

## **Tonal Alternation in Yoruba Numerals**

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### **Abstract**

This study examines the alternation between Mid and Low tones in Yoruba numerals. It reports that the basic numbers *òkan* “one”, *èta* “three”, and *èrin* “four” all have L-M tonal structure, but the M becomes L when the numbers are combined with other number items in the formation of higher numerals such as *òkànlá* “eleven”, *ètálá* “thirteen” and *èrindínlógún* “sixteen” among others. It is then argued that Yoruba has a numeral-marking L-tomorph that becomes active only when it is preceded by M. Examples are presented to show the linking of this L-tomorph in higher numerals in which the structural conditions are met.

**Keywords:** *Yoruba, numeral, tonal alternation, tomorph*

### **Introduction**

Yoruba is a cross-border West Benue-Congo language. Its speakers dominate the south-western geopolitical zone of Nigeria where they number about 30, 000, 000 (Oyetade, 2011). Yoruba has enjoyed vast scholarly attention through the years and is currently used in every domain of contemporary human communication within the speech communities. The numeral system of Yoruba is however an aspect of the language that most speakers are not exposed to because of its complexity (Oyebade, 2014). Part of the reasons for this complexity is that it combines different bases, namely base five, base ten (decimal) and base twenty (vigesimal) intricately (Babarinde 2013: 81; Akinade and Odejebi 2014)<sup>1</sup>. It also combines addition and subtraction to almost the same extent (Hurford 1975: 211). It has now been shown that the Yoruba numeral system is endangered (Babarinde 2013: 78; Oyebade, 2014:1).

The Yoruba numerals contain 16 lexemes, namely the ten basic numbers (1 - 10) and six higher numerals (20, 30, 200, 300, 400, and 20,000) (Ekundayo 1977; Akinade and Odejebi 2014: 172). The ten basic numbers are presented in (1a-j) and the higher numerals in (2a-f) below.

- (1) Basic numbers of Yoruba
- a. *òkan* “one”
  - b. *èjì* “two”
  - c. *èta* “three”
  - d. *èrin* “four”
  - e. *àrún* “five”
  - f. *èfà* “six”

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<sup>1</sup> Comrie (2013) lists Yoruba among the languages having the pure vigesimal numeral system.

- g. èje “seven”
- h. èjọ “eight”
- i. ẹsán “nine”
- j. ẹwá “ten”

(2) Higher numerals lexemes of Yoruba

- a. ogún “twenty”
- b. ogbòn “thirty”
- c. igba “two hundred”
- d. òdúnrún “three hundred”
- e. irínwó “four hundred”
- f. òkẹ “twenty thousand”

Several works exist on the Yoruba numeral system, but in depth tonal analyses of the system has been lacking. For instance, Mann (1887), Ekundayo (1977), Ajiboye (2016) and many others studied it from the morphological and syntactic perspectives as well as mathematical derivations and representations; Fabunmi (2010) compared the vigesimal system in the numerals of two dialects (Ife-Togo and Ife-Nigeria) of Yoruba, while Akinola (2014) and Faturoti (2014) studied the counting systems of Ondo and Omuo-Ekiti respectively; Babarinde (2013) discussed the complexities with the aim of aiding teaching; while Akinade and Odejobi (2014) studied the Yoruba numeral from a computational perspective. In addition to these, many of the previous works considered phonological aspect of the numerals, but they were essentially limited to the segmental materials of consonants and vowels, to the neglect of tone (Mann 1887; Babarinde 2013, etc.). Consequently, none of these previous works discussed the apparent tonal alternations involved when some of the basic numbers are concatenated in the derivation of higher numerals. This is the gap that this study seeks to fill.

### **Background on Yoruba Tone System**

Yoruba operates three contrastive tones, Low (L), Mid (M), and High (H) (Bamgbose, 1990; Laniran, 1992; Connell and Ladd, 1990:5). Orthographically, L is marked with superscript grave accent < <sup>`</sup> >, H is marked with a superscript acute accent < <sup>´</sup> >, while the M is left unmarked. These tones are illustrated in examples (3-4) below. Examples (3), illustrating the three-way tonal contrast in monosyllabic verbs and (4a-c) illustrating same in disyllabic nouns are from Laniran (1992:19).

- (3) a. lú “to mix”  
b. lu “to perforate”  
c. lù “to beat”
- (4) a. ilú “city”  
b. ilu “awl”  
c. ilù “drum”

Yoruba also has two contour tones namely the rising tone. Akinlabi (2004) shows that H is realised as a rising tone when preceded by L (5a), while L is realised as a falling tone when it is preceded by H (5b).

- (5) a. Àlá → [àlǎ] “dream”  
b. rárà → [rǎrà] “elegy”

Besides these three surface tones, Yoruba has downdrift, downstep, as well as the terracing phenomenon (Courtenay, 1968; Laniran and Clements, 2003; Adeniyi, 2009). In addition to these, the process known as Assimilated Low Tone has also been described in Yoruba (Bamgbose, 1967).

Of major concern to this work is the hierarchy among the Yoruba tones. The prevailing pattern in Yoruba is that H is the strongest, while M is the weakest of the three tones. For instance, Akinlabi (1985) argues that the M does not participate in contour formation in Yoruba. Also, in vowel sequence reduction, it has been shown that the H never gets deleted; rather it re-links to an adjacent Tone-bearing Unit (TBU) and displaces the tone on that TBU once that tone is not H (6a-b)<sup>2</sup>. Further, among the remaining two tones M and L, if M and L are concatenated across word boundaries and the vowel bearing one of them is elided, it is the M that is always deleted, whether it is its vowel that is elided or not (7a-b). Note specifically that in (7b), it is the vowel *i* bearing L, that is elided, but the L does not delete with it; rather the L re-links to the adjacent M-bearing vowel and displaces the M. Thus we have the hierarchical order H>L>M, where H always supersedes other tones, and L in turn supersedes M (Bamgbose 1990: 57).

- (6) H> (M, L) in Yoruba  
a. H>M: jí ɪ̀su → jíʃu “steal yam”  
b. H>L: kó àwo → káwo<sup>3</sup> “pack glass”
- (7) L>M in Yoruba  
a. jẹ̀ ègbo → jẹ̀gbo “eat corn meal”  
b. ta ɪ̀bɔ̀n → tà<sup>\*</sup>bɔ̀n “shoot gun”

It should be noted that examples such as *gbà ɔ̀bẹ̀ → gbɔ̀bẹ̀* “take soup” and *rà ɪ̀su → ràʃu* “buy yam” in which it appears as if the M supersedes L involve floating M tonal morpheme which marks agreement between the verbs and objects<sup>4</sup>. For more on this, see Akinlabi and Liberman (2000). Barring any tonal morpheme interference, the H>L>M hierarchy is general in Yoruba.

### **Tonal Patterns in Yoruba Numerals**

The combination of basic numbers to form higher numerals involves a number of tonal alternations. The first pattern observable from (1a-j) above is that, in their ordinal form, the basic numbers all begin with Low tone (L). Also noteworthy is that the numbers “one”, “three”, “four”, “seven” and “eight” end in Mid tone (M). In the derivation of numbers higher than 10, some basic numerals are either added to the previous number (in the tens) or

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<sup>2</sup> It is this H-dominance that explains the other type of tonal alternation whereby the verb *mú* “take” is prefixed with the basic numerals to form adjective numerals in Yoruba. In such formations the *-u* of *mú* is elided before the initial vowel of the numerals but its high tone rather re-links to the initial tone of the numeral. This is seen in adjective numerals like *mú#ení → méní* “first”, *mú#èjì → méjì* “second, two” etc.

<sup>3</sup> The syllable *wo* is downstepped, and the word is more accurately *ká<sup>\*</sup>wo*, but the diacritic is deliberately left out to allow for clarity.

<sup>4</sup> Underlyingly, “take soup” is *gbà M ɔ̀bẹ̀* and “buy yam” is *rà M ɪ̀su* both with floating mid tonal morpheme. The tonal morpheme must then be realized phonetically in order for the agreement to be expressed.

subtracted from the next (in the tens). For instance, to form numbers “eleven” to “fourteen”, numbers “one” to “four” are added to “ten” in that order (8a-d); but to form “fifteen” to “nineteen”, numbers “five” to “one” are subtracted from “twenty” in that reverse order (8e-i).

In examples (8a, c-d, f-g, i) where the input basic numbers has a final M, there is a L~M alternation such that the final M of the basic numbers change to L when followed by *lá* in the output.

(8) Formation of Higher numerals in Yoruba

- a) Ọ̀kan lá → Ọ̀kànlá “11”
- b) Èjì lá → èjìlá “12”
- c) Èta lá → ètàlá “13”
- d) Èrin lá → èrinlá “14”
- e) Àrùn-ún dín ní ogún → àrùndínlógún/èdédógún  
Five less than 20 “15”
- f) Èrin dín ní ogún → Èrìndínlógún  
Four less than 20 “16”
- g) Èta dín ní ogún → Ètádínlógún  
Three less than 20 “17”
- h) Èjì dín ní ogún → Èjìdínlógún  
Two less than 20 “18”
- i) Ọ̀kan dín ní ogún → ọ̀kàndínlógún  
One less than 20 “19”
- j) Ogún “20”

This alternation is attested in more complex higher numerals, once those higher numerals involve either the addition or subtraction of any of the numbers “one”, “three” or “four”. Examples (9a-f) contain randomly-selected illustrations of the M~L alternation in the higher numerals. Discussions of the mechanism behind the alternation are taken up in section four.

(9) Tonal alternations in higher numerals

- a) ọ̀kan lé ní igba → ọ̀kànlénígba  
one more than 200 “two hundred and one”
- b) ọ̀kan dín ní ọ̀dúnrún → ọ̀kàndínlọ̀dúnrún  
one less than 300 “two hundred and ninety-nine”
- c) èta lé ní irínwó → ètàlénirínwó  
three more than 400 “four hundred and one”
- d) èta dín ní àádórin → ètádínláàádórin  
three less than 70 “sixty seven”
- e) èrin lé ní ogórùn-ún → èrinlélógórùn-ún  
four more than 100 “one hundred and four”

- f)      èrin    dín    ní    irínwó    →    èrindínnírínwó  
four      less than 400      “three hundred and ninety-six”

The alternations still persist when used in context. Examples (10a-f) correspond directly to (9a-f). Note that only two words (*igi* “tree” and *mú* “take”) are added, but the L in question is still there, as indicated by the underlining. The import of examples (10a-f) is the illustration of an additional alternation; although the *-u* of *mú* is elided as a result of vowel sequence reduction in the derivation; its high tone is not. Rather, the high tone, which has been shown to be resistant to deletion, re-links to the vowel on its immediate right<sup>5</sup>. In the end, it is the lower tone on the vowel to the right of *mú* that get deleted in the output. As has been noted, this alternation follows known tonal patterns in Yoruba.

- (10)      Tonal alternations in context
- a)      igi    mú    òkan    lé    ní    igba    →    igi mókànlénígba  
tree take one more than 200      “two hundred and one trees”
- b)      igi    mú    òkan    dín    ní    òdúnrún    →    igi mókàndínlòòdúnrún  
tree take one less than 300      “two hundred and ninety-nine trees”
- c)      igi    mú    èta    lé    ní    irínwó    →    igi mètàlénírínwó  
tree take three more than 400      “four hundred and one trees”
- d)      igi    mú    èta    dín    ní    àádòrin    →    igi mètádínláàádòrin  
tree take three less than 70      “sixty seven trees”
- e)      igi    mú    èrin    lé    ní    ogòrùn-ún    →    igi mèrinlélógòrùn-ún  
tree take four more than 100      “one hundred and four trees”
- f)      igi    mú    èrin    dín    ní    irínwó    →    igi mèrindínnírínwó  
tree take four less than 400      “three hundred and ninety-six trees”

### **More on Tonal Patterns in Yoruba Numerals**

It can be observed that in examples (8a, c-d, f-g, i) and (9a-f) above, the input basic numerals end with M, but the M in each of the examples surface as L in the outputs. That is, the final M tones of numbers 1, 3, and 4 change to L when concatenated to form higher numerals<sup>6</sup>. There then arises the question as to what mechanism is behind this M~L alternation in Yoruba numerals.

Three possible explanations of this M~L alternation shall be examined, namely, tone lowering, dual forms of numbers 1, 3 and 4, and floating tone analyses. These alternatives will now be taken one after the other.

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<sup>5</sup> Usually, the vowel on the immediate right of *mú* is the prefix of the basic numeral in each case.

<sup>6</sup> The basic numbers *èje* “seven” and *èjò* “eight” also end with M, but they are excluded from the discussion since they do not participate in the formation of higher numerals

### **Tone Lowering**

It can be postulated that the M~L alternation is a consequence of a tone lowering process in the language. This implies that the final M on the basic numbers *òkan* “one”, *èta* “three” and *èrin* “four” is lowered to L when followed by the H-toned derivational morphemes *dín*, *lé/lá*. This is illustrated in examples (11a-f) below, with the syllables containing the alternating tones underlined.

- (11) a)      òkan dín ... → òkàn dín “one less...”  
 b)      òkan lé ... → òkàn lé “one more ...”  
 c)      èta dín ... → ètà dín “three less ...”  
 d)      èta lé ... → ètà lé “three more ...”  
 e)      èrin dín ... → èrìn dín “four less ...”  
 f)      èrin lé ... → èrìn lé “four more ...”

The problem with this postulation is that M getting lowered to L when it is followed by H does not have a phonetic motivation and is not attested in the general tonal pattern of Yoruba. That is why outputs such as we have in examples (12a-c) are ill-formed.

- (12) a)      òro dúdú → \*òrò dúdú “black bush mango”  
 b)      òbọ́ tìn-ín-rín → \*òbò tìn-ín-rín “slender monkey”  
 c)      ògo dídán → \*ògò dídán “shinning glory”

### **Dual Forms**

Another alternative way of viewing the M~L alternation is to postulate that each of the basic numbers “one”, “three”, and “four” has dual lexical representations, one ending in M and the other ending in L, as shown in (13a-c) below. For the purpose of discussion let us say that the form attested in counting is the basic representation and it ends with M, while the representation attested in the formation of higher numerals is derivational representation and it ends with L. The point will then be that this alternation is part of the lexical information of the basic numbers *òkan* “one”, *èta* “three” and *èrin* “four” in Yoruba.

While this proposal may be said to capture the alternation, at least on the surface, a question that it throws up is this: why is it that only these three numerals have to be postulated to have two lexical representations each among the basic numerals of Yoruba? And what is it about the three basic numbers that stands them out from the other basic numerals in Yoruba. A possible answer to the questions will be that they are the only basic numbers that participate in the formation of higher numbers via addition or subtraction and this alternation is required to facilitate this derivational ability.

(13) Dual representation proposal for numbers “one”, “three”, and “four”

	Basic representation	Derivational representation	gloss
a)	<u>ò</u> kan	<u>ò</u> kà <u>n</u>	“one”
b)	<u>è</u> ta	<u>è</u> tà	“three”
c)	<u>è</u> rin	<u>è</u> rìn	“four”

**Floating Tone**

A third view of the M~L alternation is to postulate that the derivation of higher numerals in Yoruba involves an L-tomorph<sup>7</sup>. For the derived forms to be understood as numerals, the tomorph surfaces on the final vowel of its basic numeral component. In order to illustrate this, examples (9a-f) are reproduced in (14a-f) below. Notice in (14a-f) that a superscript grave accent is inserted immediately to the right of each of the basic numerals *òkan* “one”, *èta* “three”, and *èrin* “four” to indicate the presence of the “floating low tomorph (FLT)”.

- (14) FLT in Yoruba numerals
- a)  $\overset{\text{`}}{\text{òkan}}$  lé ní igba →  $\overset{\text{`}}{\text{òkà}}\text{nlénígba}$   
 one FLT more than 200 “two hundred and one”
  - b)  $\overset{\text{`}}{\text{òkan}}$  dín ní òdúnrún →  $\overset{\text{`}}{\text{òkà}}\text{ndínlòdúnrún}$   
 one FLT less than 300 “two hundred and ninety-nine”
  - c)  $\overset{\text{`}}{\text{èta}}$  lé ní irínwó →  $\overset{\text{`}}{\text{ètà}}\text{lénirínwó}$   
 three FLT more than 400 “four hundred and one”
  - d)  $\overset{\text{`}}{\text{èta}}$  dín ní àádòrin →  $\overset{\text{`}}{\text{ètà}}\text{dínl'àádòrin}$   
 three FLT less than 70 “sixty seven”
  - e)  $\overset{\text{`}}{\text{èrin}}$  lé ní ogòrùn-ún →  $\overset{\text{`}}{\text{èrín}}\text{lélògòrùn-ún}$   
 four FLT more than 100 “one hundred and four”
  - f)  $\overset{\text{`}}{\text{èrin}}$  dín ní irínwó →  $\overset{\text{`}}{\text{èrín}}\text{dínirínwó}$   
 four FLT less than 400 “three hundred and ninety-six”

Example (15) below provides an Autosegmental sketch of the linking of the FLT. In (15), the FLT is represented on a tier separate from the tones underlyingly linked to segments<sup>8</sup>. In (15) as well as in the other basic numbers studied in this work, the tomorph links to the final vowel<sup>9</sup> of the basic number, and displaces the M that was underlyingly on it; thus the affected vowel is realized with L on the surface.

(15) Autosegmental illustration of L-tomorph linking in Yoruba

	Input		Tomorph linking		Output	Gloss
CV:	Òkan la	→	Òkan la	→	Òkan la	“eleven”
Tone:	L M H		L (M) H		L L H	
Tomorph:	L		L			

<sup>7</sup> According to Elugbe (1985), a tomorph is a grammatical floating tone, and it is a common feature among West Benue-Congo languages.

<sup>8</sup> This idea of placing a tomorph on an independent tier was proposed by Adeniyi & Elugbe (2018) to cater for long-distant effects of tomorphs in such a way as the principle forbidden the crossing of association lines is not violated. They argued the position using data from Gwari and Ghotuo, two West Benue-Congo languages having many shared features with Yoruba. Although this may be a departure from regular practice, interested readers are referred to the article for the full argumentation.

<sup>9</sup> “Vowel” is used in place of tone-bearing unit in this article only for convenience.

The first question that may arise from (15) is why L, a lower tone, displaces M, but this is in accordance with the established H>L>M tonal hierarchy in Yoruba. The implication of the tonal hierarchy is that where L and M are concatenated across word boundaries, in any order in Yoruba, and the segmental host of one of them is elided to trigger tonal deletion, it is the M that is always deleted. Thus, it is this tonal hierarchy that results in L-tomorph replacing underlying M in the formation of higher numerals in Yoruba. The alternation is not attested when the L-tomorph is concatenated with a linked L because both are like tones and the effect is not seen. The alternation is also not seen where H is involved because H dominates L in Yoruba, so the linking of the L-tomorph has no phonetic effect.

### **Summary and Conclusion**

Three alternative explanations of the tonal alternation in Yoruba numerals have been offered namely, that M is lowered to L in the context under focus, that the numerals have dual representations, one bearing each of the alternating tones respectively, and thirdly that numeral is marked by a L-tomorph in Yoruba. To start with, the postulation that M is lowered to L lacks sufficient support in the Yoruba sound system. This means that the assumption that M becomes lowered to L when it is followed by H (8a, c-d, f-g, i and 9a-f) is a dissimilatory effect that is not attested in Yoruba. Also, the postulation that the numerals have dual representations runs into problems when viewed in the light of the larger phonology of the language. As shown above, the tomorph argument offers a more systematic insight into the alternations seen in the numerals.<sup>10</sup> It also enjoys support in the existing phonological patterns of Yoruba. Yoruba has been shown to have different tonal morphemes that show up in phonologically defined grammatical constructions (Akinlabi and Libermann, 2000; Adeniyi, 2018). Without mentioning tonal morphemes, Bamgbose (1965: 18-19) noted that the tone in the dictionary entries of some words change when those words are used in grammatical structures. Bamgbose listed the affected grammatical structures to include subject-predicate, emphatic clauses, verbal junction, pronoun subject, pronoun object, verb before noun, and noun plus noun. Following phonological works have since proven that the said tonal changes are indeed triggered by tomorphs (Cf. Akinlabi and Libermann 2000; Adewusi 2011; Adeniyi 2018). Thus, the tonal alternation in Yoruba numerals is a result of the docking of the “numeral-marking L-tomorph” in Yoruba. The L-tomorph is shown to become active only when it is preceded by M, which is when it docks to displace a preceding M.

This work has therefore deepened understanding of the Yoruba tone system, especially the tonal structure of the numeral system of the language. The Yoruba numeral is already said to be complex, but with the discovery of active tomorph, the complexity is further understood.

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<sup>10</sup> Beavers and Sells (2013) propose that linguistic argument should be built on attested patterns of the facts in the language, in this case Yoruba numerals.



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