

Nuer Tonal Inventory*

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The tonal system of Nuer has been a matter of much uncertainty. Here we present empirical evidence in favor of a three toneme system with some typologically rare features. One of them is an intriguing case of allotony based on the phonation of the vowel: the High toneme has a falling allotone over modal vowels. Moreover, the Rising toneme has four allotones: a rising, a mid, a low and a falling allotone. The falling allotone of the Rising toneme also occurs only on modal vowels in specific contexts. We suggest that some of the allotonic variation is motivated by tonal contour simplification. We also point out the role of free variation in some of the allotonic alternations, and the constraints that put limits on the free variation between allotones.

Key words: West Nilotic, Nuer, tone, vowel phonation, allotone

1. Nuer tonal system

The primary objective of this article is to establish the tonal inventory of Nuer, a West Nilotic language indigenous to South Sudan and parts of Ethiopia, and to determine principal tonal processes responsible for the surface allotony.

This article offers empirical evidence that the Nuer tonal system is comprised of three tonemes: Low, High and Rising. However, the Nuer syllable can be associated with one of five tonal contours: high, low, rising, falling and mid. We argue that the mid and rising tones are variants of the same toneme – which we call Rising – and that these two allotones are in relatively free alternation. Moreover, the Rising toneme also has a low and a falling allotones under some circumstances. Phonation of the tone-bearing vowel plays a crucial role in realization of the tonal contour: High toneme is pronounced with a flat high pitch over breathy vowels, but with a falling pitch over modal vowels. The falling allotone of the Rising toneme, likewise, is only possible in syllables containing modal vowels.

The major source for much of existing theoretical literature on Nuer – Crazzolaro (1933) – indicates tonal properties in the transcribed material. However, Crazzolaro emphasizes that the transcriptions of tone in his work are provisional and makes little attempt to determine rules of tonal grammar. More recent work by Frank (1999) and Faust (2016) avoid transcription of tone altogether. Gjersøe (2016, 2017, 2019) is the only recent work which focuses specifically on tone in Nuer. Gjersøe's findings significantly differ from ours in regard to the number of tonemes and in the analysis of processes involved. In view of the apparent difficulties in establishing basic facts of the Nuer tonal system, this article aims to provide empirical support to the claim made by us in some previous publications (Monich and Baerman 2019; Baerman, Monich and Reid 2019) that in addition to high, low and falling tones (identified and reported as tonemes in Gjersøe 2016), Nuer inventory includes a rising and a mid tone, and to motivate organizing these five pitch contours into a three-toneme system.

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The research presented here is based on fieldwork conducted with speakers of both Western and Eastern varieties of Nuer. To be consistent, whenever individual variations in execution of the tonal contour are immaterial to the discussion or non-existent, all illustrations are based on the same speaker of the Eastern Nuer Gatjiok dialect spoken in the town of Nasir (South Sudan). This speaker is labelled as Speaker A throughout the article. As much as possible, sonorant-final and sonorant-initial lexical items are used as examples to facilitate tracing of F0. While there exist some inter-dialectal differences in the tonal properties of some roots, we find no differences between Eastern and Western varieties of Nuer that pertain to the tonal inventory or to the realization of the underlying tonemes.

Before proceeding to the analysis of Nuer data, a few words on terminology are in order. When using terms ‘pitch’, ‘pitch/tonal contour’ and the general term ‘tone’, we limit our discussion to the surface manifestations of tonal characteristics. The surface tone may or may not correspond to the underlying tonal properties of the syllable, i.e. to the toneme associated with it. Toneme labels are indicated with initial capital letters: Rising, Low, High. Various surface realizations of the same toneme are referred to as its allotones, and indicated with initial lower-case letters: rising, low, high, etc. Unless a given lexical form is enclosed with /-brackets to indicate phonemic transcription, all examples show surface tonal values, not underlying tonemes. In vowels represented with several graphemes (see Section 2 for the description of Nuer vowel system and for the conventions used in its transcription), the tonal properties of the whole syllable are indicated above the first grapheme using the following diacritics: $\acute{\text{}}$ = high tone, $\grave{\text{}}$ = low tone, $\hat{\text{}}$ = falling tone, $\check{\text{}}$ = rising tone, $\bar{\text{}}$ = mid tone.

The article is structured as follows. In section 2 we present basic facts in regard to the Nuer vowel system. In Section 3 we offer evidence that the Nuer tonal system operates with an inventory of three tonemes. In section 4 we show that the High toneme displays allotonic variation based on vowel phonation. Variation in realization of the Rising toneme and distribution of its allotones is discussed in Section 5. Section 6 reiterates our conclusions and suggests directions for future research.

2. Nuer vowel system

The Nuer vowel inventory, shown in Fig. 1, consists of fifteen monophthongs and eight diphthongs. All phonemes except / Λ / come as a modal/breathy pair. Importantly, even though breathiness is indicated here by placing two dots underneath the first grapheme of a vowel only, the presence of the diacritic means that the whole vowel is breathy, i.e. phonation properties do not change throughout the syllable.

Fig. 1 Nuer vowel inventory

$\text{i } \acute{\text{i}}$ $\text{e } \acute{\text{e}}$ $\text{\varepsilon } \acute{\varepsilon}$ \Lambda $\text{a } \grave{\text{a}}$	$\text{u } \acute{\text{u}}$ $\text{o } \acute{\text{o}}^1$ $\text{\textcircled{o}} \text{\textcircled{o}}$	$\text{ie } \acute{\text{ie}}$ $\text{\varepsilon a } \acute{\varepsilon a}$	$\text{uo } \acute{\text{uo}}$ $\text{\textcircled{o} a } \text{\textcircled{o} a}$
a. Monophthongs		b. Diphthongs	

¹ Phonemes / o , $\text{\textcircled{o}}$ / are pronounced much more to the front of the vowel space than their [-ATR] counterparts / $\text{\textcircled{o}}$, $\text{\textcircled{o}}$ /. Phonetically it would have been more accurate to represent them as / $\text{\textcircled{e}}$, $\text{\textcircled{e}}$ / but for typographical reasons and for the sake of consistency with other literature on Nuer, we follow the convention of representing these vowels as / o , $\text{\textcircled{o}}$ /.

Vowels – both diphthongs and monophthongs – occur in three degrees of length: short, long and overlong. There exist a few minimal length triplets, for example *càk* ‘tick.SG.NOM’, *câak* ‘milk.PL.NOM’, *câaak* ‘milk.PL.GEN’.

Here we follow a convention established in West Nilotic literature (see, for example, Andersen (1993, 1995), Remijsen & Manyang (2009), Storch (2005)) of representing vowel length by doubling or tripling the vowel grapheme, rather than using the IPA notation for this particular feature. In the case of diphthongs, it is the second grapheme that is doubled or tripled, so that an overlong diphthong consists of up to four graphemes.

Changes to the properties of root vowels play an important role in morphophonology of Nuer. As illustrated with a set of sample nominal paradigms in Table 1, most grammatical information is communicated through stem modification. There are four targets of morphologically conditioned modification in the stem: quality, quantity and tone of the root vowel (native Nuer roots are monosyllabic) and articulatory properties of the stem-final consonant. Some facts concerning the vowel quality modification, especially as they relate to changes in phonation, will be introduced in Section 4.

Table 1. A sample set of Nuer paradigms (Bentiu dialect, Western Nuer)

NOM SG	GEN SG	LOC SG	NOM PL	GEN/LOC PL	
kɔ́aaay	kɔ́ah	kɔ́h	kɔ́ah	kɔ́ay-nì	‘hole’
kîir	kîeer	kîir	kîer	kîer-ì	‘big river’
rêc	rêaç		rèc	rêej	‘fish’
líeer	líer/lír-à ²		líeer-í		‘water pitcher’
ròaaam	ròoom-á		ròoom	ròoom-nì	‘sheep’
dêel	dêaaal		dét	déet	‘goat/sheep’

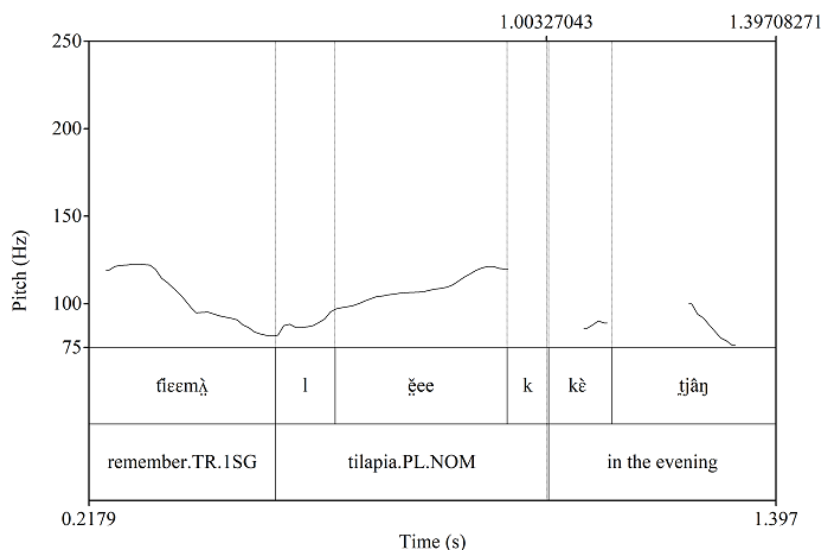
In this article we make no attempt to account for tonal processes that are involved in morphological stem modification. Instead, we aim to establish the basic parameters of the Nuer tonal system, such as the number of tonemes. We hope therefore that this study will provide a foundation for further work on Nuer tonal system, especially as it relates to morphologically conditioned tonal alternations.

3. Tonal inventory: three tonemes

3.1 Tone in segmentally unsuffixed forms. A Nuer syllable may carry one of the following five surface tones: high (H), low (L), falling (HL), rising (LH) and mid (M). In this section we present evidence that these tonal contours correspond to three tonemes: High (H), Low (L) and Rising (LH). We show that in identical frames and over vowels of identical length and phonation properties, we observe a three-way tonemic contrast.

Consider examples in Fig. 2 which all show monosyllabic nominal forms with overlong breathy vowels in the stem in order to rule out effects of phonation and vowel length on realization of the tonal contour. The nouns in Fig. 2 are shown in position of an object after a verb with a low-toned inflectional suffix and before an adjunct beginning with a low-toned syllable. Under these conditions, Nuer nouns manifest only high (*tɔ́oan*), low (*tɔ́aaan*) or rising (*lêek*) tonal contours, which we believe to correspond to three tonemes.

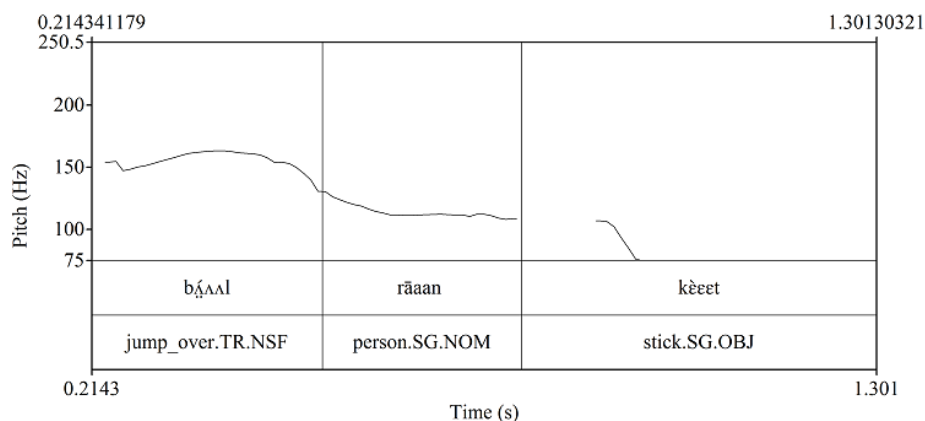
² The suffixed and unsuffixed singular oblique forms are in free variation for some lexical items.



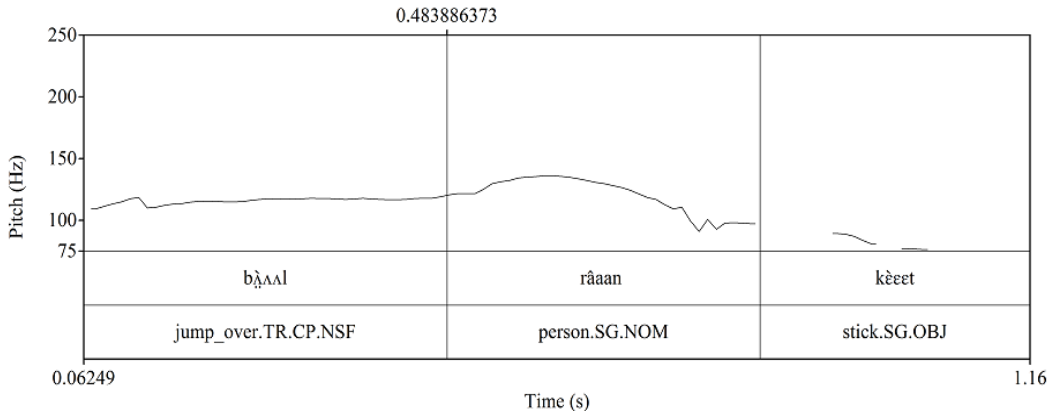
We find the same three-way contrast in verbal stems. Examples in Fig. 3 show the unsuffixed form of the verb (glossed as NSF = non-suffixed form), with breathy overlong vowels in the stem. This verbal form is always used with a postverbal subject (/rãaan/ ‘person’ in all examples in Fig. 3). In this context, the verb may have a high (*b_hããl* ‘jump_over.TR.NSF’), a low (*b_lããl* ‘jump_over.TR.CP.NSF’), or a rising pitch (*gǒoor* ‘want.AP.NSF’).

Fig. 3. The tonal contrast in unsuffixed verbal forms (Speaker A)

- a. **High** toneme in the stem: /b_hããl/ ‘jump_over.TR.NSF’
- | | | |
|-----------------------------|---------------|--------------|
| b_hããl | rãaan | kèɛɛt |
| jump_over.TR.NSF | person.SG.NOM | stick.SG.OBJ |
| ‘A person jumps over stick’ | | |

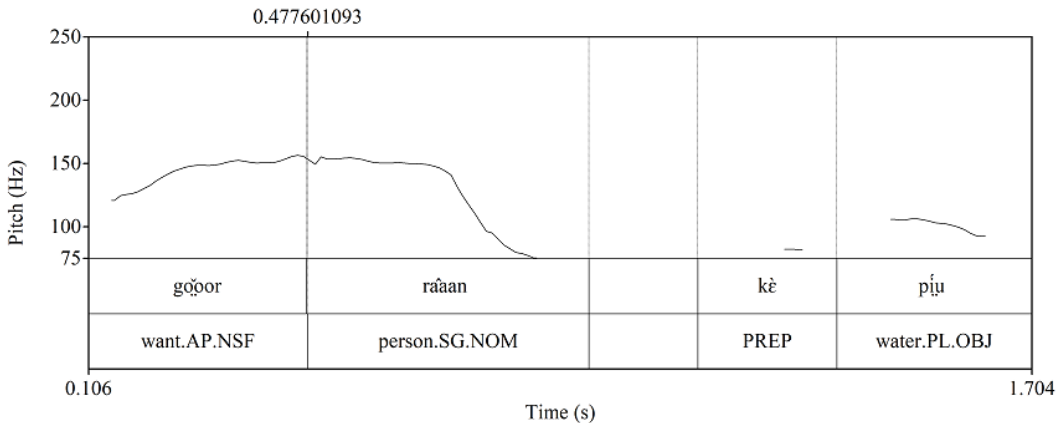


- b. **Low** toneme in the stem: /b_lããl/ ‘jump_over.TR.CP.NSF’
- | | | |
|--|---------------|--------------|
| b_lããl | rãaan | kèɛɛt |
| jump_over.TR.CP.NSF | person.SG.NOM | stick.SG.OBJ |
| ‘A person jumps over a stick (towards me)’ | | |



c. **Rising** toneme in the stem: /gɔ̃ɔɔr/ ‘want.AP.NSF’

gɔ̃ɔɔr	rɔ̃ɔɔn	kɛ	pɔ̃ɔ
want.AP.NSF	person.SG.NOM	PREP	water.PL.OBJ
‘A person wants water’			



The subject /rɔ̃ɔɔn/ is lower in pitch than the preceding verb if the verb carries a high tone, as in Fig. 3a. The subject /rɔ̃ɔɔn/ is higher in pitch than the preceding verb if the verb has a low tone, as in Fig. 3b. Finally, the pitch of the subject /rɔ̃ɔɔn/ will begin at the same level as the verb if the verb has a rising tone, as in Fig. 3c. The variation in the tonal contour of the subject (*rɔ̃ɔɔn* in Fig. 3a, *rɔ̃ɔɔn* in Fig. 3b,c) will be addressed in Section 5.

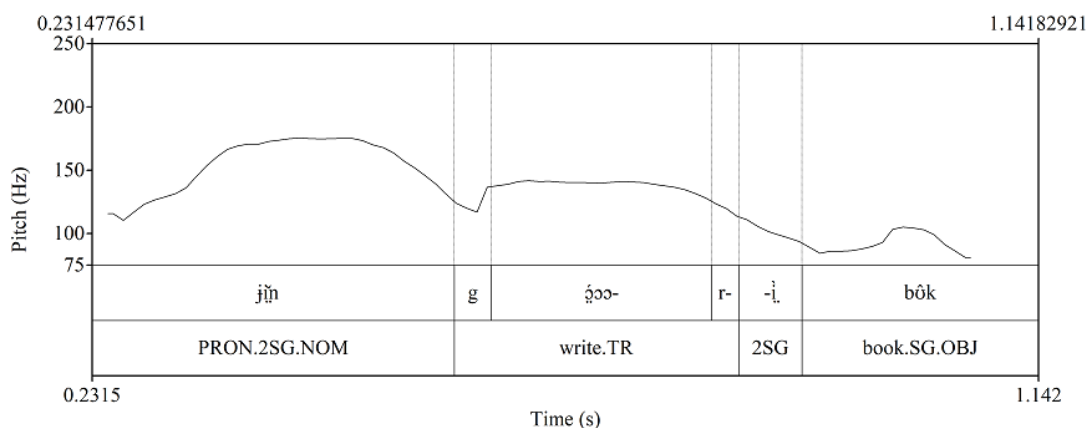
3.2 Tone in segmentally suffixed forms. Segmental affixation is much more limited in nouns than in verbs. There are two nominal suffixes – the Genitive Singular suffix *-kɔ̃ɔ* and the Plural suffix *-nɔ̃ɔ* – but they are not used as pervasively as verbal inflectional suffixes. In a great number of nominal paradigms Genitive Singular and Nominative Plural forms are produced by means of non-segmental affixation only (i.e. through stem modification). The Plural suffix *-nɔ̃ɔ* is used much more regularly in Genitive Plural forms than in Nominative Plural forms but we lack the recorded data to sufficiently exemplify this particular form. Consequently, all data in this section comes from our verbal corpus where it is easier to find minimal or almost minimal pairs to illustrate existing patterns. It should be noted however, that suffixed nominal forms display the same tonal behaviors as suffixed verbal forms.

In suffixed forms we find the same three-way tonal contrast on the stem as in unsuffixed forms. However, in the case of suffixed forms it is impossible to show the three tonemes in identical

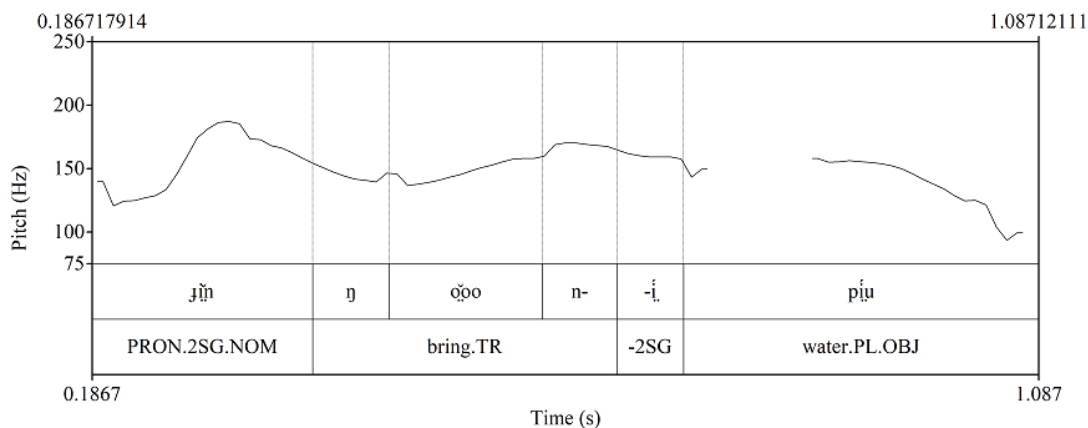
tonal environments due to constraints on the possible tonal combinations between the stem and the suffix. For example, a stem with a high tone is never followed by a high-toned inflectional suffix, while the stem with a rising tone is followed by a low-toned inflectional suffix only rarely. With the above restrictions in mind, Fig. 4 illustrates a three-way tonal contrast over the stem syllable when variably followed by a low-toned or a high-toned suffix. All examples used in Fig. 4 contain breathy overlong vowels. The tone in the stem may be high (*gḡḡḡr-* ‘write.TR’), rising (*ḡḡḡḡḡn-* ‘bring.TR’) or low (*bḡḡḡḡḡ-* ‘jump_over.CP.TR’). The Rising toneme on the stem *ḡḡḡḡḡn-* in Fig. 4b contrasts with a Low toneme on the stem *bḡḡḡḡḡ-* in Fig. 4c in contour and pitch height relative to the high-toned subject inflection.

Fig. 4. The tonal contrast in suffixed verbal forms with an overlong stem vowel (Speaker A)

- a. **High** toneme in the stem:
 ḡḡḡḡḡn gḡḡḡḡr-ḡḡḡḡḡ bḡḡḡḡḡ
 2SG.NOM write.TR-2SG book.SG.OBJ
 ‘You write a book’

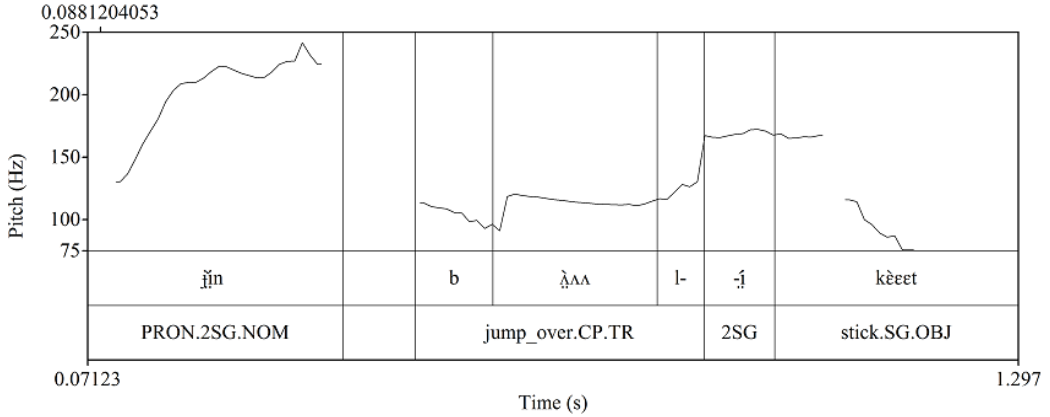


- b. **Rising** toneme in the stem:
 ḡḡḡḡḡn ḡḡḡḡḡḡḡn-ḡḡḡḡḡ pḡḡḡḡ
 2SG.NOM bring.TR-2SG water.PL.OBJ
 ‘You bring water’



c. **Low** toneme in the stem:

j̥in b̥l̥l̥l̥l̥l̥-í k̥èet
 2SG.NOM jump_over.CP.TR-2SG stick.SG.OBJ
 ‘You jump over the stick (towards me)’

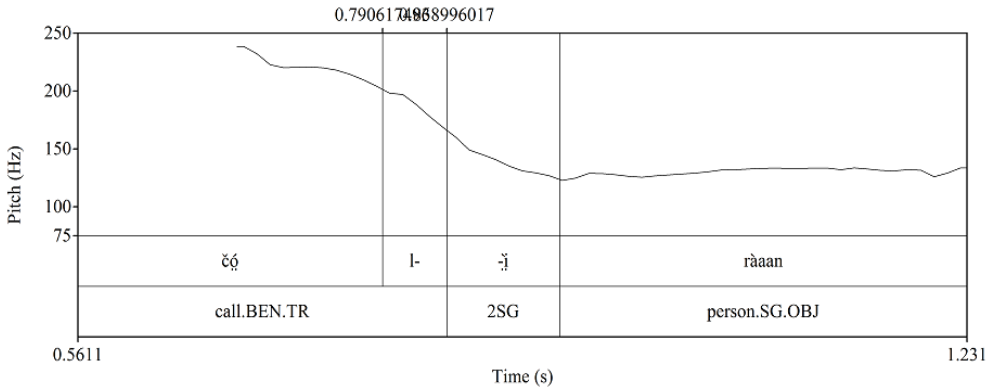


To demonstrate that the three-way tonal contrast is independent of length, Fig. 5 illustrates the three tonemes in suffixed verbal stems with short breathy vowels.

Fig 5. The tonal contrast in suffixed verbal forms with a short stem vowel (speaker A)

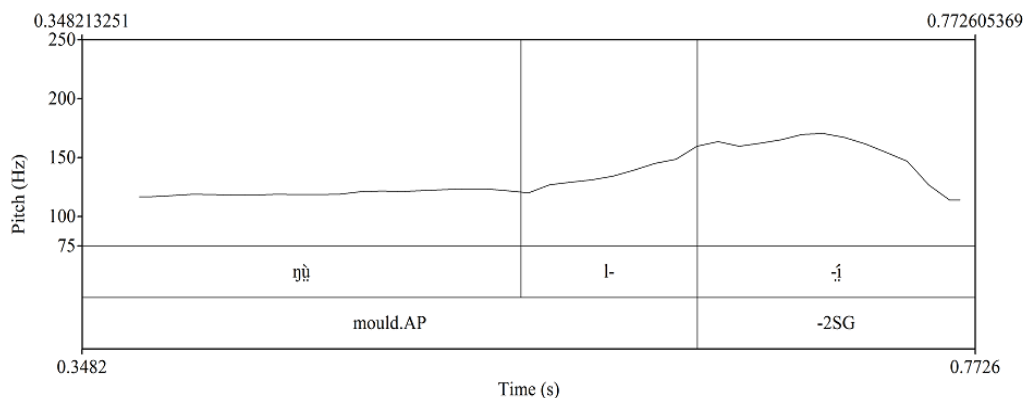
a. **High** toneme in the stem:

c̥ól-í ràaan
 call.BEN.TR-2SG person.SG.OBJ
 ‘You call a person (for somebody)’



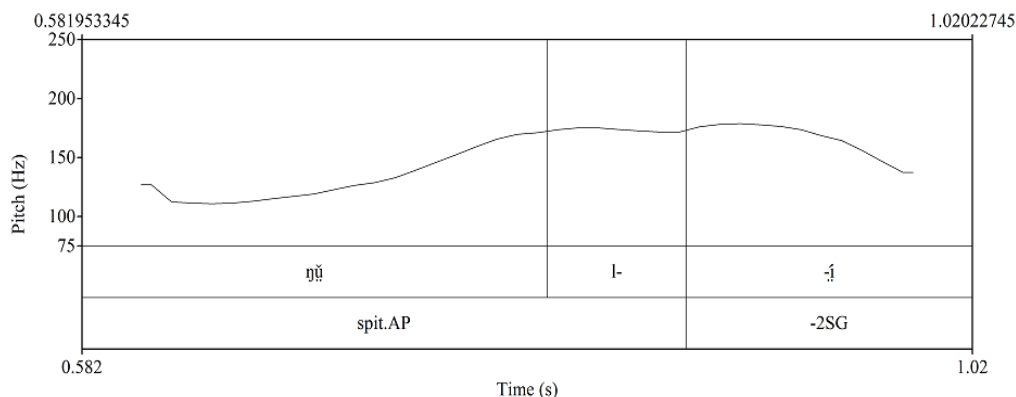
b. **Low** toneme in the stem:

ɲùl-í
 mould.AP-2SG
 ‘You mould’



c. **Rising** toneme in the stem:

ŋùl-í
spit.AP-2SG
'You spit'



Note, again, the contrast between the Low and the Rising tonemes: in Fig. 5b, which illustrates the Low toneme, F0 remained flat throughout the syllable /ŋù/, while in Fig. 5c, which illustrates the Rising toneme, F0 has increased to its maximum by the end of the syllable /ŋù/.

So far, we have demonstrated that the Nuer tonal system has three tonemes which are contrastive in identical morphophonological contexts: High, Low and Rising. Breathy vowels were chosen to illustrate the three-way contrast in all examples for a reason. In the next section, we argue that the High toneme has two allotones – a high and a falling – depending on the phonation of the vowel.

4. Allotones of the High toneme

An intriguing feature of the Nuer tonal system is that phonation of the vowel bears a direct relation to the tonal contour. We find that high level and falling tones are in perfect complementary distribution with reference to the phonation of the vowel, i.e. they are allotones of the same phoneme which we label as High. Falling pitch patterns are found only on modal vowels, while high level pitches are found only on breathy vowels.

The correlation between vowel phonation and tonal contour is manifested most convincingly in the verbal paradigm. The quality of the stem vowel in the inflected verb varies depending on the morphological properties of the form. The stem vowel in the uninflected form of

the verb and in the 2/3SG of the inflected transitive verb can be described as ‘basic’, while the stem vowel in all other inflected forms can be described as ‘modified’. Arguments for treating one variant as basic and the other as modified can be found in Monich and Baerman (2019, pp. 517-518). For most vowels derivation of the ‘modified’ vowel from its ‘basic’ variant involves diphthongization with preservation of the original phonation. The ‘modified’ variants of the vowels /ɛ/ and /o/, however, are derived by changing their phonation, i.e. by removing breathiness. The basic-modified pairs for all vowels are shown in Table 2. Note that some phonemes – i.e. monophthongs /e, o/ and all diphthongs – occur only in morphologically modified forms.

Table 2. Inflectional vowel quality modification

Basic	Modified
ɪ	ɪɛ
ᵿ	ᵿe
ɛ̤	e
ɛ	ɛa
ɛ̤	ɛa
ʌ	a
a	a
ɔ	ɔa
ɔ̤	ɔa
o̤	o
o	oɔ
ṳ	uɔ

The alternation shown in Table 2 is part of a larger phenomenon of vowel gradation which pervades the entire morphological system (see Reid 2019, Monich and Baerman 2019).

The distribution of basic and modified vowels in the inflected paradigm of a transitive verb is shown in Table 3. Only 2/3SG forms have the basic vowel. All other inflected forms have the modified vowel in the stem.

Table 3. The pattern of vowel quality modification in a transitive verb

	Singular	Plural
1		
2	Basic	Modified
3		

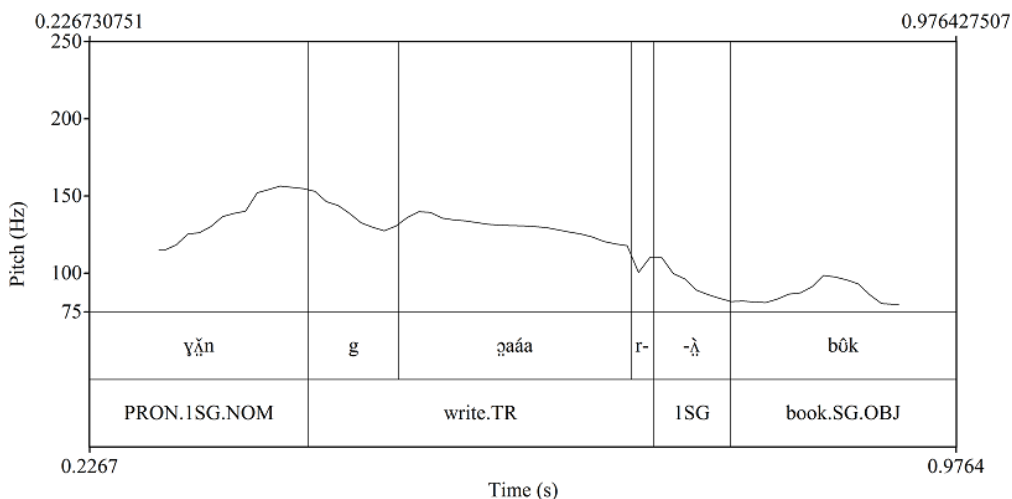
With stem vowels other than /ɛ/ and /o/, phonation of the stem vowel does not change in its modified variant. Consequently, with vowels other than /ɛ/ and /o/ there is no alternation between the high and the falling tone within each lexical paradigm. Verbal stems with breathy vowels – whether in their basic or modified variant – may be realized with a high level pitch, never with a falling tonal contour, while verbal stems with modal vowels – both basic and modified – may be realized with a falling pitch, but not with a level high tonal contour.

Figure 6 shows examples from two verbal paradigms: the verb *gɔ̤ɔ̤ŋ*- ‘come out to welcome.TR’ has a modal vowel in the stem, and the verb *gɔ̤ɔ̤r*- ‘write.TR’ has a breathy vowel in the stem. Each verb is illustrated with two forms: a 2SG form containing a basic vowel and a 1SG form containing a modified vowel. As Fig. 6 demonstrates, the tonal contour of the stem remains the same whether the vowel is basic or modified, and depends solely on the phonation of the vowel. In the forms *gɔ̤aaar-ᵿ* (Fig. 6a-ii) and *gɔ̤ɔ̤r-ᵿ* (Fig. 6a-ii) the verb stem, which contains a breathy

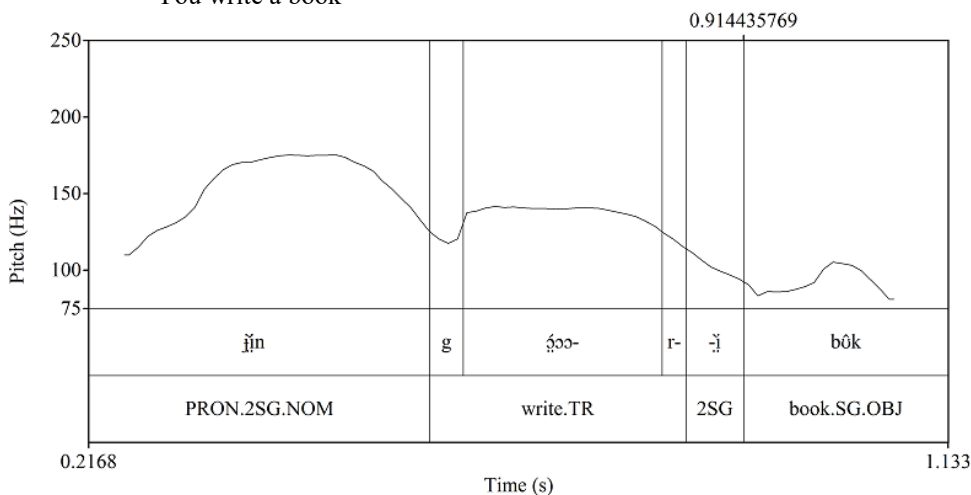
vowel, is pronounced with an F0 that stays relatively flat to the end of the syllable. In the forms *gḥaaŋ-ḥ* (Fig. 6b-i) and *gḥḥḥ-ḥ* (Fig. 6b-ii), the stem, which contains a modal vowel, is pronounced with an F0 falling rapidly towards the end of the syllable.

Fig 6. Lack of alternation between high and falling tones in the verbal paradigms with stem vowels /ɔ/ and /ɔ̃/ (Speaker A)

- a. *gḥor* ‘write.TR’
 i. 1SG: modified root vowel with a high tone
ɣḥn gḥaaar-ḥ bḥk
 1SG.NOM write.TR-1SG book.SG.OBJ
 ‘I write a book’

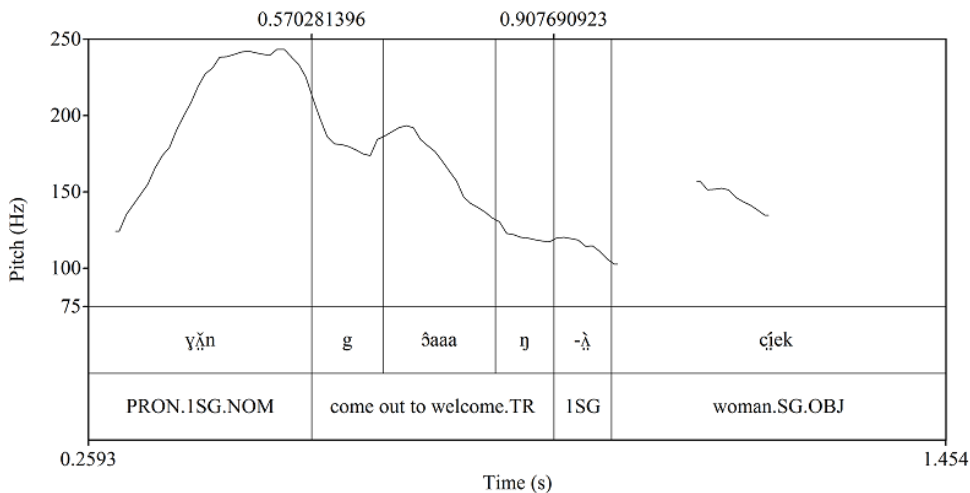


- ii. 2SG: basic root vowel with a high tone
ḥḥn gḥḥḥ-ḥ bḥk
 2SG.NOM write.TR-2SG book.SG.OBJ
 ‘You write a book’



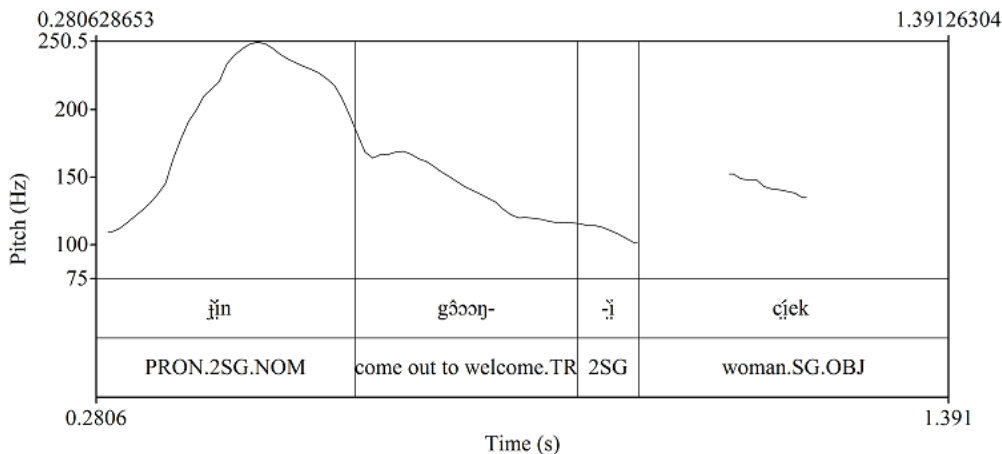
- b. gḥḥḥ ‘to come out to welcome’
 - i. 1SG: modified root vowel with a falling tone in the stem

γḥn	gḥaaaḥ-ḥ	cḥek
1SG.NOM	come_out_to_welcome.TR-1SG	woman.SG.OBJ
‘I come out to welcome the woman’		



- ii. 2SG: basic root vowel with a falling tone in the stem

jḥn	gḥḥḥḥ-ḥ	cḥek
2SG.NOM	come_out_to_welcome.TR-2SG	woman.SG.OBJ
‘You come out to welcome the woman’		



Since vowel quality modification of the two basic vowels /e/ and /o/ involves loss of breathiness, in inflected paradigms derived from stems with these vowels (and associated with a High toneme), the alternation between the high and the falling allotones is identical to the distribution of basic vs. modified vowels. In 2/3SG forms, where the stem vowel is breathy, it is

pronounced with a high flat pitch. In 1SG and all plural forms³, where the stem vowel is modal, it is pronounced with a falling pitch. An example of this alternation is provided in Table 4.

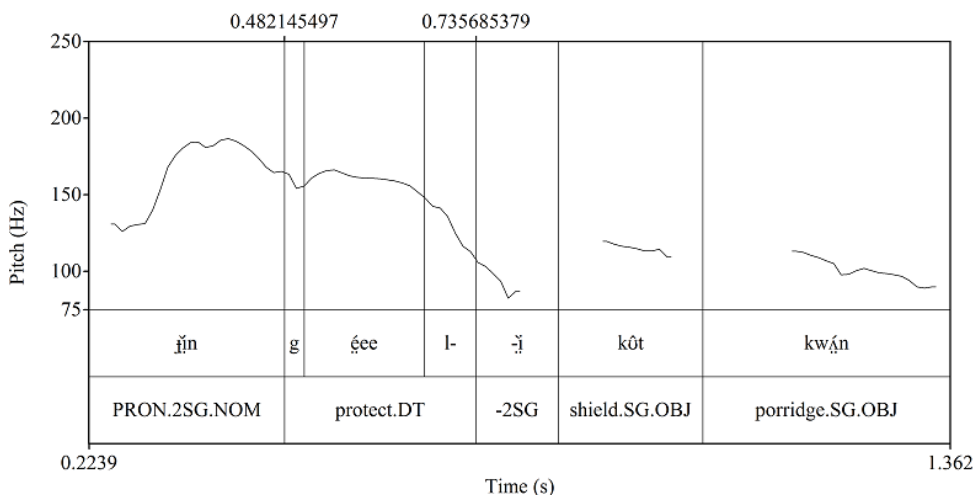
Table 4. The inflected paradigm of *géeel* ‘protect/cover.DT’

	Sing	Pl		
1 st	<i>géeel-ì</i>	<i>géeelkò</i> (Excl)	<i>géeelnè</i> (Incl Dual)	<i>géeelné</i> (Incl Plural)
2 nd	<i>géeelì</i>	<i>géeelè</i>		
3 rd	<i>géeelè</i>	<i>géeelkè</i>		

The stem vowel in the verb *géeel* ‘to protect/cover’ is /e/ and it alternates between a breathy and a modal variant in the inflected paradigm. Fig. 7 shows four forms from the paradigm in Table 4: the 2SG form *géeel-ì* and the 3SG form *géeel-è* have a breathy vowel and are pronounced with a level high pitch (Fig. 7a,b); the 1SG form *géeel-ì* and the 3PL form *géeel-kò* have a modal vowel and are pronounced with a falling pitch (Fig. 7c,d).

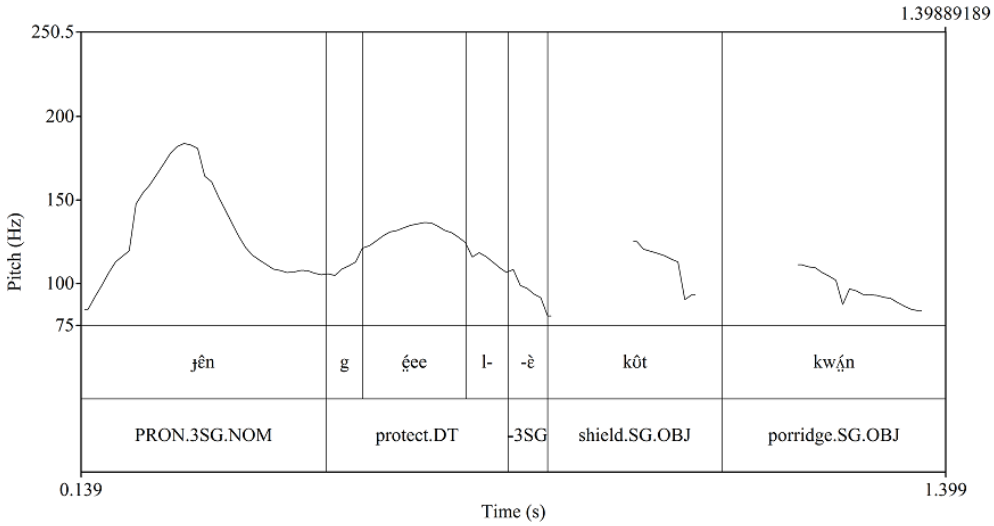
Fig. 7. Alternation of a high level and a falling tone in the verbal paradigm with a stem vowel /e/ (Speaker A)

- a. 2SG: high level tone in the stem
jìn ***géeel-ì*** *kòt* *kwàn*
 2SG.NOM protect.DT-2SG shield.SG.OBJ porridge.SG.OBJ
 ‘You protect porridge with a shield’

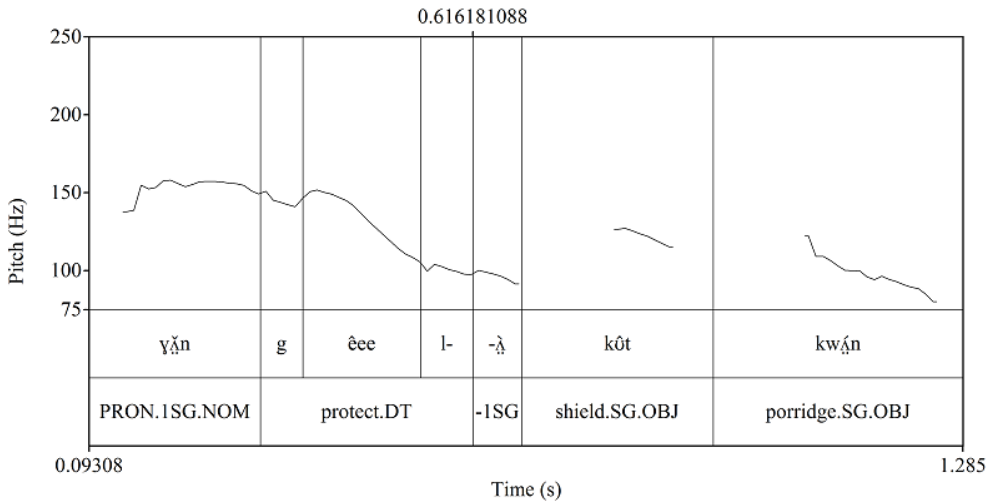


- b. 3SG: high level tone in the stem
jèn ***géeel-è*** *kòt* *kwàn*
 3SG.NOM protect.DT-3SG shield.SG.OBJ porridge.SG.OBJ
 ‘He/She protects porridge with a shield’

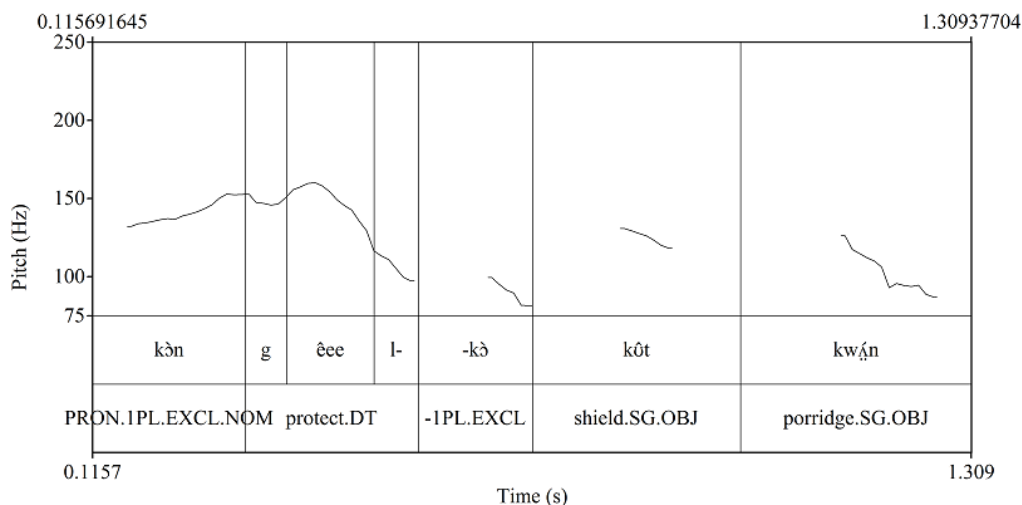
³ With the exception of the 1Plural Inclusive form, which is associated with a Rising toneme in all verbs.



- c. 1SG: falling tone in the stem
 yǎn gêeel-à kôt kwân
 1SG.NOM protect.DT-1SG shield.SG.OBJ porridge.SG.OBJ
 'I protect porridge with a shield'



- d. 1PL.EXCL: falling tone in the stem
 kòn gêeel-kò kôt kwân
 1PL.EXCL.NOM protect.DT-1PL.EXCL shield.SG.OBJ porridge.SG.OBJ
 'We protect porridge with a shield'



As with other examples of the falling pitch illustrated earlier, the F0 in Fig. 7c and 7d has accomplished its fall by the end of the syllable (which is not always vowel-final in these particular examples). The high level pitch over the breathy vowel in Fig. 7a and Fig. 7b remains high at the end of the syllable even if the final point of the pitch trajectory is overall falling, with the low point in the next syllable.

Consideration of examples such as those presented in Fig. 6 and 7 lead us to reject the possibility that the alternation between the falling and the high level tonal contour over the verbal stem vowel is an independent inflectional marker. The alternation between the two tonal contours follows the distribution of breathy vs modal vowels precisely, as summarized in Table 5.

Table 5: Distribution of falling and high level tones in the verbal stem

	Stem with a breathy vowel (not /ɛ/, /ɔ/)	Stem with a modal vowel	Stem with /ɛ/, /ɔ/
1SG (modified vowel)	gɔ̃aaar-ɔ̃ 'write.TR-1SG'	gɔ̃aaŋ-ɔ̃ 'come out to welcome.TR-1SG'	gɛeel-ɔ̃ 'protect.TR-1SG'
2SG (basic vowel)	gɔ̃ɔ̃ar-ɔ̃ 'write.TR-2SG'	gɔ̃ɔ̃ŋ-ɔ̃ 'come out to welcome.TR-2SG'	gɛeel-ɔ̃ 'protect.TR-2SG'

We see the same relationship between phonation and tone in nominal forms: stems that have a modal vowel may be associated with a falling pitch (i.e. *rɔ̃ɔ̃om* 'sheep.PL.NOM', *tɔ̃ŋ-nɔ̃* 'egg.PL-OBL', etc.), but never a high level contour. Stems that have a breathy vowel, may be associated with a high level pitch (i.e. *pɔ̃aaar* 'cloud.PL.NOM', *ŋwɔ̃g-nɔ̃* 'neck.PL-OBL', etc.) but never a falling pitch. The relationship between the realization of the High toneme and the phonation on the vowel is very robust. In fact, as will be now shown, this phenomenon extends to vowels of segmental affixes also.

Let us take a brief look at the inflectional verbal suffixes. Two of them – the 1SG and the 2SG – contain breathy vowels, while the rest contain modal vowels. The inflectional suffixes are not associated with inherent tonal values⁴. Depending on the grammatical properties and the lexical

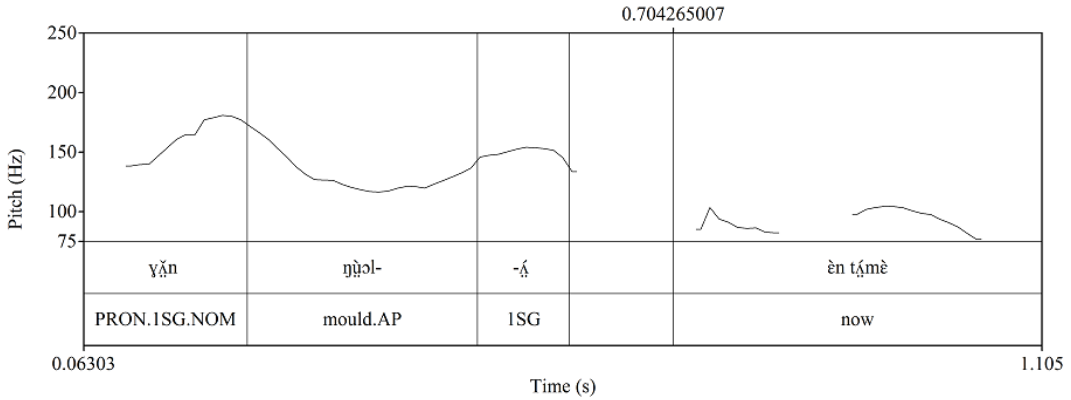
⁴ Again, the 1Plural Inclusive form is an exception in regard to tone, as it is associated with a set LH-HL tonal pattern (LH on the stem, HL on the suffix) independently of the morphological and lexical properties of the verb.

class of the verb, all singular and all plural inflectional suffixes in the same paradigm are either low-toned or alternate between a high and a falling tone depending on the phonation of the suffix vowel. In the latter case, the tone of the suffix is realized as a high level pitch in 1SG and 2SG forms (-ǎ and -ǎ correspondingly), but as a fall with all other persons (3SG -ê, 1PL.EXCL -kɔ̃, 1PL.INCL -nê, 2PL -ê, 3PL -kê). We suggest that the suffix is associated with a High toneme in paradigms with this tonal pattern. Fig. 8 shows an example of all singular personal forms and a 2PL form (as representative of plural personal forms) from the verbal paradigm with a low-toned stem *ɲùl-* ‘mould.AP’ and an underlying High toneme on the suffix.

Fig 8. Realization of the High toneme in the inflectional suffixes (Speaker A)

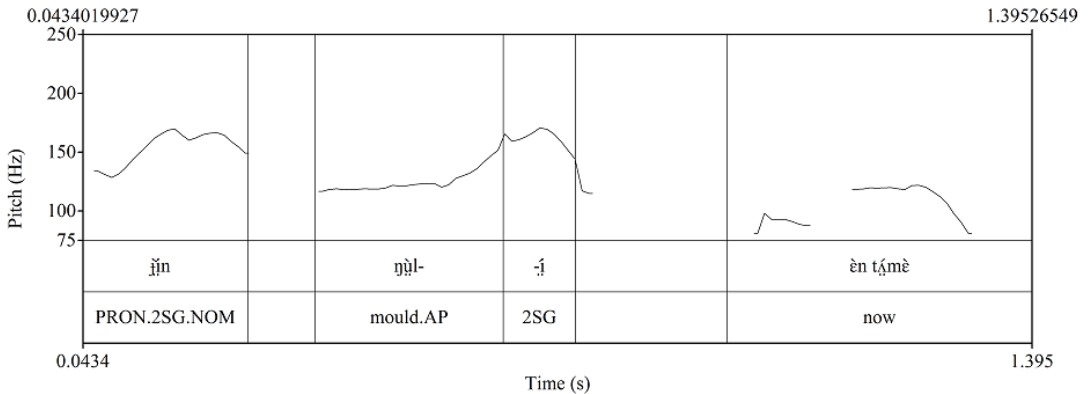
a. Breathy suffix: 1SG

ɣǎn ɲùl-ǎ èntǎmè
 1SG.NOM mould.AP-1SG now
 ‘I’m moulding now’



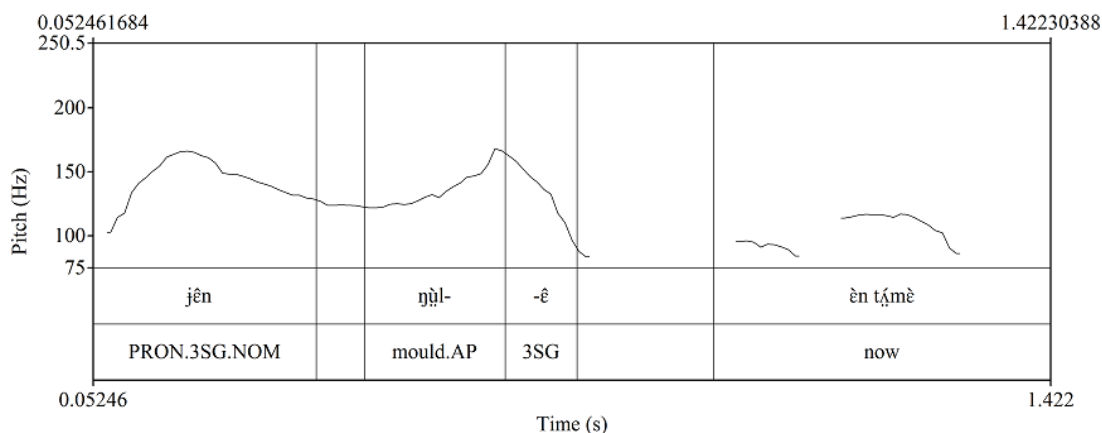
b. Breathy suffix: 2SG

ǰǎn ɲùl-ǎ èntǎmè
 2SG.NOM mould.AP-2SG now
 ‘You are moulding now’



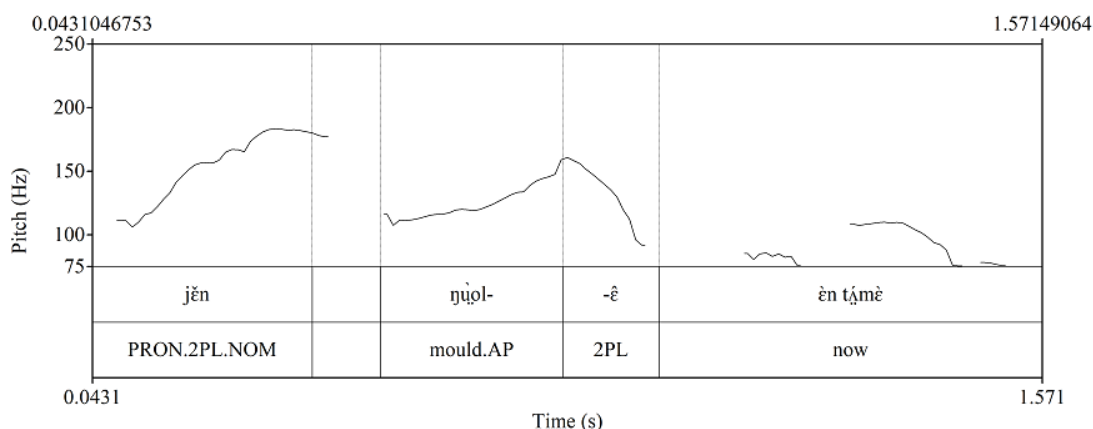
c. Modal suffix: 3SG

ǰên ɲùl-ê èntǎmè
 3SG.NOM mould.AP-3SG now
 ‘He/she is moulding now’

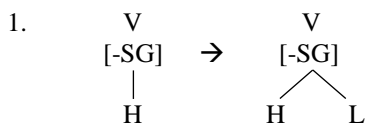


d. Modal suffix: 2PL

jën ὴùl-ê èntɔ̀mè
 2PL.NOM mould.AP-2PL now
 ‘You (PL) are moulding now’



Since this article avoids discussing rules involved in morphotonemic processes, for the purposes of description of the Nuer tonal system we assume that there is only a High toneme that can have a high and a falling allotones. In autosegmental terms the allotonic variation can be captured by a single rule in (1), which adds an L after H if it is linked to a vowel associated with a [-Spread Glottis (SG)] feature (i.e. a modal vowel).



The alternation between falling and level pitch contours based on the phonation of the vowel serves as a secondary indicator of vowel quality contrast. Moreover, in the speech of Nuer speakers with vanishing or marginal vowel phonation contrasts, the contrast between the level and the falling allotones seems to be taking on a role of a primary indicator of the difference in vowel quality. In our experience, vowels pronounced with correct phonation but with an incorrect tonal contour are perceived by native speakers to have unintended phonation. For example, the word *túk*

‘bead.SG’ pronounced with a high level pitch contour is recognized as *tjik* by Nuer speakers and may be identified either as *tjik* ‘cloud over sun’ or as *tjik* ‘chin’. In order to make the vowel recognizable as modal, the falling pitch is obligatory. Further experimental work is required to ascertain the role that tonal contour plays in recognition of the vowel phonemes.

5. Allotones of the Rising toneme

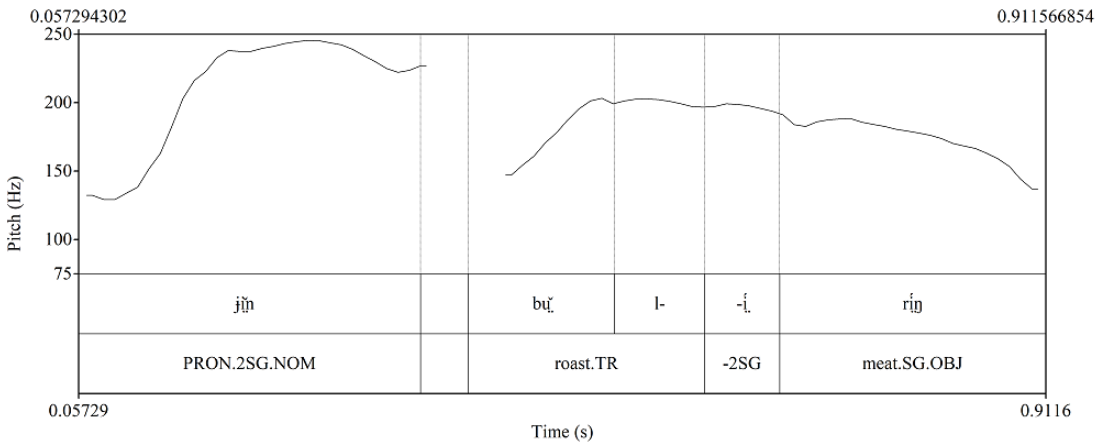
Of the three tonemes found in Nuer, the Rising toneme shows the most variation in its realization. In addition to having a variant that is pronounced with a rising pitch, it also has a mid, low, and falling allotones. As with the High toneme, phonation of the vowel plays a role in conditioning some of the allotonic variation.

5.1 Mid allotone of the Rising toneme. Figure 9 shows the form *bɿl-í* ‘roast.TR-2SG’ as pronounced by three Nuer speakers. Speaker A and speaker B are speakers of the Nasir Gatjiok dialect, which is part of the Eastern Nuer dialectal group. Speaker C is a Western Nuer speaker from Bentiu. There exists a dialectal variation in pronunciation of singular transitive forms with short sonorant-final stems such as *bɿl-* ‘roast.TR’ (i.e. sonorant-final stems belonging to what we call a Class I tone-length class). In Eastern Nuer the vowel in the singular stem is short, i.e. *bɿl-í*, while in Western Nuer the vowel in the stem is overlong, i.e. *bɿuul-í* (see Monich and Baerman 2019).

Figure 9. Variation between speakers in realization of the Rising toneme in the verbal stem

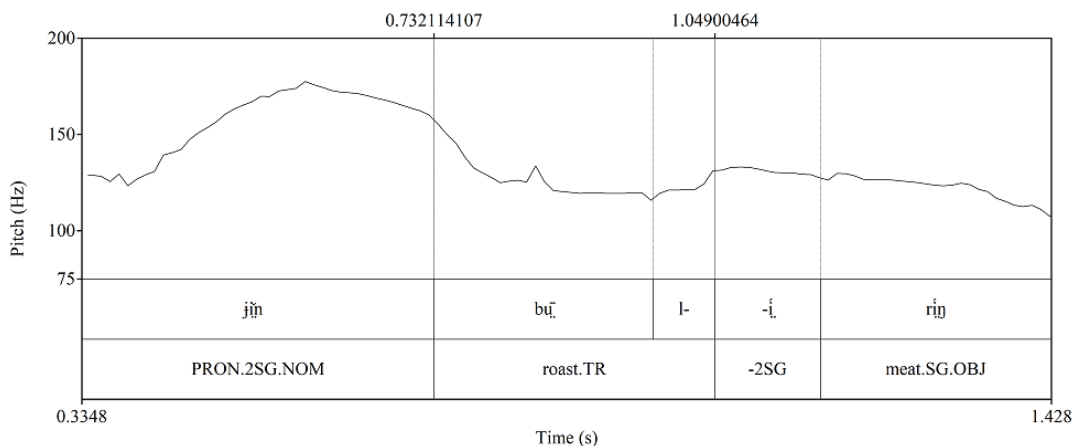
- a. Speaker A (Nasir)

j̃ɿn	bɿl-í	r̃ɿŋ
2SG.NOM	roast.TR-2SG	meat.SG.OBJ
‘You roast meat’		

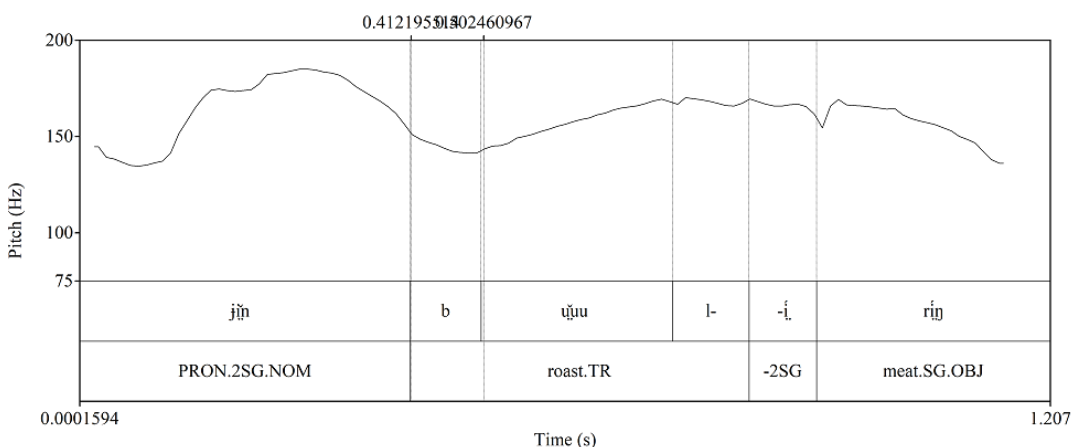


- b. Speaker B (Nasir)

j̃ɿn	bɿl-í	r̃ɿŋ
2SG.NOM	roast.TR-2SG	meat.SG.OBJ
‘You roast meat’		



c. Speaker C (Bentiu)
 jɿn bɿuul-ị riŋ
 2SG.NOM roast.TR-2SG meat.SG.OBJ
 ‘You roast meat’



As Fig. 9 shows, the short stem vowel in *bɿl-ị* is pronounced with a rising pitch by speaker A. Speaker B pronounces the same stem at a slightly lower pitch than the following segmental suffix, but without any audible rise. In other words, speaker B has a mid tone on the stem. Speaker C, who, as a speaker of Western Nuer dialect, has an overlong vowel in the stem, pronounces the stem vowel with a rising pitch.

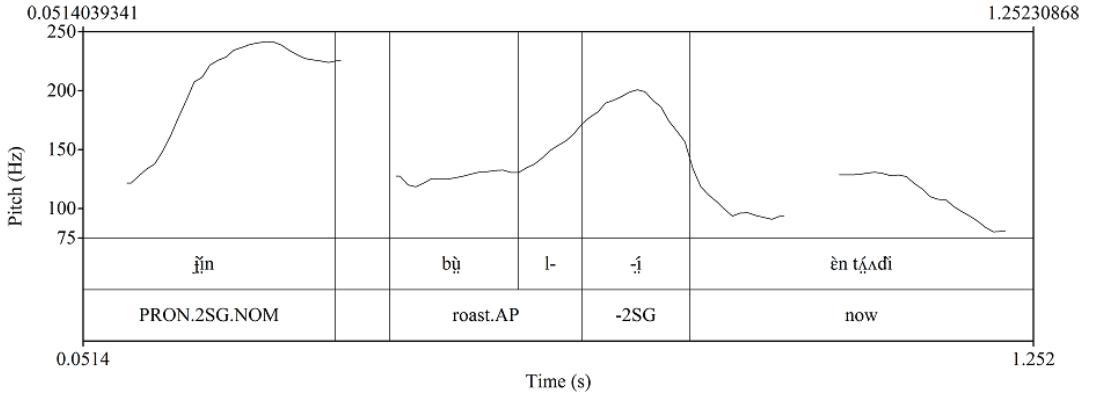
For the same three speakers, this Rising toneme is contrastive with a Low toneme, which has an F0 that is much lower than that of the following high-toned inflection. Figure 10 shows the 2SG antipassive stem *bɿl-* ‘roast.AP’ pronounced by speakers A, B, C. This form has a Low toneme on the stem and a high-toned inflection, as expected for the verbs of this class (Monich and Baerman 2019). There are no dialectal differences in pronunciation of the antipassive forms. All speakers clearly pronounce the stem of the verb on a pitch lower than the following inflectional suffix, sometimes, as Fig. 10a shows, drastically so. For speaker B the difference between mid and low tone of the stem before a high tone on the inflection is quite subtle: the pitch of the stem in both forms is at 120 Hz, but the inflection is at 130Hz following the mid tone on the stem (Fig. 9b), and at 143 Hz following the high tone on the stem (Fig. 10b). For this particular speaker, who has a very

limited dynamic range, the difference is enough to distinguish between the transitive form in Fig. 9b and the antipassive form in Fig. 10b.

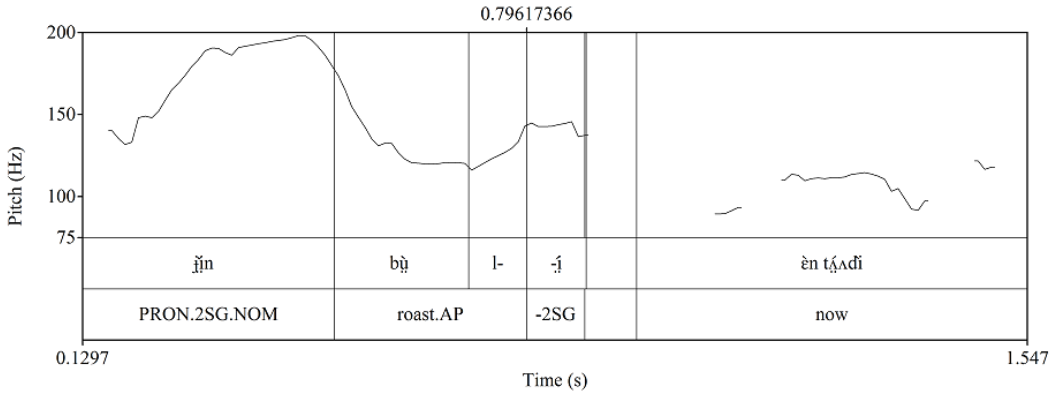
Fig. 10. Realization of the Low toneme in the verbal stem by several speakers

ǰǰn bǰl-ǰ èntǰǰdi
 2SG.NOM roast.AP-2SG now
 ‘You roast now’

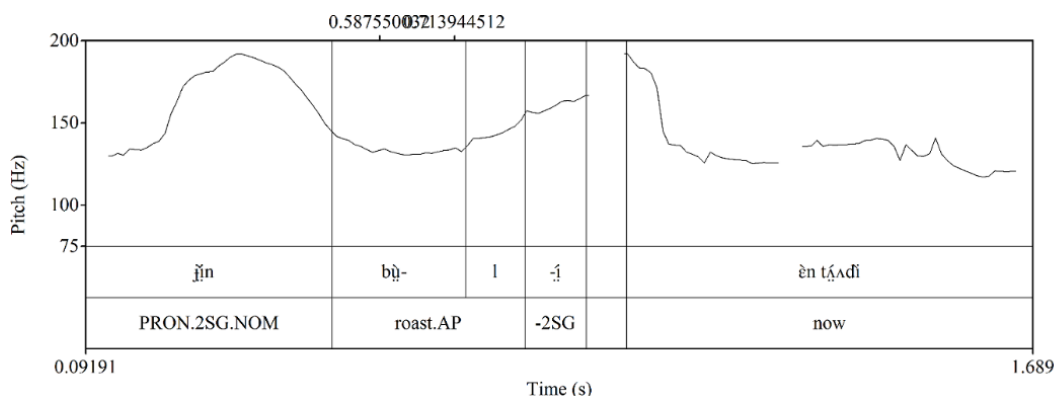
a. Speaker A (Nasir)



b. Speaker B (Nasir)



c. Speaker C (Bentiu)



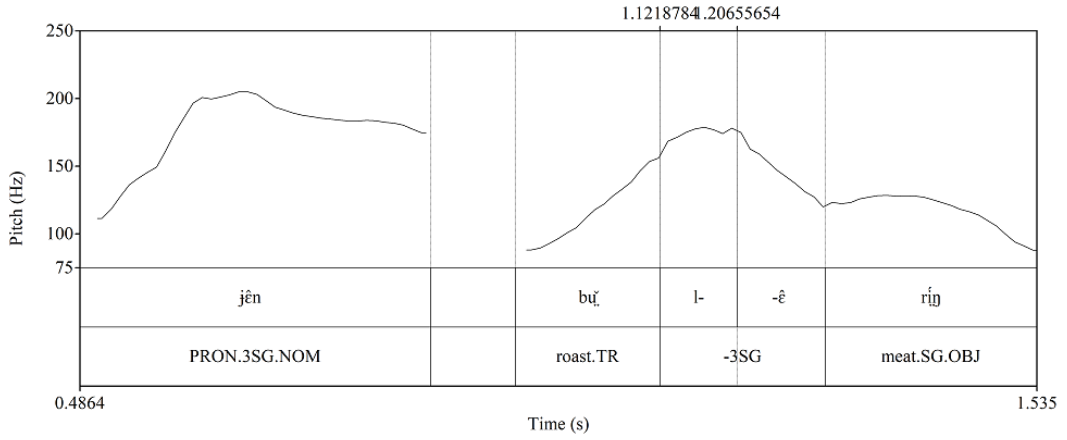
The mid tone is always non-contrastive with a rising tone. These two pitch patterns are thus two allotones of the same toneme. In some phonological environments they are found in free variation. For example, as Fig. 9 shows, in identical contexts the Rising toneme is pronounced with a mid allotone by some speakers (Fig. 9b) but with a rising allotone by others (Fig. 9a). There are some phonological factors which condition preference for one allotone vs. the other even when both realizations of the Rising toneme are acceptable. The mid allotone tends to be preferred on short vowels, while the rising allotone is preferred on longer vowels. It appears also that the rising allotone is more often encountered on breathy vowels than its mid variant, so the phonation of the vowel seems to play a role. A rising allotone is also more likely to be found phrase-initially (after a pause) than the mid allotone.

There are, however, some contexts which demand the rising or the mid allotone of the Rising toneme without possibility of free variation. Thus, the situation illustrated in Fig. 9, where the Rising toneme on the inflected verbal stem is optionally realized with either its rising or its mid allotone, is possible only in 1/2SG inflected forms, where the inflectional suffix, associated with a High toneme, has a breathy vowel. Before inflectional endings which are associated with a High toneme but contain a modal vowel (and are therefore realized with a falling allotone of the High toneme), the Rising toneme on the stem is realized invariably as a rise, never as a mid tone. Fig. 11 shows that speakers A, B, C pronounce the 3SG form of the same paradigm with a characteristic rise-fall pitch contour which will be encountered again in Section 5.2.

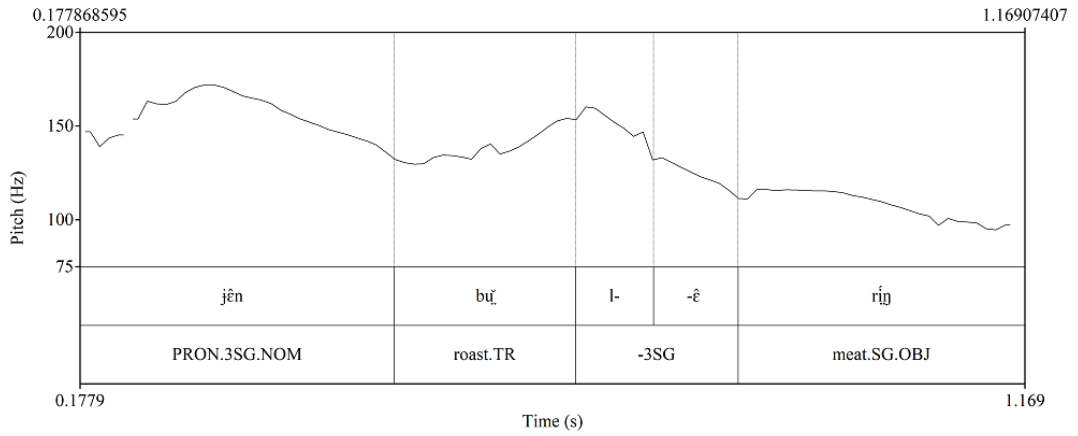
Fig 11. Realization of the Rising toneme in the stem before a falling inflection by several speakers

EN	j̄en	b̄ùl-ê	r̄ij̄
WN	j̄en	b̄ùuul-ê	r̄ij̄
	3SG.NOM	roast.TR-3SG	meat.SG.OBJ
	'He/she roasts meat'		

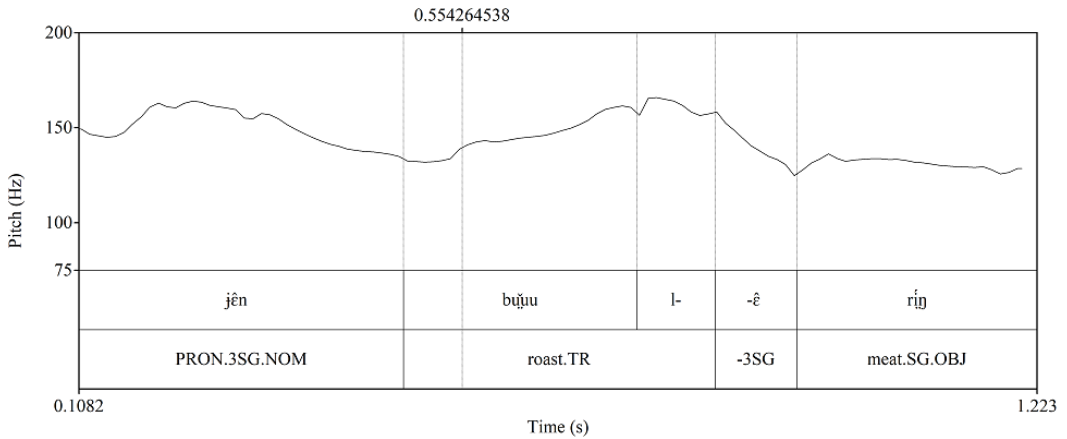
a. Speaker A (Nasir)



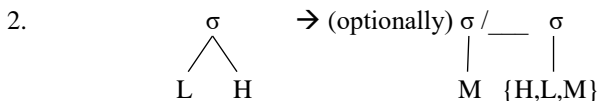
b. Speaker B (Nasir)



c. Speaker C (Bentiu)



The hard rule guiding realization of the Rising toneme therefore prohibits it from being realized as a mid tone before a fall in the next syllable. However, instead of stating this rule in negative terms, it is better to specify the apparent environments where conversion of LH into M can apply, as shown in (2).



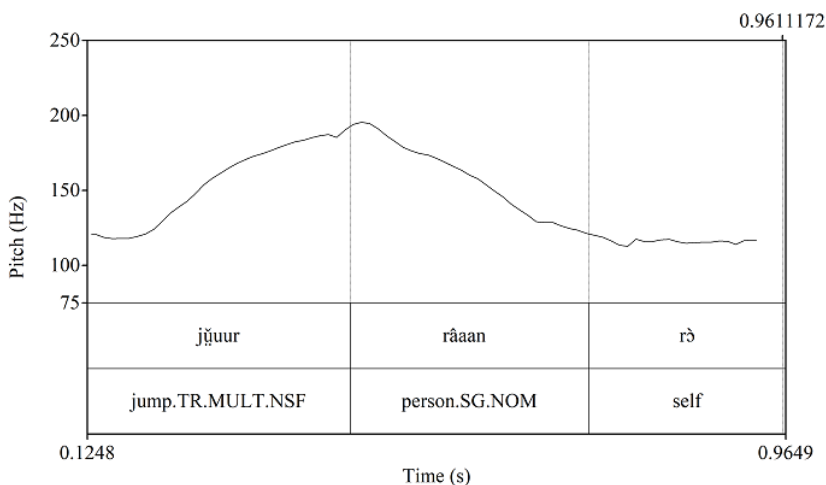
The rule in (2) states that an LH sequence can optionally be converted to M before a syllable associated with H, L or M tonal autosegments. In this section, we presented evidence that LH sequence may be converted to M before the high allotone of the High toneme in the next syllable. In sections 5.2 and 5.3 we will show that this rule applies also before a Low toneme and before a mid allotone of the Rising toneme.

5.2 The falling allotone of the Rising toneme. The mid tone is not the only allotone of the Rising toneme. In some contexts, an underlying Rising toneme may be realized also as a fall, provided that the vowel is modal. This allotone can be observed most readily in nouns following monosyllabic verbal forms such as an uninflected verb or an inflected auxiliary. Some examples with an uninflected form of the verb were provided earlier in the article; recall that in Fig. 3b,c the postverbal subject /râaan/ ‘person’ had a falling pitch contour after uninflected verbal forms with a low or a rising pitch. Below we provide several more examples where the noun /râaan/ ‘person’, which is underlyingly associated with a Rising toneme, is realized with a falling allotone (*râaan*): two examples where /râaan/ follows an uninflected verb with a Rising toneme (Fig. 12a), and two examples where /râaan/ follows an uninflected verb with a Low toneme (Fig. 12b).

Fig. 12. Falling allotone of the Rising toneme (Speaker A)

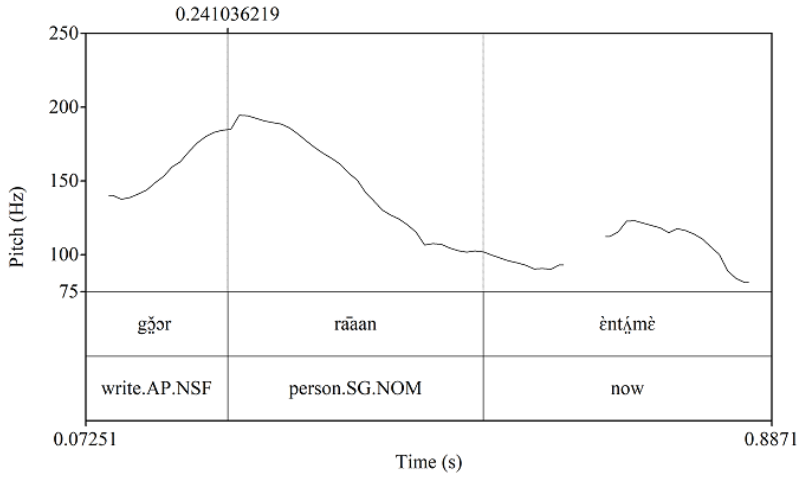
a. After a Rising toneme

- i. $\begin{array}{ccc} \text{j\ddot{u}uur} & \text{r\ddot{a}aan} & \text{r\grave{o}} \\ \text{jump.TR.MULT.NSF} & \text{person.SG.NOM} & \text{self} \\ \text{‘A person jumps many times’} & & \end{array}$



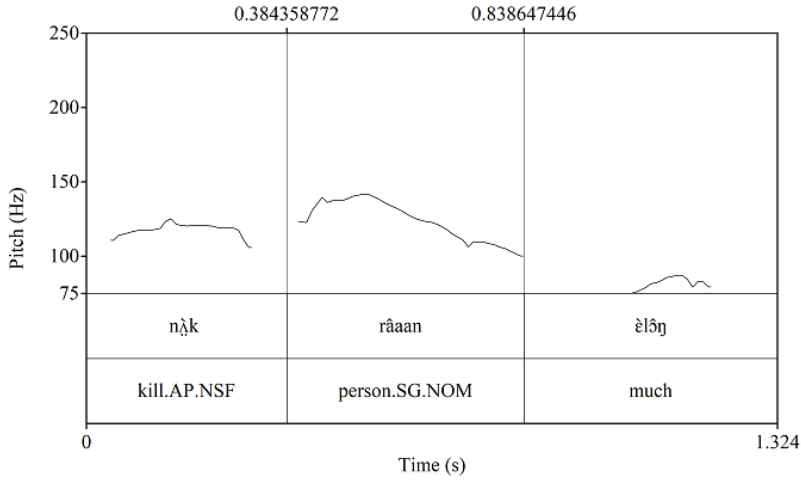
- ii. $\begin{array}{ccc} \text{g\ddot{o}or} & \text{r\ddot{a}aan} & \text{\textasciitilde{e}nt\grave{a}m\grave{e}} \\ \text{write.AP.NSF} & \text{person.SG.NOM} & \text{now} \end{array}$

‘The person writes now’

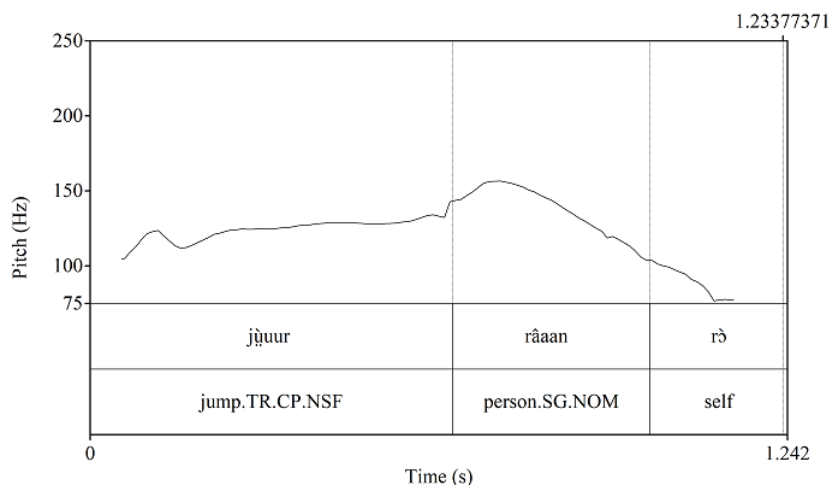


b. After a Low toneme

- i. nək **rāaan** ɛ̃lɔŋ
 kill.AP.NSF person.SG.NOM much
 ‘The person kills a lot.’



- ii. j̣ụur **rāaan** rɔ̃
 jump.TR.CP person.SG.NOM self
 ‘A person jumps towards me.’

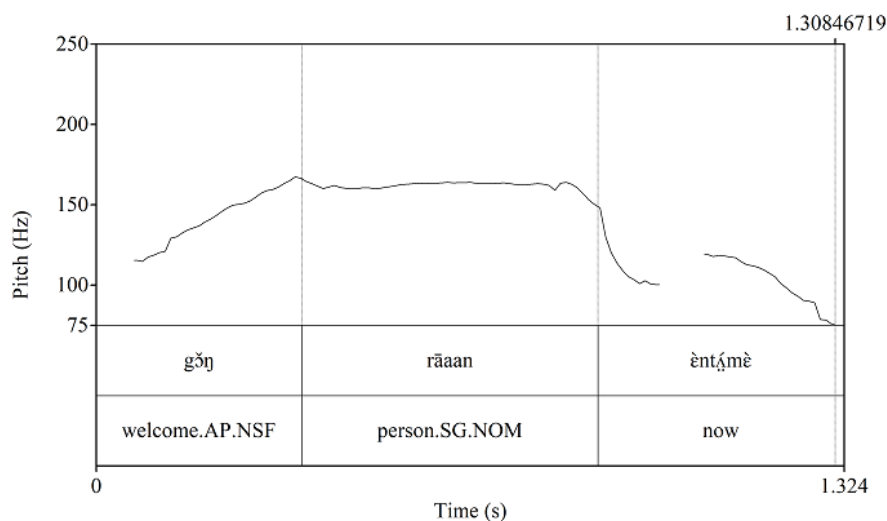


Realization of the Rising toneme with a falling pitch in this case is apparently optional, as the mid allotone may also be used. In support of this assertion, Fig. 13 provides two examples of the same postverbal subject /rāaan/ but this time realized with a mid level pitch, i.e. *rāaan*, following uninflected verbs with Rising (Fig. 13a) and Low tonemes (Fig. 13b).

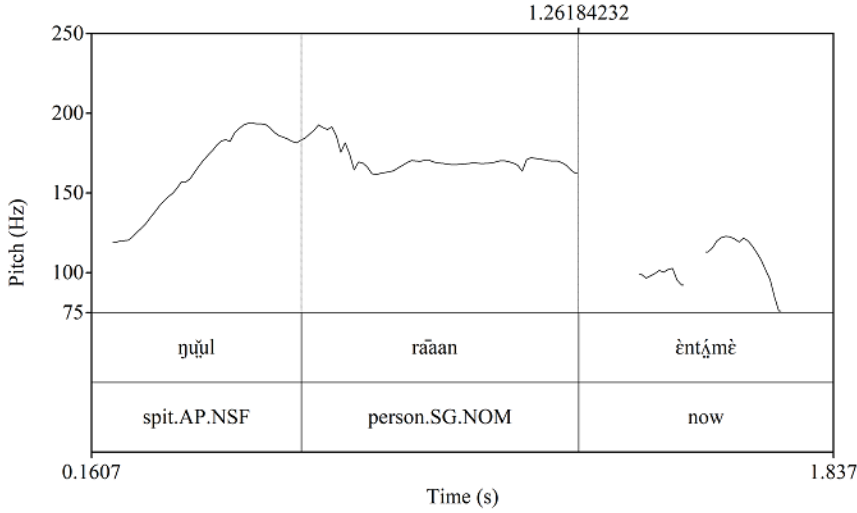
Fig. 13. Mid allotone of the Rising toneme (Speaker A)

a. After the Rising toneme

- i. gǒŋ rāaan èntámè
 welcome.AP.NSF person.SG.NOM now
 ‘The person comes out to welcome now’

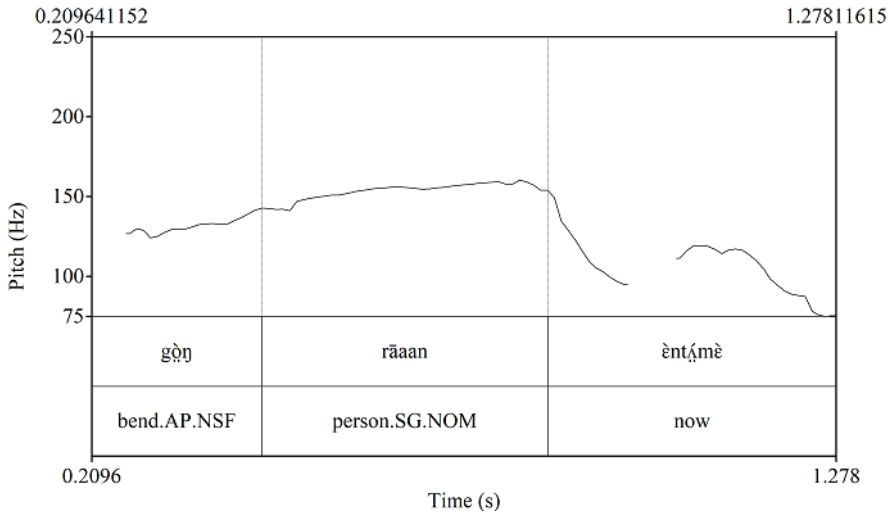


- ii. ɲǔul rāaan èntámè
 spit.AP.NSF person.SG.NOM now
 ‘The person spits now’

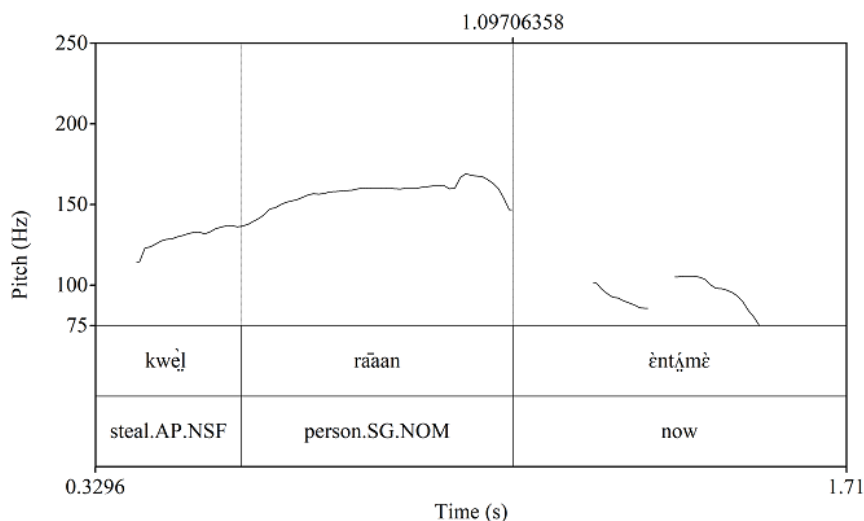


b. After the Low toneme

- i. g̊ɔ̄ŋ rāaan ɛ̀nt̪ámè
 bend.AP.NSF person.SG.NOM now
 ‘The person bends now’

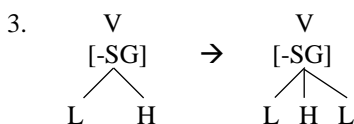


- ii. kw̄ɛl rāaan ɛ̀nt̪ámè
 steal.AP.NSF person.SG.NOM now
 ‘The person steals now’

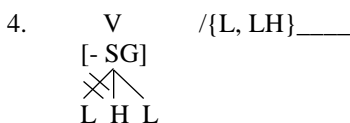


We thus find one more context (in addition to the context captured by rule (2)) where the mid allotone is in free variation with another allotone of the Rising toneme. Following a rising or a low tone on a preceding syllable, the Rising toneme may be realized with either the falling or the mid allotone if the second syllable contains a modal vowel. If the second syllable contains a breathy vowel, however, only the mid allotone of the Rising toneme may be used.

We can account for the existence of the falling allotone of the Rising toneme by extending the rule in (1), which inserts an L after H in modal vowels, to apply in syllables associated with an LH tonal melody also (i.e. where H is part of LH combination), as in (3).



The result of L-insertion after an H-tone by the rule in (1) is a syllable associated with the HL tonal melody, and this contour is simple enough. However, when applied to a syllable with an LH melody, L-insertion by the rule in (3) yields LHL tonal contour. Nuer seems to disallow three tonal autosegments linked to the same syllable in the surface realization of the tonal contour (a constraint against tonal overcrowding), and various repairs may be applied to simplify this complex tonal contour, depending on the phonological context. One possible repair is to disassociate the final L, leaving behind a rising pitch contour. In phrase-final positions the LH may be further reduced to an L by deleting the middle H (see Section 5.3). However, in some tonal contexts the LHL sequence associated to a single syllable is repaired by disassociating the initial L autosegment by the operation in (4). Disassociation of the initial L in the LHL tonal contour takes place if the preceding syllable is associated with a Low or with another Rising toneme. The examples in Fig. 3b and Fig. 12b illustrate the former case, while the examples in Fig. 3c and Fig. 12a illustrate the latter case.



Of course, when an LH sequence is optionally converted to M by the rule in (2), as in all examples in Fig. 13, it is no longer eligible to undergo L-insertion by the rule in (3), since the

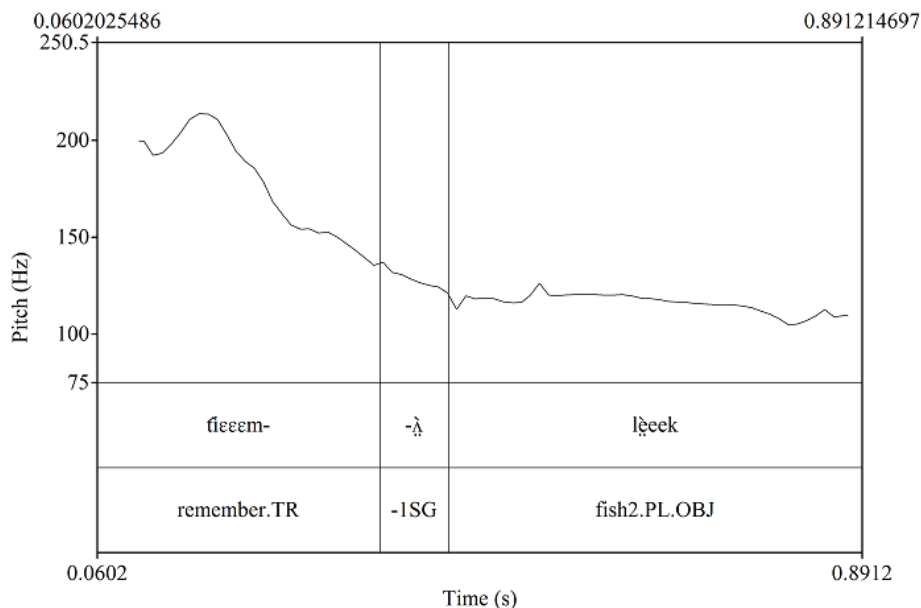
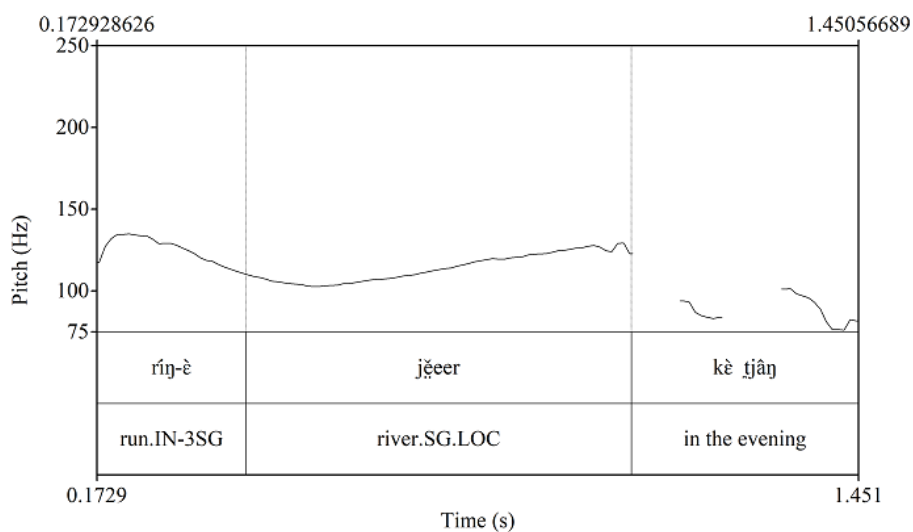


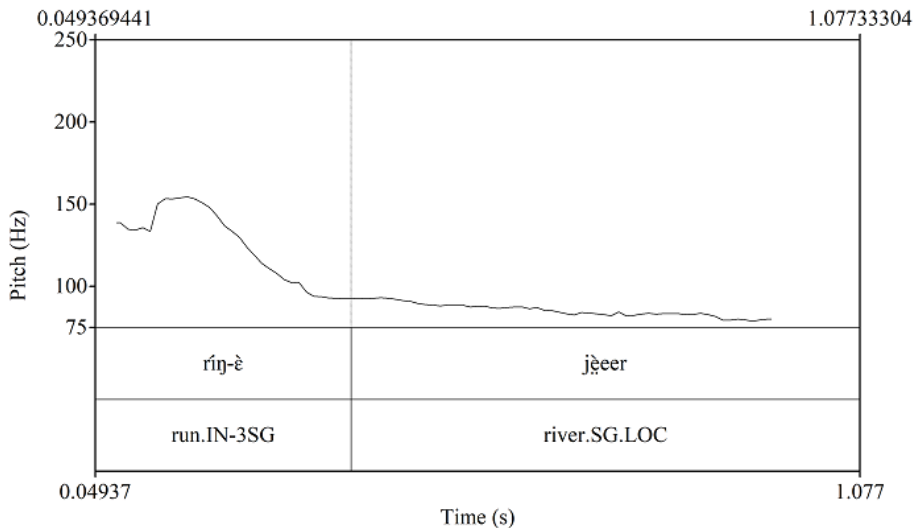
Figure 15 provides another example of the Rising toneme surfacing with low tonal contour, this time using a locative object. The locative object /jǽer/ ‘river.SG.LOC’ is pronounced with a rising tone when placed in a phrase-medial position, as in Fig. 15a, but with a low tone in a phrase-final position, as in Fig. 15b.

Fig. 15. A locative noun with a Rising toneme phrase-finally and phrase-medially (Speaker A)

- a. Rising toneme (/jǽer/) → rising tone ([jǽer]) phrase-medially
 rɪŋ-è **jǽer** kè tʃân
 run.IN-3SG river.SG.LOC PREP evening.SG.OBJ
 ‘He/she is running to the river in the evening’



- b. Rising toneme (/j̥eer/) → low level tone ([j̥eer]) phrase-finally
 r̥ɪŋ-è **j̥eer**
 run.IN-3SG river.SG.LOC
 ‘He/she is running to the river’



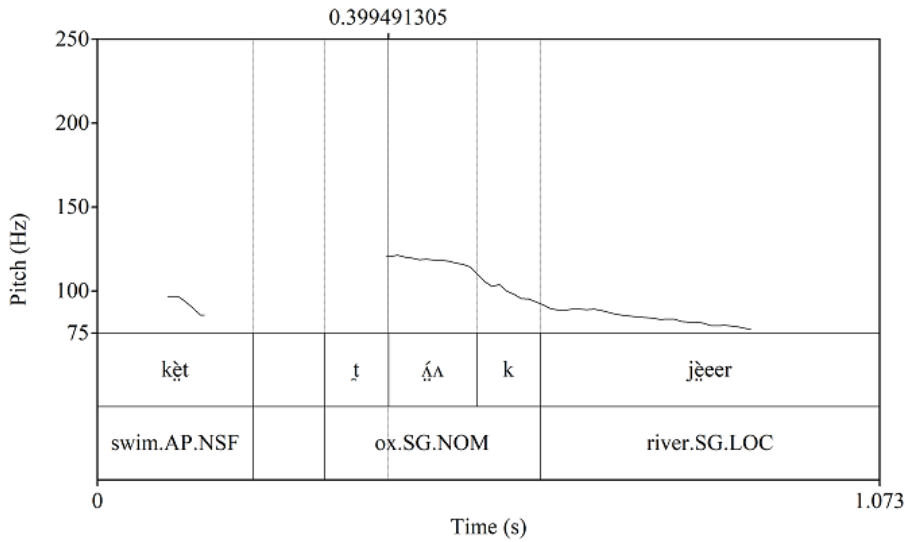
This pattern of neutralization between the Rising and the Low toneme can be captured in autosegmental terms, presuming that the Rising toneme consists of two autosegments L and H. Phrase-finally, the H that follows an L in the same syllable is disassociated by the rule in (5), so that the whole syllable is realized with a low pitch.

5. $\begin{array}{c} \sigma]_{\text{Phr}} \\ / \quad \backslash \\ L \quad H \end{array}$

However, the Rising toneme does not neutralize with the Low toneme in all phrase-final positions. For example, consider how the tonal contour of /j̥eer/ ‘river.SG.LOC’ varies in phrase-final position depending on the tone of the preceding noun. Figure 16 illustrates the tonal contour of this locative adjunct following subjects associated with various tonemes. Each toneme is exemplified with two nouns of contrasting phonation.

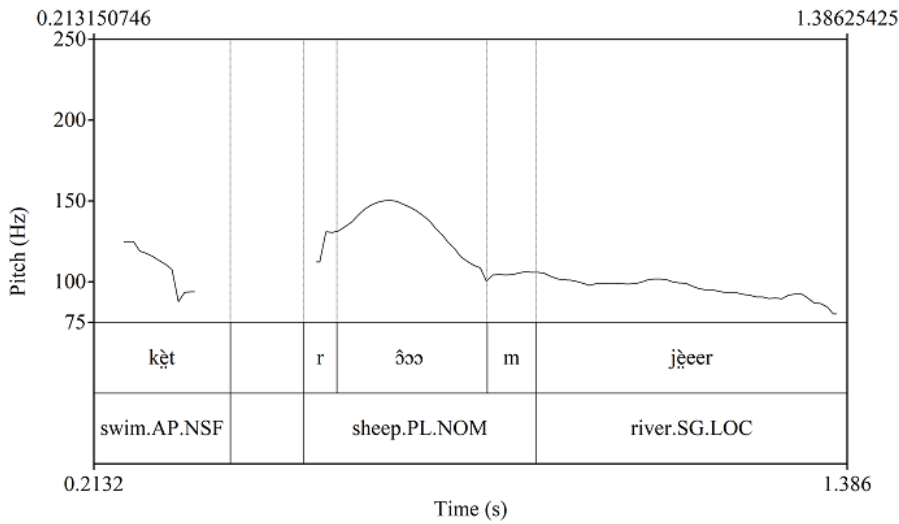
Fig 16. A phrase-final locative noun with a Rising toneme following nouns with various tonal properties and vowel phonation (Speaker A)

- a. After a High toneme:
 i. Low after [t̥ʌk] (high allotone of the High toneme)
 k̥et t̥ʌk **j̥eer**
 swim.AP.NSF ox.SG.NOM river.SG.LOC
 ‘An ox swims in the river’



ii. Low after [rɔɔm] (falling allotone of the High tone)

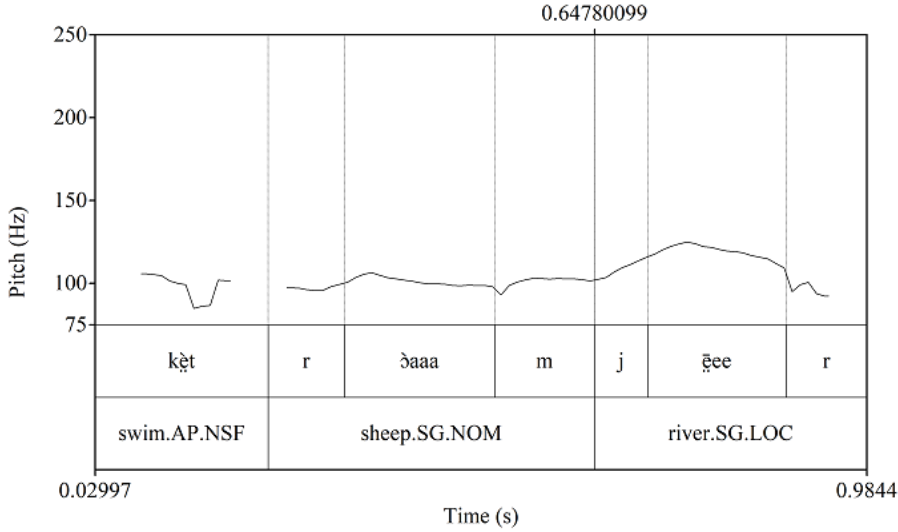
kɛt rɔɔm **jɛɛr**
 swim.AP.NSF sheep.PL.NOM river.SG.LOC
 ‘Sheep swim in the river’



b. After a Low toneme:

i. Mid after [rɔaaam] (Low toneme)

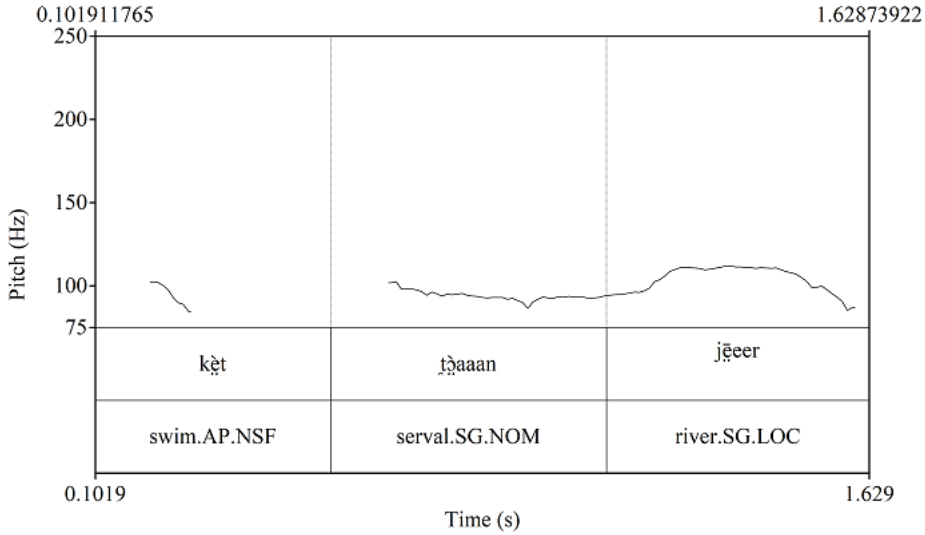
kɛt rɔaaam **jɛɛr**
 swim.AP.NSF sheep.SG.NOM river.SG.LOC
 ‘A sheep swims in the river’



ii. Mid after [t̚ðaaan] (Low toneme)

kët	t̚ðaaan	j̄eer
swim.AP.NSF	serval.SG.NOM	river.SG.LOC

‘A serval swims in the river’

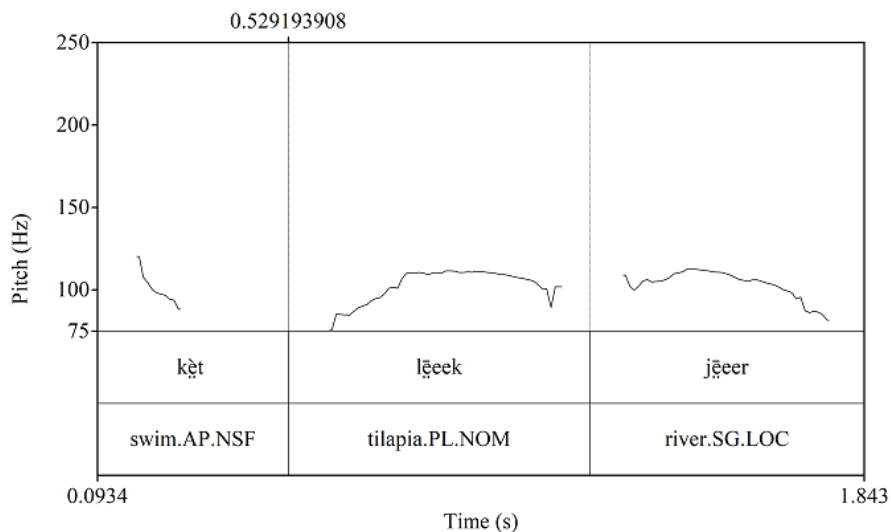


c. After a Rising toneme:

i. Mid after [l̄eek] (mid allotone of the Rising toneme over a breathy vowel)

kët	l̄eek	j̄eer
swim.AP.NSF	tilapia.PL.NOM	river.SG.LOC

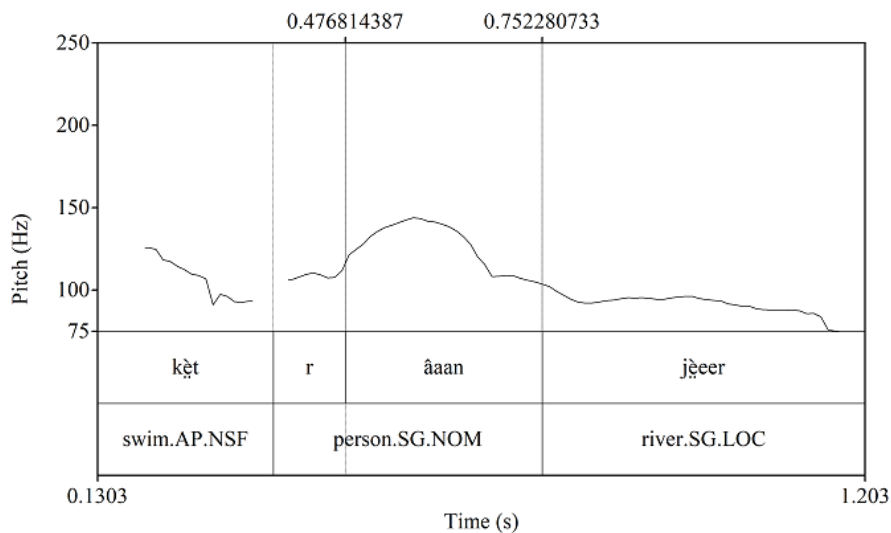
‘Tilapia swim in the river’



ii. Low after [râaan] (falling allotone of the Rising toneme over a modal vowel)

kët	râaan	jëer
swim.AP.NSF	person.SG.NOM	river.SG.LOC

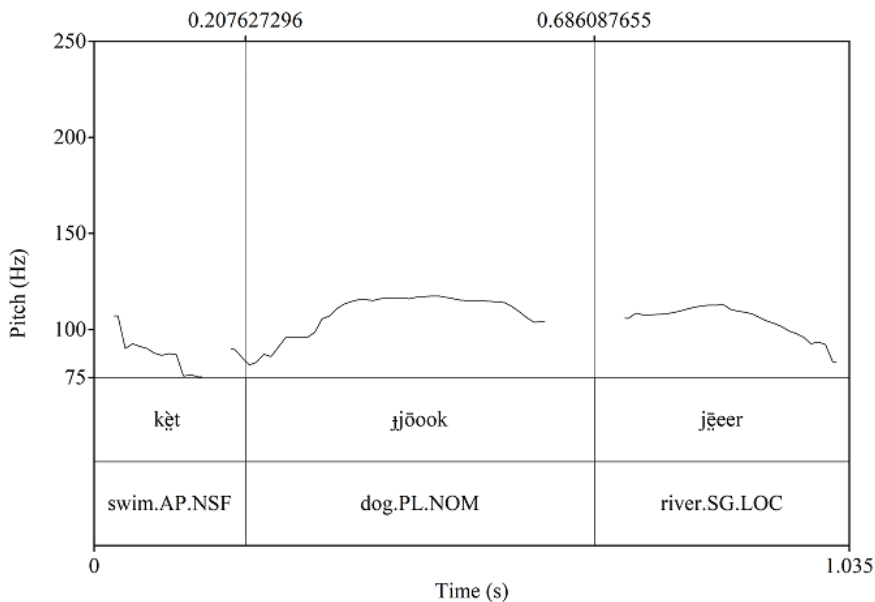
‘A person swims in the river’



iii. Mid after [jjōook] (mid allotone of the Rising toneme over a modal vowel)

kët	jjōook	jëer
swim.AP.NSF	dog.PL.NOM	river.SG.LOC

‘Dogs swim in the river’



In Fig. 16a, following a noun with the High toneme (either its high or its falling allotone), the adjunct /jēer/ is realized with a low pitch. In Fig. 16b, following a noun with a Low toneme, the adjunct /jēer/ is realized with a mid allotone. Following a noun lexically associated with a Rising toneme, as in Fig. 16c, the tone of the adjunct /jēer/ apparently depends on the allotone of the Rising toneme that is used in the preceding syllable. If the preceding noun is associated with a mid allotone, as in Fig. 16c-i, /jēer/ is realized with a mid allotone also: it is pronounced on exactly the same pitch as the subject [lĕeek] (/lĕeek/) ‘tilapia.PL.NOM’. If, however, the preceding noun is pronounced with a falling allotone of the Rising toneme (which is possible only if it contains a modal vowel), as in Fig. 16c-ii, the adjunct /jēer/ has a low tone: it is pronounced lower than the preceding subject [rāaan] (/rāaan/) ‘person.SG.NOM’. Clearly, the choice of the allotone of the Rising toneme for the subject affects realization of the Rising toneme of the adjunct.

Therefore, we see that even in a phrase-final position, the Rising toneme is not realized with its low-pitched variant automatically: it alternates between a mid and a low allotone depending on the tonal properties of the preceding word. Nevertheless, these facts are consistent with the autosegmental analysis suggested in Section 5.2: when the sequence LH is converted to M, operations targeting either of the two autosegments comprising the underlying contour of the Rising toneme LH may no longer apply. The rule in (5), which is responsible for the generation of the low allotone of the Rising toneme phrase-finally, is bled by LH → M transformation. The result is that the Rising toneme may be realized with either one of two pitch contours phrase-finally: low or mid. In the next section we address the reason why the second LH sequence in this and other contexts is sometimes converted to M and sometimes is not.

5.4 Limits of variability in realization of the Rising toneme. In summary, we find that, while realization of the tonal contour of the High and Low tonemes is independent of the surrounding tonal context, the allotony of the Rising toneme is very much conditioned by its tonal environment. It is impossible to illustrate and analyze all possible contexts here. However, it is clear that much of the variation in realization of the Rising toneme is aimed at minimization of contouring, i.e. keeping peaks and troughs to a minimum. Note that various complex combinations of H and L are permitted and, when involving successions of High and Low tonemes, cannot be avoided. For example, two High tonemes over modal vowels are realized as an HL-HL sequence (where the dash indicates a syllable boundary) without any further adjustments. However, sequences involving the Rising

toneme take advantage of allotonic variation in its realization in order to minimize tonal contouring. Thus a Rising toneme followed by a High toneme, where both syllables contain modal vowels, is realized only as LH-HL tonal sequence, and not as HL-HL or M-HL. The mid and the falling allotone of the first Rising toneme cannot be employed in this environment, as both the HL-HL sequence, which requires two falls, and the M-HL sequence, which involves a pitch plateau followed by a peak and a fall, are more complex to execute than the sequence LH-HL, which consists of a single peak.

Likewise, sequences of two Rising tonemes (such as illustrated, for example, in Fig. 16c) are never realized as LH-LH. Two adjacent syllables associated with a Rising toneme in the underlying representation may have the following surface tonal contours in non-phrase-final position: M-M, LH-M, LH-HL (if the second syllable has a modal vowel), HL-LH (if the first syllable has a modal vowel). Complex tonal contours LH-LH and M-LH are avoided through several strategies which make use of various allotones of the Rising toneme. One of the ways that the complex melody LH-LH may be simplified is by converting the second LH combination into M as shown in (6).

6. LH-LH → LH-M.

In this case, the first LH sequence may also be converted into M as a matter of free variation by the rule in (2) (with the usual tendencies discussed in Section 5.1).

Conversion of the LH sequence into M after another LH is the only strategy available for repairing the LH-LH tonal sequence when the vowel of the second syllable is breathy. However, when the second syllable contains a modal vowel, the allotone HL may also be yielded by a combination of the rules in (3) and (4). In other words, the sequence LH-LH may undergo the following transformations: LH-LH → LH-LHL → LH-HL. Note that in accordance with the rule in (2), in cases where the second of two consecutive Rising tonemes is realized as a fall, the first Rising toneme must be realized as a rise, without the option of being converted into a mid tone.

Availability of these two strategies in dealing with consecutive Rising tonemes is the reason for the possibility of alternate tonal contours in some constructions. Thus we see an alternative realization of the tonal contour over the verb and the postverbal subject in Fig. 12 and 13. Likewise, following the 1SG negative auxiliary *c-ǎ*, an object with a Rising toneme and a modal vowel may be pronounced with a mid allotone or with a falling allotone (the relevant examples are shown in (7a)). Predictably, when the object following *c-ǎ* has a breathy vowel, the Rising toneme of the object must be realized with a mid allotone by the rule in (6), as illustrated in (7b).

7. a. Underlying:

c-ǎ	rǎaan	gùuur	èntámè
AUX.NEG.PRES-1SG	person.SG.OBJ	follow.TR.NEG.PART	now
‘I do not follow a person now’			
Variant 1:	c-ǎ rǎaan	gùuur	èntámè
Variant 2:	c-ǎ rǎaan	gùuur	èntámè

b. Underlying:

c-ǎ	lǎeek	gùuur	èntámè
AUX.NEG.PRES-1SG	tilapia.PL.OBJ	follow.TR.NEG.PART	now
‘I do not follow tilapia now’			
Variant 1:	c-ǎ lǎeek	gùuur	èntámè

To summarize, the Rising toneme may be realized with a rising, low, mid or falling pitch contours depending on the context. Phonation of the stem vowel often plays a role. Some contexts allow free variation between particular allotones of the Rising toneme, while others demand a specific realization. Some of the contexts discussed here are summarized in Table 6. The

environments shown are not meant to be exhaustive: Table 6 illustrates only phrase-initial and phrase-final contexts.

Table 6. Variability in realization of the Rising toneme

	#__-HL	#__-H	#__-LH	#__-M	#__-L
Breathy	LH	{LH, M}	—	{LH, M}	{LH, M}
Modal	LH	{LH, M}	—	{LH, M}	{LH, M, HL}
	HL-__#	H-__#	LH-__#	M-__#	L-__#
Breathy	L	L	M	M	{L, M}
Modal	L	L	{M, HL}	M	{L, M}

The variability in realization of the Rising toneme can be accounted for in autosegmental terms, assuming that it is comprised of two autosegments L and H. This tonal contour is subject to various modifications: depending on the context, one of the tonal autosegments may be deleted ($L \rightarrow \emptyset$ or $H \rightarrow \emptyset$), an L-tone may be inserted ($LH \rightarrow LHL$) or the LH contour may be converted to M ($LH \rightarrow M$).

6. Conclusions

Using empirical data, we hope to have established that Nuer has three tonemes: High, Rising and Low. Of the three tonemes, two – the High and the Low – do not undergo significant tonal adjustments and their identity is easily recognizable in every phonological environment. The Rising toneme, however, is subject to great variation, some of it free, some obligatory. We have determined that the Rising toneme has rising, low, mid and falling allotones. While we make some suggestions as to the autosegmental processes that are behind this variability, many of the details of how and where these processes apply still remain to be determined.

As part of the description of the Nuer tonal system, we provide evidence for an important connection between vowel phonation and the tonal contour. We suggest that the High toneme is represented by two allotones which are in complementary distribution: high and falling. We account for the distribution of the high and falling allotones by positing a rule formalized in (1), which adds a tonal autosegment L after an H in modal vowels. Additionally, phonation of the vowel plays a role in realization of the Rising toneme which also has a falling allotone only over modal vowels in some contexts.

While the connection between phonation and tone is well-known, especially as it is manifested in Southeast Asian languages (Brunelle, 2009; Andruski and Ratliff, 2000; Garellek et al., 2013, Garellek and Keating, 2011; Hombert et al., 1979; Gordon and Ladefoged, 2001; Kong, 2001), the particular interaction between phonation and tone that is found in Nuer appears to be unique. In so-called ‘register’ languages, such as Mon-Khmer language Takhian Thong Chong (DiCanio, 2009) or White Hmong (Ratliff, 1992; Esposito, 2012; Garellek et al., 2013) some or all tonemes come associated with specific voice quality. Languages with fully independent parameters of tone and vowel phonation, i.e. those that cross-classify tone and vowel voice quality, are rare and thus far appear to have been attested in two language families only: Otomanguean and Nilotic (Garellek and Keating, 2011). For example, in Jalapa Mazatec, an Otomanguean language, vowels may be modal, breathy or creaky and come associated either with level tones H, M, L or with contour tones LM, LH, ML, MH, HL, HM, LML, LHL, MHL (Silverman, 1995). Similarly, Dinka (Nilotic) combines breathy and modal phonation with either one of the four tonal contours (H, L, HL, LH) in all possible combinations (Andersen, 1993; Remijns & Manyang, 2009). Nowhere in the relevant literature do we find reports of allotonic variation that is conditioned by vowel phonation. The interaction between the two properties in Nuer is all the more puzzling as cross-linguistically there exists a tendency for breathy voice quality to be associated with lowering in pitch (Gordon &

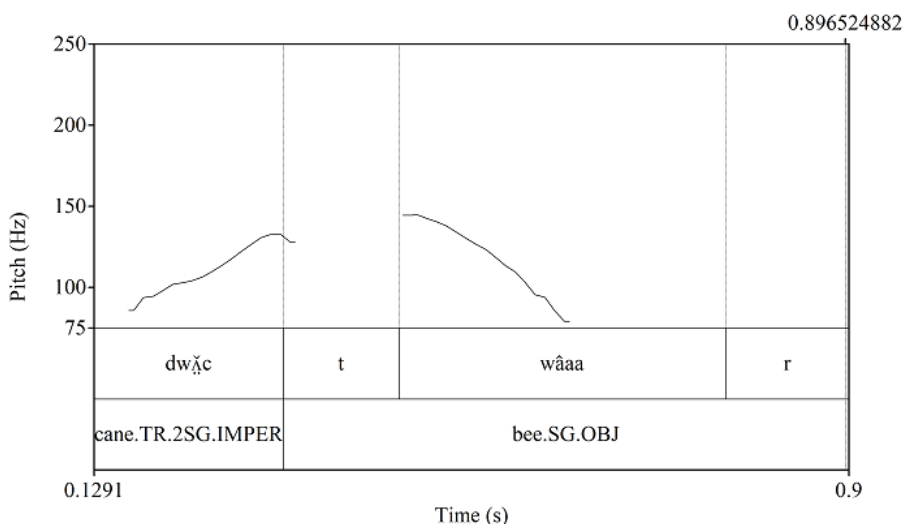
Ladefoged, 2001; Hombert et al., 1979; DiCanio, 2008). Clearly, that is not the case in Nuer, where high level pitch is maintained over breathy vowels throughout their duration.

In addition to making a contribution to theoretical and typological issues related to tonal inventories and allotonic variation, we hope that the article helps to develop a framework for elicitation of lexical material by researchers working on the documentation of Nuer. For example, we believe that the lexical tone of nominative nouns may be best elicited in a position following underived transitive 2SG imperatives – a form that is always associated with a Rising toneme, i.e. /kǎaŋ/ ‘scare.TR.2SG.IMPER’, /dwǎc/ ‘cane.TR.2SG.IMPER’, /gǒor/ ‘write.TR.2SG.IMPER’, etc. In this construction the tone of the object may be easily judged in relation to the mid tone of the preceding verbal form. As illustrated below in Fig. 17, following the 2SG imperative /dwǎc/ ‘cane!’, nouns associated with a High toneme will start on a pitch level higher than the verb (Fig. 17a, b), nouns associated with a Low toneme will be pronounced lower than the verb (Fig. 17c, d), nouns associated with a Rising toneme will be pronounced on the same pitch as the verb (Fig. 17e, g).

Fig. 17. Realization of various tonemes on the object following an underived 2SG imperative verb

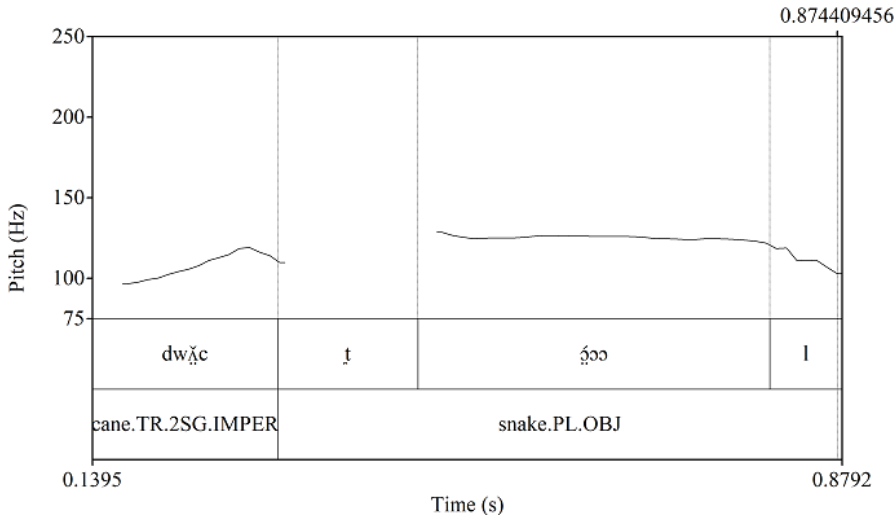
a. Object with a High toneme and a modal vowel

dwǎc	twâaar
cane.TR.2SG.IMPER	bee.SG.OBJ
‘cane the bee!’	

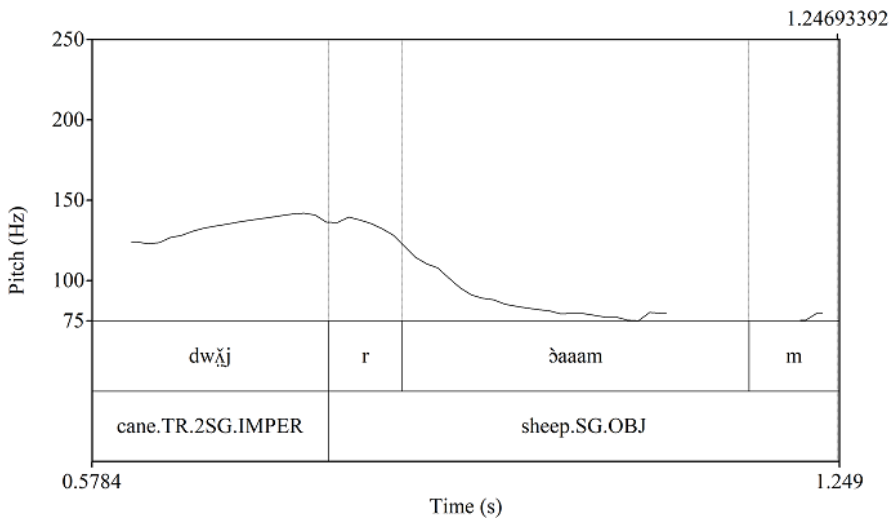


b. Object with a High toneme and a breathy vowel

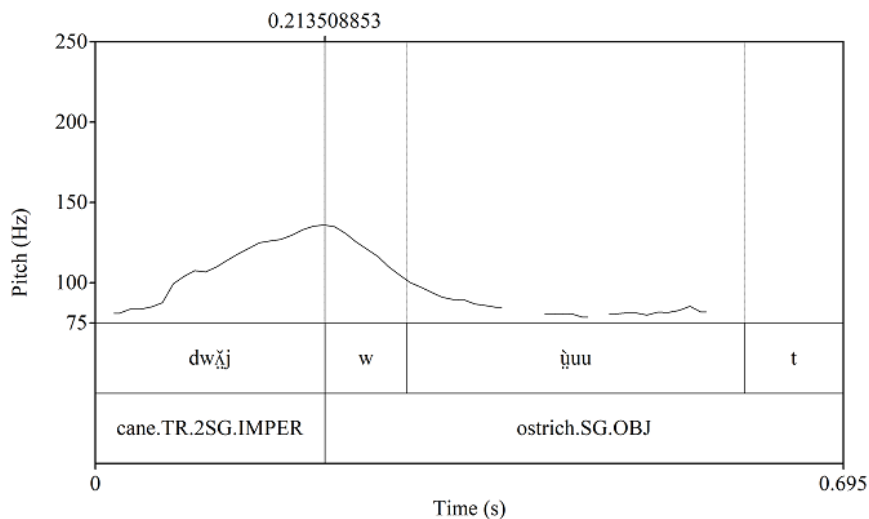
dwǎc	tǒool
cane.TR.2SG.IMPER	snake.PL.OBJ
‘cane the snakes!’	



- c. Object with a Low toneme and a modal vowel
 dwǎj rɔaaam
 cane.TR.2SG.IMPER sheep.SG.OBJ
 ‘cane the sheep (Sg)!’

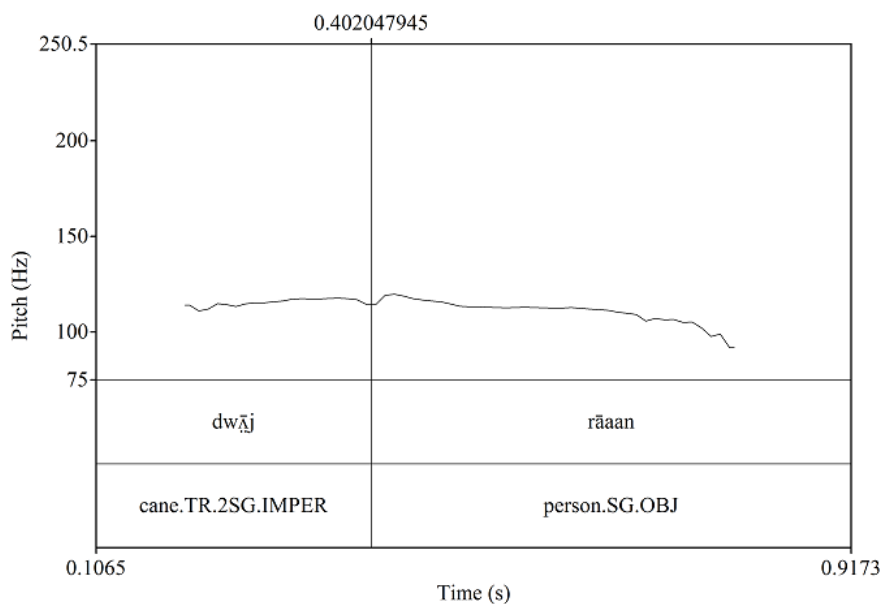


- d. Object with a Low toneme and a breathy vowel
 dwǎj wɔuuut
 cane.TR.2SG.IMPER ostrich.SG.OBJ
 ‘cane the ostrich!’



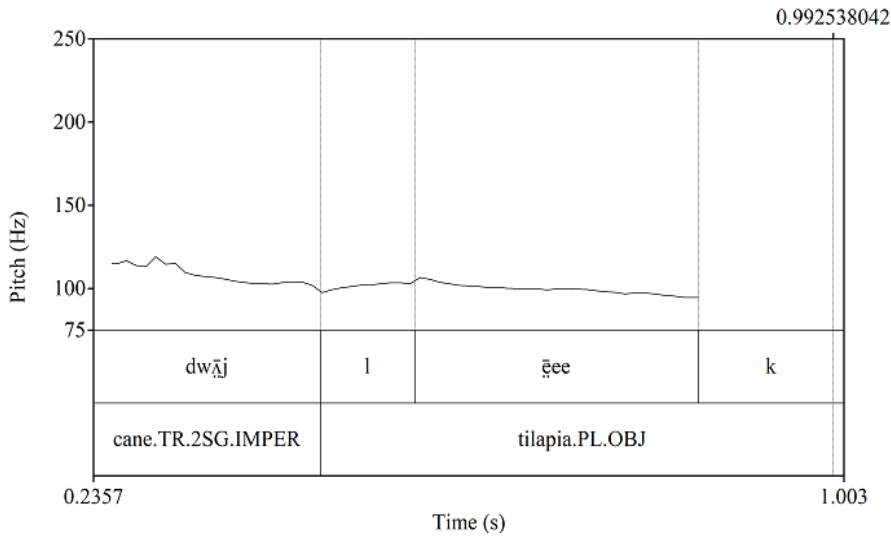
e. Object with a Rising toneme and a modal vowel

dw[̂]j rāaan
 cane.TR.2SG.IMPER person.SG.OBJ
 ‘cane the person!’



f. Object with a Rising toneme and a breathy vowel

dw[̂]j lēek
 cane.TR.2SG.IMPER tilapia.PL.OBJ
 ‘cane the tilapia (PL)!’



Importantly, we believe that the present classification of tones is exhaustive. All lexical stems are expected to follow one of the three tonal patterns that we have established here. The possibility of free variation in realization of the Rising toneme can somewhat obscure the three contrasting patterns. However, this variability is confined to the members of the same lexical tonal class and therefore is by itself predictable.

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Abbreviations

AP	Antipassive
AUX	Auxiliary verb
CP	Centripetal (i.e. denoting movement towards the speaker)
DT	Ditransitive
EN	Eastern Nuer
EXCL	Exclusive
IMPER	Imperative
INCL	Inclusive
LOC	Locative case
MULT	Multiplicative
NEG	Negative
NOM	Nominative case
NSF	Uninflected form of the verb used with a postverbal subject
OBJ	Objective case
PL	Plural
PRES	Present
SG	Singular

TR Transitive
WN Western Nuer

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