances where short vowels are preceded and followed by plosives. The sensitivity of contours to vowel length is likely to be due to timing pressure. With short vowels there is less time for a contour to get realised compared to longer vowels.

Table 3 provides a summary of the realisations of the three Nuer tonemes in different syllable-internal environments, taking into account voice quality and vowel length. The

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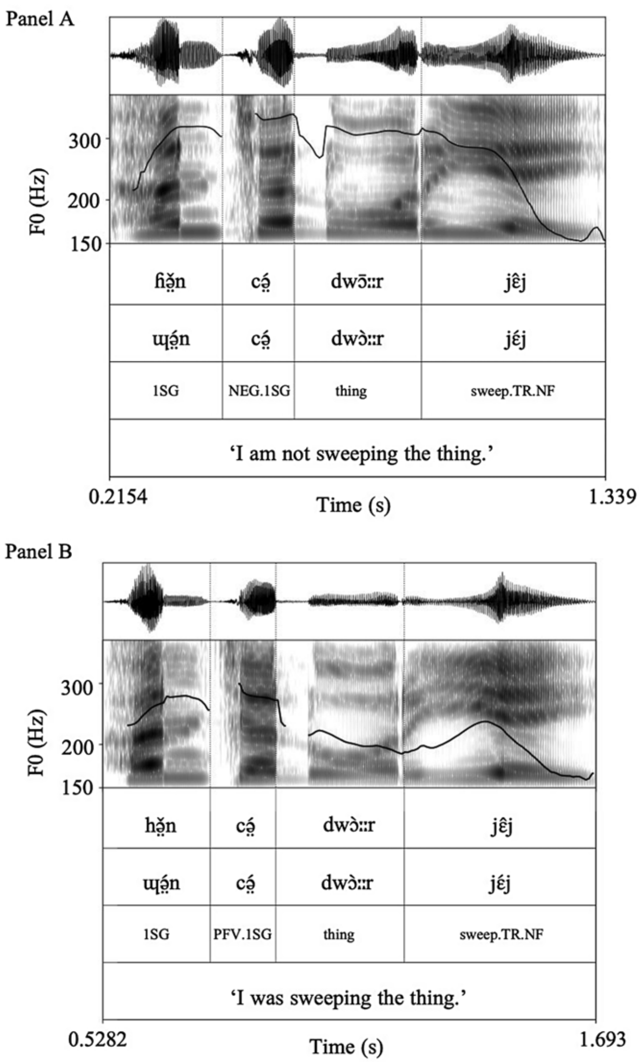

Figure 11. Register expansion exemplified in the negated sentence in Panel A compared to the segmentally identical declarative sentence in Panel B. Annotation tiers from top down: phonetic, phonemic, gloss, translation.

data is based on the realisation of tone in the first syllable of dissyllabic verbs embedded into the carrier phrase, like that presented in e.g. Figure 10.

The realisation of the three tonemes can further vary as a function of neighbouring tone and presence/absence of phrasal boundaries, see Gjersøe (2019), Reid (2019), and Monich (2020) for details.

Register expansion

Certain constructions in Nuer have a higher declination reset. Figure 11 exemplifies the negative (Panel A) and the declarative (Panel B) sentences. These sentences have identical segmental shape but differ in terms of f0. The f0 over the negative auxiliary verb in Panel A

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is around 63Hz higher than it is over the perfective auxiliary in Panel B. The effect is also observed on the following noun. It is realised with the higher f0 in Panel A than in Panel B. (The phonetic transcription for the noun in Panel A of Figure 11 shows it as mid toned [dwɔ̄::r] despite its f0 being relatively high. This is to contrast it with the realisation of the underlying High toneme which, in this context, would have f0 as high or higher than the f0 on the preceding auxiliary). The overall impression is that the negated sentence has higher f0 than the declarative sentence. This phenomenon has been referred to as 'tone raising' by Koang Nyang (2013: 64) and as 'register expansion' by Gjersøe (2019: 46).

Syllable structure

The segmental templates attested in Nuer are given in (14). Example (14a) presents the syllable structure in content words. The syllables invariably consist of an initial consonant which can be followed by one of the two glides /j/ or /w/. The vowel can be short, long or overlong and there is usually a final consonant. The syllable structure of suffixes and function words is presented in (14b). These can have an obligatory short vowel, as well as optional initial and final consonants between which there can be either a short or a long vowel.

(14) a. syllable structure in content words: C(w/j)V(:)(:)(C)

b. syllable structure in suffixes and function words: (C)V(:)(C)

examples of suffixes and function words (in bold)

ɟɛ̄n	cwḛ̄:l-ɛ́	ɛ́	wɛ̀nɛ̄
3SG	squat.IN-3SG	PREP	here

'S/he is squatting here.'

wə̤̄::r-**ḭ́** → wə̤̄::.**rḭ́**

night-PL

'nights'

ṯə̤̄::-**dɛ̀**

bull-SG.3SG.POSS

'His bull'

d̪ò̤:r-**kṳ́n**

home.PL-PL.2PL.POSS

'Your (pl.) homes'

d̪ò̤:r-**kɔ́:n**

home.PL-PL.1PL.INCL.POSS

'Our (incl.) homes'

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If a monosyllabic content word has an open syllable, the vowel is minimally long. Thus, the minimal shape of a Nuer content word can be either CVː, as in (15a) or CVC, as in (15b). The maximal shape of a monosyllabic content word is C(w/j)VːːC, as in (15c). Monosyllabic function words, by contrast, often have short vowels, as in (16a–b), and never overlong vowels. Thus, their minimal shape is V and the maximal shape is CVːC, as in (16c).

(15) a. CVː

ɟɛ̄n	ríːŋ-ɛ́	**lé̤a̤**ː	ɛ́	wɛ̀nɛ̄
3SG	run.IN-3SG	animal.OBL	PREP	here

'S/he is running to the animal here.'

b. CVC

gàt
'child'

c. CwVːːC

ɟɛ̄n	cɛ̀	ŋwàːːní̤	**kwēːːt**
3SG	PFV.3SG	thing.PL	kick.MUL.TR.NF

'S/he is/was kicking things (many times).'

(16) a. V

gwá̤ːt̪	ɛ̀	**cɛ̀**	**ɛ́**	ɲɔ́k	**ì̤**
time	COP	PFV.3SG	3SG.OBJ	do.again.NF	COMP

pṳ́t-dɛ̀	**ɛ̀**	lɔ̤́ŋ
blow.SG-SG.3SG.POSS	PREP	well

bì̤	rāːm-ɔ̀	ŋṳ̀e̤ːt
FUT	person-MED	be.determined.NF

'The more the wind blew, the more determined the person...'

b. CV

ɰɔ̤́n	**cɔ̤́**	**ɟɛ̀**	cāːr
1SG	PFV.1SG	3SG.OBJ	think.about.TR.NF

'I thought about it'.

c. CVːC

kɔ́ːn
1PL.INCL

The North Wind and the Sun

(The story was narrated by JKG – a speaker of Jikany Nasir (Eastern Nuer) dialect. The Nuer orthography was provided by the same speaker.)

1.

Targɛw kɛnɛ Cäŋ cikɛ tekɛ ŋaknɔm, *(Nuer orthography)*

tárgjâw ɰɛ́nɛ̀ çá̤̤ŋ || ɕíkɛ̀ té gɛ̄ː ɰáᶭnɔ̀m | **(phonetic transcription)**

tárgjáw kɛ́nɛ̀ cɔ̤́ŋ || cí̤-kɛ̀ té̤ kɛ̀ ᴴ́ŋáknɔ̀m | (phonemic transcription)

The North Wind (lit. fence turner) and the Sun were arguing. (English translation)

2.

kä niɛ gua̱a̱th ɛ tekɛ ŋaknəm thi̱n, cu ramɔ cɛ jɛ lar i̱ bum ni ɣän kä ji̱, cu ramɔ wä bum ni ɣän kä ji̱.

kə̤́ njɛ̂ gwá̤ːð ɛ̀ tḛ́ ɯɛ̄ː ŋáŋnɔ̀m t̪͡θḭ́n || çṳ́ rāːmə̀ jə̀ lăːr bṳ́m nḛ̄ ɯə̤̀n kə̤̀ ɟɪ̤̀ | ɕṳ́ rāːmɔ̀ wə̤́ː bṳ́m nḛ̄ ɯə̤̀n kə̤̀ ɟ͡ʑɪ̤̀ ||

kə̤́ njɛ́ gwá̤ːt̪ ɛ̀ tḛ́ kɛ̀ ᴴŋáknɔ̀m t̪ḭ́n || cṳ́ rāːm-ɔ̀ ɛ̀ láːr bṳ́m nɪ̤̄ ɯə̤́n kə̤́ ɟɪ̤̄ | cṳ́ rāːm-ɔ̀ wə̤́ bṳ́m nɪ̤̄ ɯə̤́n kə̤́ ɟɪ̤̄ ||

As they were arguing, one of them said: “I am stronger than you”, and the other said: “I am stronger than you”.

3.

Kä cuɛ tekɛ jääl mi jäl mi te bi̱i̱ ko̱cdɛ kiɛ köt, tëë puo̱nydɛ kumɛ rɔ jɛ, kɛ ɣöö ɣɔw ko̱c ɛ.

kə̤́ çwə̀ tḛ́ gɛ̀ ɟ͡ʑə̤́ːːl mḛ̀ ɟ͡ʑə̤́l | mḛ̀ tḛ́ bɪ̤̄ə kɔ̤́c̄dɛ̀ || kîeː kôt tềː pɔ̤́ːɲdɛ̀ || kṳ́mɛ̀ rɔ̀ ɟɛ́ kɛ̀ ɯɵ̀ː ɔ̄w kɔ̤́ɟɛ̀ ||

kə̤́ cṳ́ ɛ̀ tḛ́ kɛ̀ ɟə̤́ːːl mɪ̤̀ ɟə̤́l | mḭ́ tḛ́ ᴴbɪ̤ːj kɔ̤́c-dɛ̀ || kíeː kɵ́t té ɛ̀ pɔ̤́ɔ̤ːɲ-dɛ̀ || kṳ́m-ɛ́ rɔ̀ ɟɛ́ kɛ̀ ɯɵ̀ːːw ɯɔ̄w kɔ̤́c-ɛ́ ||

There was a traveller travellingin a cloak (lit. cloth for his cold) wrapped around him because it was cold.

4.

Ci Targɛw ɛ lat ɛ ɣöö mi wa̱a̱ puo̱t ɛlo̱ŋ ɛn bi̱i̱ ɛmɔ, bi ramɔ jɛ bɛ ka̱m raar, kɛ buo̱mdä ɣän Targɛw.

ɕḭ̀ tárgjâw ɛ̀ lāt ɛ̀ ɯɵ̀ːːʷ | mḭ́ wà̤ː pɔ̤̀r ɛ̀ lɔ̤́ŋ || ɛ́n bḭ̀ː ɛ́mɔ̀ː || brāːmə̀ ɟɛ́ bɛ̄ kà̤m râːr || kɛ̀ bɔ̤̀ːmdə̤́ | ɦə̤́n târgjàw ||

cḭ̀ tárgjáw ɛ̀ lāt ɛ̀ ɯɵ̀ːːw | mḭ́ wà̤ː pɔ̤̀ɔ̤t ɛ̀ lɔ̤́ŋ || ɛ́n ᴴbɪ̤̀ːj ɛ́mɔ̀ || bɪ̤̀ rāːm-ɔ̀ ɟɛ́ bɛ̄ kà̤m ráːr || kɛ̀ bɔ̤̀ɔ̤ːm-də̤́ | ɯə̤́n tárgjáw ||

The North Wind said: “If I blow hard on (his) cloak, that person will take it off, because of my strength, me the North Wind”.

5.

Ca jiök ɣo̱o̱, wër Targɛw.

cāː ɟjɵ̂ː ɯɔ̤̀ː ə̀ wér târgjàw ||

càː ɛ́ ɟjɵ̄ː ɯɔ̤̀ː wér tárgjáw ||

And he was told: “Ok North Wind, go!”.

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6.

Gua̲a̲th ëë ci Targɛw wä puo̲tdɛ,

gwă̤ːð ē ɟi̤ târgjâw wă̤ː pṳ́dɛ̀ ||

gwá̤ːt̪ (m)ēː cì̤ tárgjáw wā̤ː pṳ́t-ɛ́ ||

Then the North Wind started blowing.

7.

mi cɛ puo̲t ɛlo̲ŋ bi ramɔ kuo̲li bi̲i̲dɛ, bɛ wä mi kuɛ kuo̲li bi̲i̲dɛ puo̲nydɛ.

í̤ c͡ɕɛɛ̀ pɔ̤̀d ɛ̀ lɔ̤́ŋ | brāːmɔ̀ k͡xɔ̤̀lí̤ bì̤ːd͡ʑɛ̀ | bɔ̀ wā̤ mɔ́ kwɔ̂ | kɔ̤̀lé̤ bì̤ːɾɛ̀ pɔ̤́ːɲdɛ̀||

mí̤ cɛ̀ pɔ̤̀ɔ̤t ɛ̀ lɔ̤́ŋ | bì̤ rāːm-ɔ̀ kɔ̤̀ɔ̤l-í̤ $^{\mu}$bì̤ː-dɛ̀ | bɛ̀ wɔ̤́ mí̤ kṳ́ ɛ̀ | kɔ̤̀ɔ̤l-í̤ $^{\mu}$bì̤ː-dɛ̀ pɔ̤́ɔ̤ːɲ-dɛ̀ ||

When it blew hard, the person wrapped the cloak more tightly around himself.

8.

Gua̲a̲th ɛ cɛ nyɔk i̲ putdɛ ɛlo̲ŋ bi ramɔ ŋuot la kulɛ ni bi̲i̲dɛ puo̲nydɛ.

gwă̤ːð ɛ̀ ɕɛ̄ː́ ɲɔ̂ɰɔ̤̀j pṳ́dɛ̀ ɛ̀ lɔ̤́ŋ brāːmɔ̀ ɰòɔːt || làː kṳ́l né̤ bì̤ːɾɛ̀ pɸ͡ɔ̤́ːɲdɛ̀ ||

gwá̤ːt̪ ɛ̀ cɛ̀ ɛ́ ɲɔ́k ì̤ pṳ́t-dɛ̀ ɛ̀ lɔ̤́ŋ bì̤ rāːm-ɔ̀ ŋòɔːt || l̤àː kṳ́l-ɛ́ ní̤ $^{\mu}$bì̤ː-dɛ̀ pwɔ̤́ːɲ-dɛ̀ ||

The more the North Wind blew, the more the person wrapped his cloak around his body.

9.

Mäni mëë cɛ ŋo̲a̲ŋ. Cɛ dhal /kenɛ luäŋ ɛ ɣöö bi raan bi̲i̲dɛ ka̲m raar puo̲nydɛ.

mə̤̀ ní̤ mēː | ɕɛ̀ ŋɔ̤̀a̤ːːŋ || cɛ̄ː́ d̪àl | kɛ́n ɛ̄ lɔ̤̂ŋ ɛ̀ ɰə̆ː brāːːn | bì̤ːɾɛ̀ kà̤m ráːr ɸɔ̤́ːɲdɛ̀ ||

mə̤̀ ní̤ méː | cɛ̀ ŋɔ̤̀a̤ːːŋ || cɛ̀ ɛ́ d̪àl | kɛ́nɛ̀ ɛ́ lwə̤̀ŋ ɛ̀ ɰə̀ː bì̤ rāːːn | $^{\mu}$bì̤ː-dɛ́ kà̤m ráːr pwɔ̤́ːɲ-dɛ̀ ||

[He blew] until he got tired. He failed, as he did not manage to remove the person's cloak.

10.

Ɛn wa̲nəmɔ cu i̲ Cäŋ wä ɣän a lɛ̈nä wä,

ɛ̀ wā̤ːnɔ́mɔ̄ ɕṳ̂i ɕɔ̤́n wɔ̤́ || ɔ̤́n à lēanɔ̤́ wā̤ ||

ɛ̀(n) wā̤ːnɔ́mɔ̄ cṳ́ ì̤ cɔ̤́n wɔ̤́ || ɰɔ̤́n à lēan-ɔ̤́ wɔ̤́ ||

Then the Sun said: "I say, let me have a go."

11.

gua̲a̲th ëë ci Cäŋ wä lɛpɛ ɛ määth ɛ määth cu raan bi̲i̲dɛ wä kɛ mi kämɛ jɛ raar ɛ määth.

gwă̤ːð é̀ː ɕī̤ŋ wɔ̤́ːː lɛ́bɛ̀ || ɛ̀ mă̤ːːð ɛ̀ mā̤ːːθ | ɕṳ́ rāːːn | bì̤ːdɛ̀ wɔ̤̀ː | mɔ́ kɔ̤́mɛ̀ ɟɛ̀ rāːr ɛ̀ mā̤ːːs ||

gwá̤ːt̪ méː cì̤ cɔ̤́ŋ wɔ̤́ː lɛ́b-ɛ́ || ɛ̀ mā̤ːːt̪ ɛ̀ mā̤ːːt̪ | cṳ́ rāːːn | $^{\mu}$bì̤ː-dɛ̀ wɔ̤̀ː | méː kɔ̤́m-ɛ́ ɟɛ̄ ráːr ɛ̀ mā̤ːːt̪ ||

And the Sun started shining. Slowly, that person started to unwrap his cloak.

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12.

Amäni mëë ci Cäŋ lëth, cu ramɔ bi̱i̱dɛ cuɛ ka̱m raar.

ɛ̀ mə̤̄ né̤ mēː | c͡ɕì̤ çə̤̆ŋ lɪ̂t̪ || cṳ́ râːmɔ̄ː bɪ̤ːɾɛ̀ | cwə̀ kà̤m ráːr̥ ||

ɛ̀ mə̤̀ nɪ̤́ méː | cɪ̤̀ cə̤́ŋ lét̪ || cṳ́ rāːm-ɔ̀ μ́bɪ̤ː-dɛ̀ | cṳ́ ɛ́ kà̤m ráːr ||

And the Sun got so hot that the person removed his cloak.

13.

Ɛn wa̱nɔmɔ cu Targɛw ɛ lat ɣëë! Ciɛ ku läny kɛ buɔ̱m ɛpuc ji̱n Cäŋ, ca̱ ŋa̱c i̱ bum ni ji̱n.

ɛ̀ wā̤nɔ́mɔ̀ || ɕṳ́ târgjâw ɛ̀ làt ɛ̌ːːc̄ || ɕi̤ɛ́ wṳ́ lé̤ɲ ɛ̀ bɔ̤́ːm pí̤c || ɟí̤n çə̤́ŋ | cá̤ː ŋà̤ɟ ɪ̤́ bṳ́m nɪ̤̀ ɟɪ̤̀n ||

ɛ̀(n) wā̤ːnɔ́mɔ̀ || cṳ́ tárgjáw ɛ̀ lāt eːːj || cɪ̤̀ ɛ́ kṳ́ lé̤ɲ kɛ̀ bɔ̤́ɔ̤ːm ɛ̀ pṳ́c || ɟɪ̤́n cə̤́ŋ | cə̤́ ɛ́ ŋà̤c ɪ̤́ bṳ́m nɪ̤́ ɟɪ̤́n ||

At that moment, the North Wind said, “Wow, Sun, you are stronger than me. I know it now, you are stronger.”

14.

Kä wa̱nɔmɔ cu Cäŋɛ cu ŋa̱c i̱ bum ni jɛn.

kə̤́ wā̤nə́mɔ̄ || çṳ́ ɛ̀ çə̤́ŋ ɛ̀ çṳ̀ ŋá̤c̄ || è bṳ́m nɪ̤̀ ɟ͡ʑɛ̀n ||

kə̤́ wā̤ːnɔ́mɔ̄ || cṳ́ ɛ̀ cə̤́ŋ ɛ̀ cṳ́ ŋá̤c || ɪ̤̀ bṳ́m nɪ̤́ ɟɛ̄n ||

From that time the Sun knew it was the stronger one.

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Supplementary material To view supplementary material for this article, please visit https://doi.org/10.1017/S0025100323000191.

Appendix

Vowel and voice quality dataset Data from two South Sudanese speakers of Nuer: a female speaker RNM (Lou, Eastern Nuer) and a male speaker PGM (Leer, Western Nuer).

Filename disambiguation: RNM_1_01.wav

speaker initials_example number_repetition number.wav

All examples show phonemic transcription. Brackets signal optionality. Suffixes -ə̤́ and -ɪ̤́ are the first and second subject agreement suffixes, respectively.

A1. ɟí̤n **ní**ː**n**-í̤ ɛ́ wɛ̀nɛ̄(mɛ̄)
‘You are sleeping here.’

A2. ɟí̤n **tí**ː**t**-í̤ rāːːn / ŋwàːːní̤
‘You are observing a person / things.’

A3. ɟí̤n **tī̤t**-í̤ ɛ́ wɛ̀nɛ̄
‘You are observing here.’

A4. ɟí̤n **kí**ː**t**-í̤ dí̤ːt
‘You are starting to sing a song.’

A5. ɟí̤n **kī̤t**-í̤ ɛ́ wɛ̀nɛ̄
‘You are starting to sing here.’

A6. ɟí̤n **ríŋ**-í̤ ɛ́ wɛ̀nɛ̄
‘You are running here.’

A7. ɟí̤n **rí̤**ːː**ŋ**-í̤ kə̤́ ɰə̤́/ŋə̤́
‘You are running to me.’

A8. ɟí̤n **pím**-í̤ rāːːn (ɛ́ wɛ̀nɛ̄)
‘You are punching a person (here).’

A9. ɟí̤n **pí̤**ː**m**-í̤ ɛ́ wɛ̀nɛ̄
‘You are punching here.’

A10. ɟí̤n **mí̤t̪**-í̤ ɛ́ wɛ̀nɛ̄
‘You are eating here.’

A11. ɟí̤n **tɛ́**ːː**t**-í̤ dwɔ̀ːːr
‘You are claiming back a thing.’

A12. (ɰə̤́n) **tē**ː**t**-ə̤́ ɛ́ wɛ̀nɛ̄
‘I am claiming back here.’

A13. ɟí̤n **tḛ̄**ː**t**-í̤ ɛ́ wɛ̀nɛ̄
‘You are claiming back here.’

A14. ɟí̤n **gɛ́**ːː**r**-í̤ t̪ṳ̀rbí̤ːl
‘You are riding a car.’

A15. ɰə̤́n **gē**ː**r**-ə̤́ ɛ́ wɛ̀nɛ̄
‘I am riding here.’

A16. ɟ̤í̤n **gē̤ːr**-í̤ ɛ́ wɛ̀nɛ̄

‘You are riding here.’

A17. ɰə̤́n **néːːr**-ə̤́ rāːːn

‘I am greeting a person.’

A18. ɟ̤í̤n **né̤ːːr**- í̤ rāːːn

‘You are greeting the person.’

A19. ɟ̤í̤n **t̪ɛ́ːːɰ**-í̤ kwə̤́n

‘You are fasting (abstaining from) food.’

A20. ɰə̤́n **t̪éɰ**-ə̤́ ɛ́ wɛ̀nɛ̄

‘I am fasting here.’

A21. (ɟ̤í̤n) **t̪é̤ɰ**-í̤ ɛ́ wɛ̀nɛ̄

‘You are fasting here.’

A22. ɟ̤í̤n **tɛ́ːt̪**-í̤ ɛ́ wɛ̀nɛ̄

‘You are falling down here.’

A23. ɰə̤́n **tét̪**-ə̤́ rāːːn ɛ́ká

‘I am falling down for a person.’

A24. ɟ̤í̤n **té̤t̪**-í̤ rāːːn ɛ́ká

‘You are falling down for a person.’

A25. ɟ̤í̤n **tè̤ːːɰ**-í̤ dwɔ̀ːːr (ɛ́ wɛ̀nɛ̄)

‘You are hiding a thing (here).’

A26. ɟ̤í̤n **té̤ːɰ**-í̤ ŋwàːːní̤ rāːːn (ɛ́ wɛ̀nɛ̄)

‘You are hiding things for a person (here).’

[speaker RNM]

ɟ̤í̤n **té̤ːɰ**-í̤ rāːːn dwɔ̀ːːr

‘You are hiding a thing for a person (here).’

[speaker PGM]

(Note that both word orders are possible because the Patient argument is inanimate. When both the Patient and the Beneficiary are animate, the Beneficiary occurs close to the verb, followed by the Patient, see examples A46–A47).

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A27. ɰə̤́n **cáːːr**-ə̤́ rā::n
‘I am thinking about a person.’

A28. ɰə̤́n **cā̤ːr**-ə̤́ ɛ́ wɛ̀nɛ̄
‘I am thinking here.’

A29. (ɟḭ́n) **cɔ̤̄ːr**-ḭ́ ɛ́ wɛ̀nɛ̄
‘You are thinking here.’

A30. ɰə̤́n **bá̤ːːr**-ə̤́ dwɔ̀::r / rā::n
‘I am shooting a thing / person.’

A31. ɟḭ́n **bə̤́ːːr**-ḭ́ dwɔ̀::r / rā::n
‘You are shooting a thing/ person.’

A32. ɰə̤́n **tá̤ːːt̪**-ə̤́ $^{\acute{\mu}}$d̪â::r
‘I am moulding a pot.’

A33. ɟḭ́n **tə̤́ːːt̪**-ḭ́ $^{\acute{\mu}}$d̪á::r
‘You are moulding a pot.’

A34. ɰə̤́n **ká̤ːːp**-ə̤́ dwɔ̀::r /rā::n
‘I am catching a thing/person.’

A35. ɟḭ́n **kə̤́ːːp**-ḭ́ dwɔ̀::r
‘You are catching a thing.’

A36. ɰə̤́n **t̪áːːl**-ə̤́ kwə̤́n
‘I am cooking food.’

A37. ɟḭ́n **t̪áːːl**-ḭ́ kwə̤́n
‘You are cooking food.’

A38. ɰə̤́n **ŋáːːt̪**-ə̤́ dwɔ̀::r /rā::n
‘I believe a thing / person.’

A39. ɟḭ́n **gɔ̤́ːːr**-ḭ́ bòk / ŋwà::nḭ́
‘You are writing a book / things.’

A40. ɟḭ́n **gɔ̤̄ːːr**-ḭ́ ɛ́ wɛ̀nɛ̄
‘You are writing here.’

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A41. ɟí̤n **tɔ̤̄ːt-**í̤ ɛ́ wɛ̀nɛ̄

'You are spending a rainy season here.'

A42. ɟí̤n **jɔ̤̄ːt-**í̤ ɛ́ wɛ̀nɛ̄

'You are calling here.'

A43. ɟí̤n **kɔ̤̄ːl-**í̤ gàt

'You are fanning a child.'

A44. ɟí̤n **mɔ̤́ːŋ-**í̤ nàːːt̪ / rāːːn

'You gather and joke with people / a person.'

A45. ɟí̤n **t̪ɔ́ːːr-**í̤ gàt / rāːːn

'You are making a person / child float.'

A46. ɰə̤́n **t̪ɵ́ːr-**ə̤́ rāːːn gàt / tàtjāːná

'I am making a child/Tatiana float for a person.'

A47. ɟí̤n **t̪ɵ̤́ːr-**í̤ rāːːn gàt / tàtjāːná

'You are making a child/Tatiana float for a person.'

A48. ɟí̤n **kɔ̄ːɰ-**í̤ dwɔ̀ːːr

'You are buying a thing.'

A49. ɟí̤n **cɔ́ːːl-**í̤ rāːːn

'You are calling a person.'

A50. ɟí̤n **jɔ́ːːt-**í̤ rāːːn

'You are beating a person.'

A51. ɟí̤n **kɔ́ːːŋ-**í̤ rāːːn

'You are meeting, greeting a person.'

A52. ɰə̤́n **kɵ̄ːŋ-**ə̤́ ɛ́ wɛ̀nɛ̄

'I am meeting, greeting here.'

A53. ɟí̤n **kɵ̤̄ːŋ-**í̤ ɛ́ wɛ̀nɛ̄

'You are meeting, greeting here.'

A54. ɰə̤́n **gɵ́ːːr-**ə̤́ dwɔ̀ːːr / gàt

'I want a thing / child.'

A55. ɟí̤n **gɵ̤́ːːr-**í̤ dwɔ̀ːːr

'You want a thing.'

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A56. ɰə̤́n **gō**ː:**r**-ə̤́ ɛ́ wɛ̀nɛ̄
'I want here.'

A57. ɟɪ̤́n **gō**ː:**r**-ɪ̤́ ɛ́ wɛ̀nɛ̄
'You want here.'

A58. ɰə̤́n **t̪ōt**-ə̤́ dwɔ̀ːːr / jáːŋ
'I am pulling a thing / cow.'

A59. ɟɪ̤́n **t̪ó̤t**-ɪ̤́ dwɔ̀ːːr / jáːŋ
'You are pulling a thing / cow.'

A60. ɰə̤́n **c(j)ō**ː**t**-ə̤́ ɛ́ wɛ̀nɛ̄
'I am calling here.'

A61. ɟɪ̤́n **c(j)ō̤**ː**t**-ɪ̤́ ɛ́ wɛ̀nɛ̄
'You are calling here.'

A62. ɰə̤́n **ɰé**ː**p**-ə̤́ dwɔ̀ːːr / ŋwàːːnɪ̤́
'I am crushing a thing / things.'

A63. ɟɪ̤́n **ɰé̤**ː**p**-ɪ̤́ dwɔ̀ːːr
'You are crushing a thing.'

A64. ɟɪ̤́n **có**ː**l-**ɪ̤́ rāːːn / ŋwàːːnɪ̤́
'You are compensating a person / things.'

A65. ɟɪ̤́n **cṳ̄**ː**l-**ɪ̤́ ɛ́ wɛ̀nɛ̄
'You are compensating here.'

A66. ɟɪ̤́n **ŋó**ː**l-**ɪ̤́ rwɛ̀j
'You are spitting saliva.'

A67. ɟɪ̤́n **ŋṳ̄**ː**l-**ɪ̤́ ɛ́ wɛ̀nɛ̄
'You are spitting here.'

A68. ɟɪ̤́n **gō**ː**ŋ-**ɪ̤́ kwə̤́ːːr / rɔ̀
'You are bowing to a king/ yourself.'

A69. ɟɪ̤́n **tó**ːː**ɰ-**ɪ̤́ dwɔ̀ːːr / ŋwàːːnɪ̤́
'You are starting a thing/things.'

A70. ɟɪ̤́n **tṳ̄**ː**ɰ-**ɪ̤́ ɛ́ wɛ̀nɛ̄
'You are starting here.'

A71. ɟí̤n **t̪ṳ̄ːr-í̤** rāːːn / ŋwàːːní̤
'You are photographing a person / things.'

A72. ɟí̤n **t̪ṳ̄ːr-í̤** ɛ́ wɛ̀nɛ̄
'You are photographing here.'

A73. ɟí̤n **cṳ́ːːŋ-í̤** rāːːn
'You are making a person stand.'

A74. ɟí̤n **cṳ̄ŋ-í̤** ɛ́ wɛ̀nɛ̄
'You are standing here.'

A75. ɯə̤́n ríeːŋ-ə̤́ **ní̤n** ɛ́ wɛ̀nɛ̄
'I am running to sleep here.'

A76. ɯə̤́n **nēːːr**-ə̤́ ɛ́ wɛ̀nɛ̄
'I am greeting here.'

A77. ɟí̤n **nḛ̄ːːr**-í̤ ɛ́ wɛ̀nɛ̄
'You are greeting here.'

A78. ɟí̤n **kɔ̤̄ːl-í̤** ɛ́ wɛ̀nɛ̄
'You are fanning here.'

A79. ɯə̤́n **ɯōːːp-**ə̤́ ɛ́ wɛ̀nɛ̄
'I am crushing here.'

A80. ɟí̤n **ɯō̤ːːp**-í̤ ɛ́ wɛ̀nɛ̄
'You are crushing here.'

A81. ɟí̤n **kə̤́ːp-í̤** ɛ́ wɛ̀nɛ̄
'You are catching here.'

A82. ɟí̤n **jɔ̤́ːːt-í̤** rāːːn
'You are calling here.'

Abbreviations and special symbols 1,2,3 = first, second, third person; A2 = harmonic most boosted by the second format (F2); AP = antipassive; APPL = applicative; C = consonant; COLL = colloquial; COMP = comparative; CONJ = conjunction; COP = copula; DEM = demonstrative; DIST = distal; f0 = fundamental frequency; F1 = first formant; F2 = second formant; F3 = third formant; F4 = fourth formant; FIN = finite; FOC = focus; FC = floating constituent; FUT = future; H1 = first harmonic; H2 = second harmonic; H4 = fourth harmonic; H1*–H2* = first harmonic minus second harmonic where harmonic amplitudes have been corrected for effects of formants and bandwidths; HAB = habitual; IMPER = imperative; INCL = inclusive; IN = intransitive; MED = medial; MUL = multiplicative; NEG

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= present negative; NF = non-finite; OBJ = object; OBL = oblique; PASS = passive; PFV = perfective; PL = plural; POSS = possessive; PREP = preposition; PROX = proximal; PST = past; REL = relative; SE = spectral emphasis measure; sd = standard deviation; SG = singular; TR = transitive base paradigm; V = vowel; VN = verbal noun; VOT = voice onset time; ($^{\acute{\mu}}$) = floating constituent consisting of a mora and High tone; ɔ, ɔa = short vowel; ɔː, ɔaː = long vowel; ɔːː, ɔaːː = overlong vowel; á = High tone; à = Low tone; ā - Mid tone; [â] = falling contour tone; [ǎ] = rising contour tone; (.) = syllable boundary.

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