Tonal System in Kumam, a Double Downstep Language

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Kumam, a western Nilotic language, has two types of downstep high tones, a downstep high tone and a double downstep high tone. Double downstep is attested only in a handful of languages. More than two downstep high tones are synchronically attested in still fewer languages. Kumam has synchronically two kinds of downstep high tones, a downstep high and a double downstep high tones. This paper is the first attempt to demonstrate that the western Nilotic language has two types of downstep high tones, a downstep high and a double downstep high tones. This paper also shows that ‘floating tone approach’ is applicative to phonological representations of a downstep and a double downstep in Kumam. I also propose the principle that lexical tonemes are preserved within phonological units during derivation. However, more studies are needed to manifest phonological units.

Kumam tonal system consists of the general tonal principles and the language specific tone sandhi rules. The general tonal principles are common and well-known in autosegmental theories. They are summarized as follows: 1) Tonemes are assigned to TBUs from left to right. 2) Association lines do not cross each other. 3) High tonemes are preferable for being assigned to TBUs. Kumam has only two language specific tone sandhi rules, High spread and ‘Floating high assignment.’ Tone sandhi occurs beyond boundaries of phonological units. I propose the principle that all lexical tonemes are preserved within a phonological unit (word) all through tonal process. The general tonal principles are restricted by the principle that all lexical tonemes are preserved within a phonological unit (word) all through tonal process.

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Keywords: Double Downstep, ‘Floating Tone Approach’, Autosegmental Theory, Kumam, Western Nilotic

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3.5. Downstep and double downstep

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1. Introduction

Double downstep is attested only in a handful of languages (Clark 1993: 29–73, Hyman 1985: 47–83, Snider & van der Hulst 1993: 1–27). More than two downstep high tones are synchronically attested in still fewer languages. Kumam, a western Nilotic language has synchronically two kinds of downstep high tones, a downstep high tone and a double downstep high tone. This paper presents a brief sketch of tonal system in Kumam and explains how these two kinds of downstep high tones are derived synchronically. This paper deals with the phonological representations of downstep and double downstep, with particular application to Kumam.

Many linguists have argued that downstep is phonologically conditioned by a floating low tone (Clements and Ford 1979, Pulleyblank 1986). However, some linguists pointed out that the ‘floating tone approach’ is accompanied by several serious disadvantages. Some data indicated that downstep occurs between adjacent identical tonal features (Carlson 1983, Clark 1993, Odden 1982).

We will join neither in the discussion to arrive at a settlement of the issue, nor in the discussion on the theoretical issue of tonal representation. In this paper I will show that the ‘floating tone approach’ can be applied to the phonological representations of downstep and double downstep in Kumam.

Kumam is a language of the southern Lwo group of western Nilotic. Western Nilotic languages constitute a branch of the Nilotic languages, which form a large group among the members of the Nilo-Saharan phylum (Greenberg 1966). With regard to grammar and lexicon, Kumam is most closely related to Lango in the southern Lwo. Kumam is spoken in almost the whole central part of Uganda. It is spoken in the Kaberamaido district, the Soroti district, the Serere district and the Kyoga district. The number of speakers is given as 112,629 in Ethnologue (Gordon 2005).

Though the Nilo-Saharan is not comprehensively studied, the Nilotic languages are relatively well researched. There are a few descriptive works previously published. However, they are not sufficient to understand even the outlines of the languages.

There is no published work on Kumam. We have neither a dictionary nor a grammar of the language. There are descriptive works on some other western Niloite languages. The recent and most useful work is Noonan 1992, which contains grammar and small vocabulary of Lango. Noonan 1992 adopts an autosegmental analysis to demonstrate the tonal system of Lango. In this paper the autosegmental theory is adopted as well, but the approach leads us to quite different results from Noonan 1992.

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2) Noonan 1992 did not imply that Lango has a double downstep. No predecessors reported that western Nilotic languages have a double downstep.
### 2. Phonology

The purpose of this paper is to outline the tonal system of Kumam and to explain how the two kinds of downstep high tones are derived. The following section offers minimum phonological information that is a prerequisite for discussing tonal phenomena.

Kumam’s consonantal system is relatively simple. The following inventory of consonant phonemes is posited.

<table>
<thead>
<tr>
<th></th>
<th>bilabials</th>
<th>alveolars</th>
<th>palatals</th>
<th>velars</th>
</tr>
</thead>
<tbody>
<tr>
<td>voiceless stops</td>
<td>p</td>
<td>t</td>
<td>c</td>
<td>k</td>
</tr>
<tr>
<td>voiced stops</td>
<td>b</td>
<td>d</td>
<td>j</td>
<td>g</td>
</tr>
<tr>
<td>fricative</td>
<td>(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lateral</td>
<td>l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trill</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasals</td>
<td>m</td>
<td>n</td>
<td>ŋ</td>
<td>ŋ</td>
</tr>
<tr>
<td>semi-vowels</td>
<td>w</td>
<td>y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fricatives are observed only in borrowing words.

Geminated consonants are observed only in the forms which are derived via morphological processes. For instance, when a noun ending in a consonant is followed by a personal possessive suffix -ná ‘my’, the alveolar nasal /n/ of the suffix is assimilated to the preceding consonant and forms a geminated consonant with the preceding one.

(2) wan ‘eye’ + -ná ‘my’ → waŋná ‘my eye’
    del ‘skin’ + -ná ‘my’ → dellá ‘my skin’

Semi-vowels may constitute nuclei of syllables as glides with the following vowels. However, the semi-vowels are involved in the inventory of consonantal phonemes, because they may sometimes fill an onset position of syllables (cf. wan ‘eye’, yo ‘path”).

Kumam has ten vowel phonemes. The following inventory is posited.

<table>
<thead>
<tr>
<th></th>
<th>[-ATR]</th>
<th>[+ATR]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>front</td>
<td>back</td>
</tr>
<tr>
<td>high</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td>mid</td>
<td>e</td>
<td>o</td>
</tr>
<tr>
<td>low</td>
<td>a</td>
<td></td>
</tr>
</tbody>
</table>

The vowels are divided into two sets with regard to vowel harmony. The basic rule of vowel harmony is that a word consists of syllables whose nuclei contain vowels of the same value.

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3) Vowels are subjected to vowel harmony.
regarding the [ATR] category. Moreover, [+ATR] vowels control vowel harmony in words. In the example (4), the personal possessive pronounal suffix -ná ‘my’ contains a [-ATR] vowel. When the personal possessive pronounal suffix -ná ‘my’ is attached to nouns consisting of syllables with [+ATR] vowels, the [-ATR] vowel /a/ of the suffix changes its value from [-] to [+] in harmony with the value of [ATR] of the preceding vowels.

(4) bundú’kú ‘gun’ + -ná ‘my’ → bundú’kúná ‘my gun’

The vowel harmony rule is applied to affixes that constitute words, but not to clitics.

Kumam vowels have no distinctive opposition of length in lexicon. However, phonologically distinctive long vowels occur in forms which are derived through morphosyntactic processes. For instance, when a transitive infinitive suffix -ná is attached to a verbal stem, the vowel of the verbal stem is lengthened in compensation for the loss of the consonant as in (5).

(5) cam- ‘eat’ + -ná TRI → *cam-mo → camo ‘to eat’
   ted- ‘cook’ + -ná TRI → *ted-do → teedo ‘to cook’

The alveolar nasal of the transitive infinitive suffix -ná is assimilated to the preceding consonant with regard to both manner and point of articulation. The stem vowel is lengthened in compensation for the loss of one of the geminated consonants. Hence, transitive infinitive forms of verbs contain a long vowel. Vowel length has a morphosyntactic function in Kumam.

We must discuss vowel sandhi in detail, because vowel sandhi is relevant to the following discussions on tonal system in Kumam. Phonetic vowel coalescence occurs in rapid speech in Kumam. When a word ending in a vowel is followed by a word beginning with a vowel, the final vowel of the preceding word coalesces with the initial vowel of the following word. Under certain conditions the final vowel of the preceding word is deleted. The preserved vowel of the following word assumes the [ATR] value of the deleted vowel. In the example (7), when the final vowel ə of the first person singular pronoun is deleted before the vowel a of the attributive particle in vowel sandhi, the [-ATR] value of the deleted vowel ə is copied to the preserved vowel a, and the preserved vowel a turns to be [-ATR] vowel a.

(6) aná á!ték → [aná!ték]
   I ATT-strong
   ‘I am strong.’

4) Vowel harmony: ə → ə
5) Vowel sandhi occurs in unstressed vowels. In addition, vowel sandhi is blocked by some syntactic boundaries. The problem is beyond this article.
This vowel sandhi occurs only in unstressed vowels. As far as the tonal phenomena are concerned, what is important to note is the following: When a vowel is deleted in vowel sandhi, the toneme primarily associated with the deleted vowel is preserved. Including the tonal phenomena the vowel sandhi rule is formalized in (8). The preceding vowel \( V_1 \) is deleted before the following vowel \( V_2 \), though the tonemes \( T_1 \) and \( T_2 \) are preserved. In the example (9), the high toneme associated with the final vowel of the word jobi ‘buffalo’ is preserved during tonal process, even though the vowel is deleted in vowel sandhi in (9).

(8) Vowel Sandhi on phonetic level

\[
\begin{align*}
\text{Vowel category:} & \quad [\alpha \text{ATR}] & \quad [\alpha \text{ATR}] \\
\text{Tone level:} & \quad \begin{array}{ccc}
T_1 & T_2 & T_1 & T_2 \\
\end{array} \\
(9) & \quad \begin{array}{ccc}
\text{H} & \text{H} & \text{L} \ (\text{L}) & \text{H} \ (\text{L}) \\
\end{array} & \quad \begin{array}{ccc}
\text{HH} & (\text{L}) & \text{H(L)} \ (\text{L}) \\
\end{array} \\
\text{jóbi} & \text{a=té!d-ó} & \quad \begin{array}{c}
\text{[jó bá !té!dó]} \\
\text{buffalo 1SG=PERF:cook/ TR} \\
\text{The buffalo, I cooked.} \\
\end{array}
\end{align*}
\]

Vowel sandhi takes place also on morphophonological level. When a morpheme ending in a vowel is followed by a morpheme beginning with a vowel in morphological derivation, the preceding vowel is deleted under certain conditions. As far as tonal phenomena are concerned, a toneme which is associated primarily with the deleted vowel is preserved even if the vowel is deleted in accordance with the vowel sandhi rules. Including the tonal phenomena the vowel sandhi rule of morphophonological level is formalized in (10).

(10) Vowel Sandhi on morphophonological level

\[
\begin{align*}
\text{Tone level:} & \quad \begin{array}{ccc}
T_1 & T_2 & T_1 & T_2 \\
\end{array} \\
(10) & \quad \begin{array}{ccc}
\cdots V_1 - V_2 \cdots \\
\end{array} & \quad \begin{array}{ccc}
\cdots \varphi - V_2 \cdots \\
\end{array}
\end{align*}
\]

In the case of vowel sandhi on morphophonological level, vowel categories of [ATR] can be ignored, because vowels of affixes are subjected to vowel harmony. Although the final vowel \( V_1 \) of the preceding morpheme is deleted before the first vowel \( V_2 \) of the following

---

6) Tonal processes will be discussed in Section 3.

7) A subject clitic bears LH. The perfect aspect is marked with a supra-segmental morpheme, L. A verbal stem bears H in indicative. A transitive formative suffix bears L. High tone of the rightmost position of the noun jobi ‘buffalo’ is assigned to the leftmost tone bearing unit of the following verbal complex a=tédo ‘I cooked.’ Low tone of the leftmost position of the verbal complex becomes a floating low tone. The tonal process will be discussed in detail later.
morpheme, the toneme T₁, which is primarily assigned to V₁, is preserved. In the example (11), when middle forms are derived by attaching the middle suffix -ere to verbal stems, the vowel of the transitive formative suffix -e is deleted according to the vowel sandhi rules. Verbal stems bear a low toneme in infinitive and the transitive formative suffix -e bears a low toneme in underlying representations. The middle suffix -ere bears a high toneme and a low toneme in a sequence. When the middle suffix is attached to verbal transitive stems, all the lexical tonemes LLHL are preserved even if the vowel of the transitive formative suffix -e is deleted in accordance with the vowel sandhi rules.

(11) L L H L  L L H L
    |   | !/
ted-ere → ted-ere
cook:TR-MID
‘To be cooked’

3. Tonal system in Kumam

Kumam is a tone language, exhibiting a low tone, a high tone, a falling tone, a rising tone, a downstep high tone and a double downstep high tone which contrast on phonetic level. However, a low toneme and a high toneme are posited in underlying representations. There are a few tone sandhi rules which have the effect of altering underlying representations of a phonological unit (word) in some phonological environments. The tonal sandhi occurs beyond boundaries of phonological units (words). In addition to the language specific tone sandhi rules, Kumam follows general tonal principles of assigning tonemes to tone bearing units.

3.1. Inventory of tones

Phonetically there are four level tones in Kumam. They are referred to as a high tone, a low tone, a downstep high tone and a double downstep high tone. A high tone is transcribed with an acute accent on a vowel, because a tone bearing unit (TBU, hereafter) consists of syllables, and besides, only vowels always form a syllable nucleus in Kumam. There is neither a syllabic nasal nor a syllabic consonant in the language. A low tone is transcribed without any mark on a vowel. There are two contour tones, a falling tone and a rising tone. A falling tone is transcribed with a circumflex on a vowel. A rising tone is transcribed with

8) A tone bearing unit associated with a high and a low tonemes is pronounced with a high tone in surface representation. The tonal process will be discussed in detail in section 3.

9) Vowel harmony: e → e

10) Being inspired by Hayata (1999), a phonological unit is defined here as a unit in which a lexical tone pattern is preserved during tonal process. If a word is defined phonologically, a phonological unit is similar to a word. However, the tonologically defined boundaries are not necessarily coincident with other phonologically defined boundaries in Kumam. In order to avoid definition of ‘word’, I use the term ‘phonological unit.’
a wedge on a vowel. Kumam has a downstep high tone and a double downstep high tone. 
A downstep high tone is transcribed with an acute accent on a vowel preceded by an astonishing mark before the syllable whose nucleus the vowel forms. A double downstep high tone is transcribed with an acute accent on a vowel preceded by double astonishing marks before the syllable whose nucleus the vowel forms.

There are the following significant tonal distinctions on phonetic level in Kumam:

<table>
<thead>
<tr>
<th>(12) Tone</th>
<th>Transcription</th>
<th>Abbreviation</th>
<th>Musical step</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>[a]</td>
<td>l</td>
<td>do</td>
</tr>
<tr>
<td>high</td>
<td>[á]</td>
<td>h</td>
<td>fa</td>
</tr>
<tr>
<td>falling</td>
<td>[ă]</td>
<td>f</td>
<td>fa-do</td>
</tr>
<tr>
<td>rising</td>
<td>[â]</td>
<td>r</td>
<td>do-fa</td>
</tr>
<tr>
<td>downstep high</td>
<td>[!á]</td>
<td>ds</td>
<td>mi</td>
</tr>
<tr>
<td>double downstep high</td>
<td>[!!á]</td>
<td>dds</td>
<td>re</td>
</tr>
</tbody>
</table>

Since high tones may be actually pronounced lower than the preceding low tones as a result of the intonational phenomenon of downdrift, it is impossible to express phonic height of tones in an absolute scale of musical steps. However, a double downstep high tone is not common crosslinguistically. A rough description of phonic height in a scale of musical steps assists to hold an approximate image of tones, especially of a double downstep high tone.

| (13) cak        | ‘milk’       | l            | do           |
| dóg           | ‘mouth’      | h            | fa           |
| bakô/bakó     | ‘wife’s brother’ | 1 f/l h     | do fa-do/do fa |
| nën           | ‘Look!’      | r            | do-fa        |
| sandú!kú      | ‘box’        | l h ds       | do fa mi     |
| a=nê!!nê      | ‘I saw her/him.’ | 1 h dds | do fa re     |

The noun ‘wife’s brother’ has two free variants, a form which is pronounced with a falling tone in the final syllable and another which is pronounced with a high tone in the final syllable. The two forms are free variants. However, a high tone mostly appears in the environment where a falling tone is expected to appear in Kumam. A falling tone appears in phonologically limited environments.

A rising tone is in limited distribution where it appears exclusively in subjunctives or imperatives.

A downstep high tone is viewed not only as a product of tone sandhi rules, but also as a surface representation of lexical tonal patterns, while a double downstep high tone is viewed as a product of tone sandhi rules.
3.2. Tonemes in underlying representations

Two tonemes, a high toneme and a low toneme, are posited in underlying representations. This position results in the six tones in surface representations listed in (12). Underlying tonemes are transcribed with large capitals, H for a high toneme and L for a low toneme. When a low toneme is assigned to a TBU, the TBU is phonetically pronounced with a low tone. When a high toneme is assigned to a TBU, the TBU is phonetically pronounced with a high tone. When a high toneme and a low toneme are assigned to a TBU sequentially, the TBU is phonetically pronounced either with a high tone or with a falling tone. When a low toneme and a high toneme are assigned to a TBU in a sequence, the TBU is phonetically pronounced with a high tone or a rising tone. When a TBU associated with a high toneme is preceded by a floating low toneme, it is phonetically pronounced with a downstep high tone. A downstep high tone appears only after another high tone. If a TBU associated with a high toneme is preceded by a sequence of a floating low toneme, a floating high toneme and a floating low toneme, then it is phonetically pronounced with a double downstep high tone. A double downstep high tone appears only after another high tone.

In order to clarify the above-mentioned relation between the underlying representations and the surface representations, we make use of autosegmental tone analysis.

(14) \( L \rightarrow [l] \)

\[
\begin{array}{ccc}
L & L \\
\mid \\
\text{wic} & \rightarrow & \text{wic} & \text{‘head’}
\end{array}
\]

(15) \( H \rightarrow [h] \)

\[
\begin{array}{ccc}
H & H \\
\mid \\
\text{dog} & \rightarrow & \text{dog} & \text{‘mouth’}
\end{array}
\]

The TBU connected to an underlying low toneme with an association line is pronounced with a surface low tone as in (14). The TBU connected to an underlying high toneme with an association line is pronounced with a surface high tone as in (15).

(16) \( HL \rightarrow [h] \)

\[
\begin{array}{ccc}
\text{LHL} & \text{L H L} \\
\mid & \mid \\
\text{bako} & \rightarrow & \text{bakó} & \text{‘wife’s brother’}
\end{array}
\]

(17) \( HL \rightarrow [f] \)

\[
\begin{array}{ccc}
\text{LHL} & \text{L H L} \\
\mid & \mid \\
\text{bako} & \rightarrow & \text{bakó} & \text{‘wife’s brother’}
\end{array}
\]

The TBU connected to an underlying high toneme and an underlying low toneme with association lines in a sequence is mostly pronounced with a surface high tone as in (16).

11) A falling tone appears in limited phonological environments.
12) A rising tone occurs in subjunctive or imperative mood.
Besides, the TBU connected to an underlying high toneme and an underlying low toneme with association lines in a sequence may be pronounced with a surface falling tone in some phonological environments as in (17).

\[(18) \text{LH} \to [r] \quad \text{LH} \quad \text{L H} \quad \mid / \quad \text{nén} \to \text{nén} \quad \text{'Look!'}\]

\[(19) \text{LH} \to [h] \quad \text{LL(H)} \quad \text{L L (H)}^{13} \quad \mid \mid / \quad \text{cogo} \to \text{cogó} \quad \text{'bone'}\]

The TBU connected to an underlying low toneme and an underlying high toneme with association lines in a sequence may be pronounced with a surface rising tone as in (18). However, a rising tone appears only in limited syntactic environments\(^{14}\). The TBU connected to an underlying low toneme and an underlying high toneme with association lines in a sequence is usually pronounced with a high tone as in (19).

\[(20) \text{H(L)H} \to [h!h] \quad \text{LH(L)H} \quad \text{L H (L) H} \quad \mid \mid / \quad \text{sandukú} \to \text{sandú!kú}\]

When the TBU connected to an underlying high toneme with an association line is preceded by a floating low toneme, it is pronounced with a downstep high tone as in (20). A downstep high tone appears only after another high tone.

\[(21) \text{H(L)(H)LH} \to [h!!h] \quad \text{LH(L)(H)LH} \quad \text{L H(L)(H)(L)H} \quad \mid \mid / \quad \text{a=nén-é} \to \text{a=né!!n-é} \quad \text{'I saw her/him.'}\]

If the TBU connected to an underlying high toneme with an association line is preceded by a sequence of a floating low toneme, a floating high toneme and a floating low toneme, then it is pronounced with a double downstep high tone as in (21). A double downstep high tone appears only after another high tone.

Underlying tonemes are assigned to TBUs according to the general tonal principles. The general tonal principles are as follows: 1) Tonemes are assigned to TBUs from left to right. 2) Association lines do not cross each other. 3) High tonemes are preferable for being assigned to TBUs. The derivations (14) to (21) follow the general tonal principles.

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13) The final high toneme is a floating toneme, which is discussed in section 3.3. Floating tonemes are transcribed with large capitals in brackets.

14) A rising tone appears in subjunctive or imperative mood.
Now let me propose tentative underlying representations of a downstep high tone and a double downstep high tone as in (20) and (21) respectively. The proposal will be attested by morphophonological data in section 3.5.

3.3. High spread and ‘Floating high assignment’

Kumam has language specific tone sandhi rules which have the effect of altering underlying tonal representations of phonological units (words) in particular phonological environments\(^{15}\). The language specific tone sandhi rules are called High spread and ‘Floating high assignment’. The tone sandhi occurs beyond boundaries of phonological units (words).

At first we discuss High spread. When a phonological unit (word) bearing a high toneme in the rightmost position is followed by a phonological unit (word) bearing a low toneme in the leftmost position, the high toneme in the rightmost position of the preceding phonological unit (word) spreads over the phonological unit (word) boundary to the following phonological unit (word). The simple formulation (22) shows that the rightmost high toneme of the preceding phonological unit (word) is copied to the leftmost position of the following phonological unit (word), if the following phonological unit (word) begins with a low toneme. To clarify the relation between tonemes and TBUs in High spread, we make use of a convention in autosegmental theory as in (23).

\[
\begin{align*}
(22) \text{High spread} \\
\cdots H \# \# L \cdots \rightarrow \cdots H \# \# HL \cdots
\end{align*}
\]

\[
\begin{align*}
(23) \text{LHH  L} & \quad \text{L H H  L} \\
& \quad | \quad | \quad | \quad | \\
abuke wàŋ & \rightarrow \quad \text{ábúké wàŋ} \\
eyelash eye & \quad \text{‘eyelash’}
\end{align*}
\]

The rightmost high toneme of the preceding phonological unit (word) is connected with association lines not only to the rightmost TBU of the preceding phonological unit (word), but also to the leftmost TBU of the following phonological unit (word) according to High spread. In the example (23), when a phonological unit (word) abuke ‘eyelash’ bearing a high toneme in the rightmost position is followed by a phonological unit (word) wàŋ ‘eye’ beginning with a low toneme, the rightmost high toneme of abuke ‘eyelash’ is assigned not only to the rightmost TBU of it, but also to the leftmost TBU of wàŋ ‘eye’. Since an underlying high and an underlying low tonemes are sequentially connected to the TBU of wàŋ ‘eye’ with association lines, the TBU is pronounced with a falling tone\(^{16}\).

The noun abuke ‘eyelash’ bears a lexical tonal pattern LHH. When the noun abuke ‘eyelash’ is pronounced in citation, it is pronounced with a low, a high and a high tones in

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15) I will discuss ‘phonological unit (word)’ in section 3.4.
16) A TBU associated with a high and a low tonemes is usually pronounced with a high tone. A falling tone occurs in limited phonological environments. The word wàŋ ‘eye’ is in the phonological environments where a falling tone appears.
surface representation because an underlying low, an underlying high and an underlying high tonemes are assigned sequentially to TBUs as in (24). The noun waŋ ‘eye’ bears a lexical tonal pattern L. When the noun waŋ ‘eye’ is pronounced in citation, it is pronounced with a low tone in surface representation because an underlying low toneme is assigned to the TBU as in (25).

(24) LHH          LH H
     | | |
  abuke → abûké ‘eyelash’

(25) L           L |
  waŋ → waŋ       ‘eye’

A TBU to which a high and a low tonemes are assigned in a sequence is mostly pronounced with a high tone, though a falling tone is also expected to occur. A falling tone mostly appears only in limited environments. When a high tone is copied to a monosyllabic phonological unit (word) bearing a low toneme by tone sandhi rules, the monosyllabic phonological unit (word) is pronounced with a falling tone as in (23)\(^\text{17}\). We will discuss the environments where a falling tone appears in section 3.4.

Next, we discuss ‘Floating high assignment’. When a phonological unit (word) ending with a floating high toneme is followed by a phonological unit (word) beginning with a low toneme, the floating high toneme is assigned to the leftmost TBU of the following phonological unit (word), not to the rightmost TBU of the preceding phonological unit (word). The simple formulation (26) shows that the floating high toneme in the rightmost position of the preceding phonological unit (word) is assigned to the leftmost position of the following phonological unit (word) beyond the boundary. To clarify the relation between tonemes and TBUs in ‘Floating high assignment’, we make use of convention of autosegmental theory as in (27).

(26) ‘Floating high assignment’

\[
\cdots (H) \# \# L \cdots \rightarrow \cdots \# \# HL \cdots
\]

(27) LL(H) L       L L H L
     \ \ \ /
  cogo rac → cogo râc
  bone bad ‘The bone is bad.’

The noun cogo ‘bone’ bears a lexical tonal pattern LL(H), provided that the rightmost high tone is a floating high toneme. The adjective rac ‘bad’ bears a lexical tonal pattern L. When the noun cogo ‘bone’ is followed by the adjective rac ‘bad’, the noun cogo ‘bone’ is pro-

---
\(^{17}\) A falling tone appears also in ‘Floating high assignment’.
nounced with a low and a low tones in a sequence and the adjective rac ‘bad’ is pronounced with a falling tone in surface representations. This is because the floating high toneme in the rightmost position of the noun cogo ‘bone’ is assigned to the leftmost TBU of the adjective rac ‘bad’, not to the rightmost TBU of the noun cogo ‘bone’. Since a high and a low tonemes are connected to the TBU of the adjective rac ‘bad’ with association lines, the TBU is pronounced with a falling tone.

The cogo ‘bone’ bears a lexical tonal pattern LL(H). When the noun cogo ‘bone’ is pronounced in citation, it is pronounced with a low and a high tones as in (28). This is because a low, a low and a high tonemes are assigned to TBUs from left to right in accordance with the general tonal principles, and thus the second low toneme from right end and the rightmost high toneme are assigned to the rightmost TBU. Because a low and a high tonemes are connected to the TBU with association lines, the rightmost TBU is pronounced with a high tone. As discussed in section 3.2, a TBU associated with a low and a high tonemes is usually pronounced with a high tone. The adjective rac ‘bad’ bears a lexical tonal pattern L. When the adjective rac ‘bad’ is pronounced in citation, it is pronounced with a low tone as in (29).

(28) LL(H)  L L (H) = (19)
  | \/
  cogo → cogó ‘bone’

(29) L  L
  |
  rac → rac ‘bad’

The High spread and ‘Floating high assignment’ occur beyond boundaries of phonological units (words).

3.4. Floating tonemes and phonological unit (word)

Floating tonemes are mostly generated in tonal processes with application of tone sandhi rules. The examples like (30) show how floating tonemes are generated in the process of tonal derivation.

(30) LHH LH  L H H (L) H
  | | |
  abuke waŋ-ŋa → abúké wáŋŋá
  eyelash eye-my ‘my eyelash’

The personal possessive pronominal suffix -ná ‘my’ is endowed with an underlying high toneme. The noun abuke ‘eyelash’ bears a lexical tonal pattern LHH. The noun waŋ ‘eye’

18) The adjective rac ‘bad’ is in the environments where a falling tone appears.
19) The alveolar nasal consonant of the suffix is assimilated to the preceding velar nasal consonant.
bears a lexical tonal pattern L. The rightmost high tone in ويةك ‘eyelash’ is assigned not only to the rightmost TBU, but also to the leftmost TBU of ىب ’my eye’ according to High spread. When tonemes are assigned to TBUs from left to right in compliance with the general tonal principles, the second low tone from right end and the rightmost high tone are left to be assigned to the rightmost TBU of ىب ’my eye’. The high tone is chosen to be assigned to the rightmost TBU of ىب ’my eye’ according to one of the general tonal principles that high tonemes are preferable for being assigned to TBUs. The second low tone from right end is not assigned to any TBU, because a high tone is assigned to the TBU to which the low tone is expected to be assigned. Consequently the low tone becomes a floating tone. The rightmost TBU associated with a high tone is pronounced with a downstep high tone because it is preceded by a floating low tone.

Floating tonemes sometimes appear in processes of tonal derivation without application of tone sandhi rules. The example like (31) demonstrates how a floating tone appears in process of tonal derivation without application of tone sandhi rules.

(31) LHLH     L   H (L) H
                  \   |   |
sanduku → sandu'kú ‘box’

The word sanduku ‘box’ is specified to bear the tonal pattern LHLH in lexicon\(^{20}\). When the word sanduku ‘box’ is pronounced in citation, the rightmost TBU is pronounced with a downstep high tone. When tonemes are assigned to TBUs from left to right according to the general tonal principles, the second low tone from right end and the rightmost high tone are left to be assigned to the rightmost TBU of the noun sanduku ‘box’. Because the general tonal principles impose that high tonemes are preferable for being assigned to TBUs, the rightmost high tone is assigned to the rightmost TBU. Consequently the second low tone from right end loses a TBU to be assigned and becomes a floating low tone. The rightmost TBU associated with a high tone is pronounced with a downstep high tone after a floating low tone in surface representation.

Now we discuss a phonological unit (word). I propose a principle that all lexical tonemes are preserved within a phonological unit (word) during tonal derivation.

The noun sanduku ‘box’ constitutes a single phonological unit (word). The noun sanduku ‘box’ bears a lexical tonal pattern LHLH. According to the principle proposed above, all lexical tonemes, a low, a high, a low and a high tonemes, are preserved within the phonological unit (word), sanduku ‘box’, during tonal derivation. In order that all the lexical tonemes can be preserved within the phonological unit (word), the rightmost high tone must be assigned to the rightmost TBU of the phonological unit (word), sanduku ‘box’.

Nevertheless, the tonal derivation like (32) violates the principle that all tonemes are preserved within a phonological unit (word) during tonal derivation. If the second low

\(^{20}\) There is a group of nouns which are pronounced with a downstep high tone in rightmost position. These nouns are regarded to bear more number of tonemes than that of TBUs.
toneme from right end is assigned to the rightmost TBU of the noun sanduku ‘box’ in accordance with one of the general tonal principles that tonemes are assigned to TBUs from left to right, the rightmost high toneme is assigned to the leftmost TBU of the following phonological unit (word) beyond the boundary. The surface representation is not well-formed.

\[
\begin{array}{ccccccc}
\text{(32) LHLH} & L & L & H & L & H & L \\
| & | & | & \backslash \\
\text{sanduku rac} & \rightarrow & *\text{sandúku râc} \\
\text{box bad} & ‘The box is bad.’
\end{array}
\]

On the other hand, the tonal derivation like (33) obeys the principle that all lexical tonemes are preserved within a phonological unit (word) during tonal derivation. Even if followed by another phonological unit (word), the rightmost high toneme of the noun sanduku ‘box’ must be assigned to the rightmost TBU of it in order that all lexical tonemes can be preserved within the phonological unit (word). Since the rightmost high toneme of the noun sanduku ‘box’ is assigned to the rightmost TBU, the second low toneme from right end loses a TBU to be assigned and becomes a floating toneme. The rightmost TBU associated with a high toneme is pronounced with a downstep high tone after a floating low toneme. The adjective rac ‘bad’ is pronounced with a falling tone because of High spread.

\[
\begin{array}{ccccccc}
\text{(33) LHLH} & L & L & H (L) & H & L \\
| & | & \backslash & \backslash & \backslash \\
\text{sanduku rac} & \rightarrow & \text{sandúlkû râc}
\end{array}
\]

The tonal derivations with application of tone sandhi rules like (30) can be explained also by the principle that all lexical tonemes are preserved within a phonological unit (word) all through tonal process. The noun affixed with a personal possessive pronominal suffix -na ‘my’ constitutes a single phonological unit (word). Since all lexical tonemes are preserved within a phonological unit (word) all through tonal process, the rightmost high toneme of the noun abuke wâŋa ‘my eyelash’ is assigned to the rightmost TBU. Consequently the second low toneme from right end loses a TBU to be assigned and becomes a floating low toneme. The rightmost TBU associated with a high toneme is pronounced with a downstep high tone after a floating low toneme.

The idea of phonological unit (word) explains why the noun sanduku ‘box’ is pronounced with a downstep high tone in the rightmost position not only when it is pronounced in citation, but also when it is followed by another phonological unit (word) beginning with a low toneme, as in (31) and in (33), respectively.

There is an exception to the principle that all lexical tonemes are preserved within a phonological unit (word) during tonal derivation. Floating high tonemes violate the principle. Floating high tonemes are assigned to TBUs beyond boundaries of phonological units (words), if they are followed by another phonological unit (word) beginning with a
low toneme. We already discussed the fact that floating high tonemes are assigned to TBUs beyond boundaries of phonological units (words), which we call ‘Floating high assignment’. Now we discuss ‘Floating high assignment’ again from the viewpoint of a phonological unit (word).

\[(34) \text{LL(H) L} \quad \text{L L (H) L} = (27) \quad \text{\mid\mid\mid} \quad \text{cogo rac \to cogo râc} \quad \text{bone bad} \quad \text{‘The bone is bad.’} \]
\[(35) \text{LL(H) L L (H)} = (19, 28) \quad \text{\mid\mid} \quad \text{cogo \to cogó ‘bone’} \]

The noun cogo ‘bone’ bears a floating high toneme in the rightmost position. When the noun cogo ‘bone’ is followed by the phonological unit (word) rac ‘bad’ beginning with a low toneme, the rightmost floating high toneme of the noun cogo ‘bone’ is assigned to the leftmost TBU of the following phonological unit (word) rac ‘bad’. Consequently the noun cogo ‘bone’ is pronounced with a low and a low tonemes, and the adjective rac ‘bad’ is pronounced with a falling tone as in (34). When the noun cogo ‘bone’ is not followed by any phonological unit (word), all lexical tonemes are assigned to TBUs in compliance with the principle that all lexical tonemes are preserved within a phonological unit (word) during tonal derivation. When tonemes are assigned to TBUs from left to right, the rightmost TBU of the noun cogo ‘bone’ is connected with a low and a high tonemes as in (35). The rightmost TBU associated with a low and a high tonemes is pronounced with a high tone as discussed already in section 3.2.

The principle that lexical tonemes are preserved within a phonological unit (word) during tonal process explains the phonological environments where a falling tone appears. A falling tone mostly appears when a monosyllabic phonological unit (word) bearing an underlying low toneme is preceded by a phonological unit (word) which bears a high toneme or a floating high toneme in the rightmost position. Namely a falling tone mostly appears in a monosyllabic phonological unit (word) when the monosyllabic phonological unit (word) alters its tone by the effect of High spread or ‘Floating high assignment’. The example (36) shows that a falling tone appears in High spread.

\[(36) \text{LHH L} \quad \text{L H H L} = (23) \quad \text{\mid\mid\mid\mid} \quad \text{abuke waŋ \to abûké wâŋ ‘eyelash’} \]

The noun waŋ ‘eye’ is a monosyllabic phonological unit (word) bearing a low toneme in lexicon. When the noun waŋ ‘eye’ is preceded by the noun abuke ‘eyelash’ bearing a high
toneme in the rightmost position, the rightmost high toneme is assigned not only to the rightmost TBU of the noun abuke ‘eyelash’ but also to the TBU of the noun waɲ ‘eye’ according to High spread. A high and a low tonemes are assigned to the TBU of the noun waɲ ‘eye’, because all the lexical tonemes are preserved within the phonological unit (word). The TBU associated with a high and a low tonemes is pronounced with a falling tone, while a TBU associated with a high and a low tonemes is usually pronounced with a high tone in a multisyllabic phonological unit (word) (cf. (16)).

The principle that all lexical tonemes are preserved within a phonological unit (word) during tonal process guarantees the stability of lexical meanings of phonological units (words). Lexical meanings are unstable if lexical tonemes are not preserved within a phonological unit (word) during tonal process. In the example (36), if the noun waɲ ‘eye’ is pronounced with a high tone in surface representation as a TBU associated with a high and a low tonemes is mostly pronounced with a high tone in a multisyllabic phonological unit (word), the lexical meaning of the noun waɲ ‘eye’ is not stable. If the noun waɲ ‘eye’ is pronounced with a falling tone after High spread rule is applied, it is transparent that the noun waɲ ‘eye’ bears primarily a low toneme in lexicon. For the above-mentioned reasons, one of the general tonal principles that tonemes are assigned to TBUs from left to right is restricted by the principle that all lexical tonemes are preserved within a phonological unit (word) during tonal process.

Now we can summarize the tonal system in Kumam as follows:

a) General tonal principles (1 Tonemes are assigned to TBUs from left to right. 2 Association lines do not cross each other. 3 High tonemes are preferable for being assigned to TBUs.)

b) Language specific tone sandhi rules (High spread and ‘Floating high assignment’)

c) Principle that lexical tonemes are preserved within a phonological unit (word) during tonal process.

3.5. Downstep and double downstep

We have already seen some examples of downstep. Let me add some examples of downstep in verbal morphology. Though aspect is marked by a suprasegmental morpheme in Kumam, tense is not marked in verbal complex.

\[
(37) \text{LHHL} \quad H \quad \text{L H H (L) H} \quad | \quad | \quad | \quad |
\]

\[a=ted-o \quad \text{cam} \quad \rightarrow \quad a=téd-ó \quad !cám\]

1SG=IMPERF:cook-TR food
‘I cook food.’

The clitic of the first person singular a= bears a lexical tonal pattern LH\(^{21}\). The imperfect

\[21\) The independent personal pronoun an ‘I’ bears a lexical tonal pattern LH, from which the subject clitic a= ‘1SG’ originated.\]
aspect is marked with no toneme. Every simple verbal stem bears a lexical high toneme in indicative\(^\text{22}\). The transitive formative suffix -\(\text{c}\) bears a low toneme in lexicon. Consequently, the verbal complex a=tedo 'I cook' bears LHHL as its lexical tonal pattern. The noun cam 'food' bears a lexical high toneme. When tonemes are assigned to TBUs from left to right in the verbal complex a=tedo 'I cook', the rightmost low toneme of the verbal complex loses a TBU to which it is expected to be assigned and becomes a floating low toneme. The TBU of the word cam 'food' associated with a high toneme is pronounced with a downstep high tone after the floating low toneme as in (37).

The example (38) shows the tonal derivation of verbal complex in perfect aspect.

\[
\begin{array}{ccc|ccc|}
(38) & L & H & L & H & L & H \\
\hline
\text{a=ted-ō} & \text{cam} & \rightarrow & \text{a=té!d-ō} & \text{!cám} \\
1\text{SG=PERF:cook-TR food} \\
'I cooked food.'
\end{array}
\]

The noun cam 'food' is pronounced with a downstep high tone also in perfect aspect. A downstep high tone appears inside the verbal complex in perfect aspect.

The clitic of the first person singular a= bears a lexical tonal pattern LH. The perfect aspect is marked with a suprasegmental morpheme, a low toneme. Every simple verbal stem bears a lexical high toneme in indicative. The transitive formative suffix -\(\text{c}\) bears a low toneme. Consequently the verbal complex a=tedo 'I cooked' bears LHHL as its lexical tonal pattern in perfect aspect. When tonemes are assigned to TBUs from left to right, the third low and the second high tonemes from right end, and the rightmost low toneme of the verbal complex a=tedo 'I cooked' are left to be assigned to the rightmost TBU. The second high toneme from right end is chosen to be assigned to the rightmost TBU because high tonemes are preferable for being assigned to TBUs. Furthermore, if the second high toneme from right end is assigned to the rightmost TBU, all lexical tonemes are preserved within a phonological unit (word) except for the rightmost low toneme. The rightmost low toneme becomes a floating toneme. Assignment of the second high toneme from right end to the rightmost TBU obeys the principle that all lexical tonemes are preserved within a phonological unit (word) during tonal derivation. The floating low toneme in the final position of a phonological unit (word) which is derived in compliance with the general tonal principles is interpreted still as a member of the lexical tonemes specified to the verbal complex.

The third low toneme from right end loses a TBU to be assigned because the second high toneme from right end is assigned to the rightmost TBU. Thus, the third low toneme from right end becomes a floating toneme, and the rightmost TBU associated with a high toneme is pronounced with a downstep high tone after the floating low toneme. The TBU

\(^\text{22}\) Simple verbal stems are those which are not affixed by derivational suffixes.
of the noun cam ‘food’ associated with a high toneme is also pronounced with a downstep high tone after a floating low toneme.

Double downstep is attested in rare languages. Kumam has a double downstep high tone. A double downstep high tone appears in verbal complex of perfect aspect as in (39).

\[(39)\ LHLHLH \quad \text{L H (L)(H)(L) H} \quad | \quad | \quad \text{e=nek-ɔ-a} \rightarrow \text{e=nẽ!!k-á} \quad \text{(vowel sandhi: ɔ+a \rightarrow a)}\]

3SG=PERF:kill-TR-1SG

‘He killed me.’

The clitic of the third person singular e= bears a lexical tonal pattern LH. The perfect aspect is expressed by a suprasegmental morpheme, a low toneme. A simple verbal stem bears a high toneme in indicative. The transitive formative suffix -a bears a lexical low toneme. The first person singular object suffix -a bears a lexical high toneme. Consequently the verbal complex e=nek-a ‘he killed me’ bears LHLHLH as its lexical tonal pattern.

As already discussed, vowel sandhi occurs also on morphophonological level. The tonemes which are primarily associated with a deleted vowel are preserved in vowel sandhi (cf. (10)). When the first person singular object suffix -a is attached to the transitive formative suffix -ɔ, the vowel ɔ of the transitive formative suffix is deleted according to vowel sandhi rules. All the tonemes including a low toneme which is primarily associated with the vowel ɔ are preserved during derivation. Because the verbal complex affixed by the first person singular object suffix -a constitutes a single phonological unit (word), all lexical tonemes are preserved within the phonological unit (word) all through tonal process. When tonemes are assigned to TBUs from left to right, the fourth low, the third high and the second low tonemes from right end, and the rightmost high toneme are left to be assigned to the rightmost TBU of the verbal complex e=nek-a ‘he killed me’. In order that all tonemes can be preserved within the phonological unit (word) and obey one of the general tonal principles that high tonemes are preferable for being assigned to TBUs, the rightmost high toneme of the verbal complex e=nek-a ‘he killed me’ must be assigned to the rightmost TBU of the verbal complex. As a result the fourth low, the third high and the second low tonemes from right end lose TBUs to be assigned and become floating tonemes. After a sequence of a floating low, a floating high and a floating low tonemes, the rightmost TBU of the verbal complex e=nek-a ‘he killed me’ is pronounced with a double downstep high tone.

A double downstep high tone sounds auditorily as low as a low tone. However, a double downstep high tone retains phonological characteristics of a high toneme, because a double downstep high tone originates from a high toneme that is lowered by the preceding floating tonemes. A double downstep high tone behaves phonologically as a high toneme in the same way as a downstep high tone does. After a double downstep high tone, a TBU which primarily bears a low toneme is pronounced with a high tone as in (40). Namely a double downstep high tone causes High spread in the same manner as a high toneme does.
(40) LHLHLH \[ \text{LLL} \] \[ \text{L H \{L\}(H)(L)H} \] \[ \text{L L L L} \]
\[ \varepsilon=\text{nek-a} \] \[ \text{nakanaka} \] \[ \rightarrow \] \[ \varepsilon=\text{nêl-k-á} \] \[ \text{nakanaka} \]
3SG=PERF:kill-TR-1SG repeatedly

‘He killed me repeatedly.’

The rightmost TBU of the verbal complex \( \varepsilon=\text{nek-a} \) ‘he killed me’ is pronounced with a double downstep high tone, and the following TBU is pronounced with a high tone. The high toneme associated with the rightmost TBU of the verbal complex is copied by High spread rule to the leftmost TBU of the word nakanaka ‘repeatedly’\(^{(29)}\).

The first person singular object suffix -a is pronounced with a double downstep high tone in perfect aspect as in (39), while it is pronounced with a downstep high tone in imperfect aspect as in (41).

(41) LHLHLH \[ \text{L H(H)(L)H} \]
\[ \varepsilon=\text{nek-a} \] \[ \rightarrow \] \[ \varepsilon=\text{nêl-k-á} \]
3SG=IMPERF:kill-TR-1SG

‘He kills me.’

The third person singular clitic \( \varepsilon= \) bears a lexical tonal pattern LH. The imperfect aspect is marked with no morpheme. Every simple verbal stem bears a lexical high toneme in indicative. The transitive formative suffix -\( \text{a} \) bears a lexical low toneme. The first person singular object suffix -a bears a lexical high toneme. Consequently the verbal complex bears LHLHLH as its lexical tonal pattern. The verbal complex affixed by the object suffix constitutes a single phonological unit (word). When tonemes are assigned to TBUs from left to right, the third high and the second low tonemes from right end, and the rightmost high toneme are left to be assigned to the rightmost TBU of the verbal complex \( \varepsilon=\text{nek-a} \) ‘he kills me’. In order that all lexical tonemes can be preserved within the phonological unit (word) and obey one of the general principles that high tonemes are preferable for being assigned to TBUs, the rightmost high toneme is assigned to the rightmost TBU of the verbal complex \( \varepsilon=\text{nek-a} \) ‘he kills me’. Thus the third high and the second low tonemes from right end lose TBUs to be assigned and become floating tonemes. The rightmost TBU of the verbal complex \( \varepsilon=\text{nek-a} \) ‘he kills me’ is pronounced with a downstep high tone after a sequence of a floating high and a floating low tonemes.

The distinction between perfect aspect and imperfect aspect is made only by tones. The rightmost TBU of the verbal complex \( \varepsilon=\text{nek-a} \) ‘he killed me’ is pronounced with a double downstep high tone in perfect aspect and the rightmost TBU of the verbal complex

---

\(^{(23)}\) Nakanaka ‘repeatedly’ bears a lexical tonal pattern LLLL.


\( e=n\text{\textasciitilde}k-a \) ‘he kills me’ is pronounced with a downstep high tone in imperfect aspect. The fact indicates that a downstep high tone and a double downstep high tone contrast in Kumam.

4. Concluding remarks

This is the first report to point out that Kumam has two kinds of downstep, a downstep high tone and a double downstep high tone. As far as we know, there is no previous report to indicate that western Nilotic languages have a double downstep.

The data shows that ‘floating tone approach’ is applicative to phonological representation of a downstep and a double downstep in Kumam. I also proposed the principle that lexical tonal patterns are preserved within phonological units (words) during tonal derivation. However, more studies are needed to clear phonological units (words).

List of abbreviations

ATR: advanced tongue root
ATT: attributive particle
ds: downstep high tone
dds: double downstep high tone
f: falling tone
H: high toneme
h: high tone
(H): floating high toneme
IMP: imperative
IMPERF: imperfect aspect
L: low toneme
l: low tone
(L): floating low toneme
MID: middle suffix
PERF: perfect aspect
r: rising tone
T: toneme
TBU: tone bearing unit
TR: transitive formative suffix
TRI: transitive infinitive suffix
1SG: first person singular
3SG: third person singular
#: word boundary
-: affix morpheme boundary
=: clitic morpheme boundary
References


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