Linguistic analysis of the structure of Yoruba numerals

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Abstract

This article analyses the structure of Yoruba numerals and their derivation. Data are collected from the compilation of Yoruba numerals and observation of its use coupled with the researcher’s intuitive knowledge of the language. The work dwells on the existing literature on numerals too. The author adopts a descriptive method in analysing the data. The work looks at the roles of affixes in realising odd numbers, multiples of 20, centenary, bicentenary, and so on in their order of increase. It is discovered that the direction of counting in Yoruba is largely progressive. Besides, the language adopts base 5, decimal (base 10) and vigesimal (base 20) systems of counting. It is equally discovered that the choice of either of the two variations ogó-/ọgọ́- is largely dependent on the articulatory parameter of the first vowel (V1) of the root word. It is noted that the Yoruba numeral system offers a suitable linguistic database for both the theoretical and empirical domains of linguistic study especially documentary linguistics. The current study has general pedagogic implications for the teaching and learning of Yoruba numerals.

Key words: base five, cardinal, centennial number, documentary linguistics, language typology, morphological processes, ordinal, phonological processes, syntactic structure, vigesimal system

Introduction

The traditional system of counting, in any given speech community, constitutes one of the sociolinguistic factors that make up the distinctiveness and individuality of that community as against other communities. This article refers to the counting system as a product of human intelligence and people’s limitless capacity for in-depth thoughtfulness. The article nullifies Atoyebi’s (1989) claim that numerals appear to be an aspect of language study to which researchers, scholars and linguists pay less attention. Scholarly
works abound on numerals generally both in theory and typology, for example, Adeoye (1979), Armstrong (1962), Awobuluyi (1994), Borchardt (2011), Comrie (2005), Esiri (2011), Greenberg (1978), Lounge (2011), Oduoye (1969) and Oyebade (2011), to mention a few. In fact, investigating numeral systems is popular among, for instance, linguists, psychologists and anthropologists. Borchardt (2011) observes that there are many under-described numeral systems, especially in Africa. According to Greenberg (1978) and Comrie (2006), research on numeral systems is not only a very interesting topic but also an academically valuable reference resource for those involved in the academic disciplines of Linguistics, Anthropology, Ethnology, History and Philosophy of Mathematics. Scholars such as Oduoye (1969), Adeoye (1979), Oyebade (2010), Lounge (2011) and Esiri (2011) have presented a number of scholarly papers on the Yoruba numeral system but none have extended their study to the linguistic analysis of the subject. The article describes the derivation of the Yoruba counting system with its arithmetic technicalities and also analyses the linguistic structure of the Yoruba numerals. Since not much work has been done in this area, by extension, the article will add to the existing documentation and database in the language. The consequences of these description and analyses for the pedagogic situation are contained in its capacity to illuminate the understanding of the learners and throw more light on how some seemingly complex numerals are derived.

The foregoing justifies Everett’s (2003) submission on the need to make permanent some significant features of African Linguistics especially the counting system for its theoretical insights to the body of language study. The significance of traditional numerals within the linguistic and pedagogical development of a language, as expressed by Awobuluyi (1994, 33), motivated me to write this article. Comrie (2005) notes that the surviving thousands of the world’s ethnic groups use a variety of numeral systems, for example: duodecimal systems, decimal systems, quinary systems, quaternary systems, ternary systems, binary systems, incomplete decimal systems, mixed systems, body-part tally systems, and so on. Though there have been concerted efforts by scholars, like Armstrong (1962), a detailed analysis of the construction of numerals from a mathematical point of view is not readily available. Using the mathematical phenomenon of base 5, decimal (base 10) and vigesimal (base 20) counting systems, the article explains the complexity associated with numerals in the Yoruba language.

Counting is an indispensable part of humanity. Whether consciously or unconsciously, counting is something people do every day, whether in the market (during price haggling), on the farm (during yam storage), in offices and their homes, or anywhere else while taking stock of items. In fact, counting has been part of human existence right from creation. In the Bible of the Christian faith, it is recorded in Psalm 90 vs. 12 ‘that may God teach us to count our days so that we might put our minds in the path of wisdom’. It may be argued that the Yoruba language is unlikely to be highly endangered in the proper sense of the word considering the number of its native speakers and linguistic
researches available in the language. However, Foley (1984) observes that one of the areas usually identified as being seriously endangered in the use and study of the language is the numeral system. This is evident in the observation that children nowadays rarely know how to count in Yoruba. Even adults code-switch using Yoruba with English when they engage in activities that involve numerals or count money and other objects in the language. Code-switching, according to Auer (1984) and Franceschini (2002), could be a manifestation of insufficient knowledge in either of the languages in use. In Comrie’s (2005, 2006) opinion, there are many instances of languages that are not particularly endangered, but whose numeral systems are endangered.

Needless to say, these invaluable linguistic data should also be documented as soon as possible, as the indigenous numeral systems of minority ethnic groups are particularly prone to be replaced by neighbouring politically and economically predominant languages. The younger generations tend to give up the traditional numeral systems and adopt the borrowed ones; this phenomenon is especially prevalent in Melanesia, South and South-East Asia, Central and South America and certain areas of Africa. This is because during rapid globalisation, the act of counting in a minority language is left to older members of the community, while the younger generation often tend to shy away from native numerals and prefer to express numerals in some other dominant language, with the result that the traditional numeral systems of most small languages are being rapidly replaced by those of dominant languages. Even the numeral systems of large languages can be endangered in this way, for example Japanese and Thai numerals have been largely replaced by Chinese (Comrie 2005).

According to Comrie (2006), language death is the result of social factors, and counting systems are generally particularly susceptible to social factors. He illustrates this further:

>a community encountering another community with greater numeracy may well borrow the “missing” parts of its system from that other community, but the contact may also involve replacements of parts or all of the existing system, and can also affect languages that come into contact even where there is no great difference in numeracy, but just cultural or commercial superiority of one group over the other (Comrie 2006, 1).

This, and here I would agree with Comrie, is why numeral systems are more seriously endangered than languages. Comrie (2006, 1) concludes that given the present rate of death of languages in the world, it may well no longer be possible to determine even approximately what the range of possible numeral systems in natural language is or to assess what the relative frequency of different types would be.

Being an aspect of linguistic documentation, since data are not entirely obtained from either the researcher or the literature but also from the observation of its numeral usages in a natural speech community, the article is a necessary tool for the preservation of the Yoruba cultural norms and values which are fast becoming extinct.
According to Himmelmann (1998), one of the ultimate aims of language documentation is the production of a detailed and comprehensive record of the linguistic practices peculiar to a given speech community. He further clarifies the practices as both noticeable linguistic behaviour often made manifest in the speech act of members of the speech community, and the native speakers’ metalinguistic intuition that enables them to provide interpretations and systematisations for linguistic units and events. Language documentation is more or less a new field of study especially in Linguistics in recent time. Woodbury (2003) contends that this new area is preoccupied with the making and keeping of records of significant features of the world’s languages and their pattern of use.

The primary objective of the current study is to describe the derivation of numerals in Yoruba and to analyse their structure linguistically while contributing in some way to the documentation of this most vulnerable aspect of the Yoruba language.

Suffice it to say that in the presentation of data in the article, I make use of the standard Yoruba orthography and International Phonetic Alphabet (IPA) symbols especially where a word is rendered in phonetic transcription. The article is divided into sections for an exhaustive discussion of the subject matter. The first section gives a brief historical background of numerals and the concept of base in number. The second segment looks at the counting system in Yoruba with its arithmetic techniques. The third part concentrates on a linguistic analysis of Yoruba numerals. The last section summarises and highlights the findings.

A brief historical background of numerals

In his treatment of the history of numerals, Spencer (1976, 4) reports that primitive tribes were able to keep count of their sheep and other items by using sticks, stones, fingers, notches in wood, and knots in a string. Beller and Bender (2011), and Andrea and Beller (2012) buttress this observation that like number words and written numerals, fingers can be used to represent numbers. In fact, due to their ubiquitous availability, agility and discrete quantity, they are considered the most natural tool for counting, which renders them attractive for theories of embodied (numerical) cognition. It would be an overstatement to say that each language has words that are used for counting and that such number words can be written down in the same way as other words in a language. According to Borchardt (2011), there is some controversy in the literature on languages without numerals such as Pirahã and languages with restricted numeral systems. Certain South American indigenous languages, notes Comrie (2005), only distinguish the numbers ‘one’ and ‘many’. These fascinating phenomena, like a kaleidoscope, reflect the diversity and different development steps of human counting concepts. While giving the diachronic account of numerals, Girling (1958, 69–70) makes the assumption that counting is nearly as old as speech and numerals are as old as writing.
The fact that every speech community has its own number words, in which numerals are written, is confirmed by Mitchell (1976, 31) when he presents examples from six European languages to illustrate how numerals are written in number words (see Table 1).

Table 1: Numerals in some European languages (Mitchell 1976, 31)

|       | ENGLISH | FRENCH | ITALIAN | GERMAN | DUTCH | SPANISH |
|-------|---------|--------|---------|--------|-------|---------|
| 1.    | One     | Un     | Uno     | ein    | Een   | Uno     |
| 2.    | Two     | Deux   | Due     | zwei   | Twee  | Dos     |
| 3.    | Three   | Trois  | Tre     | drei   | Drie  | Tres    |
| 4.    | Four    | Quatre | Quattro | vier   | Vier  | Cuatro  |
| 5.    | Five    | Cinq   | Cinque  | funf   | Vijf  | Cinco   |
| 6.    | Six     | Six    | Sei     | sechs  | Zes   | Seis    |
| 7.    | Seven   | Sept   | Sette   | sieben | Zeven | Siete   |
| 8.    | Eight   | Huit   | Otte    | acht   | Acht  | Ocho    |
| 9.    | Nine    | Neuf   | Nove    | neun   | Negen | Nuve    |
| 10.   | Ten     | Dix    | Dieci   | zehn   | Tien  | Diez    |

It is not only in the European languages that number words are used; they are found in all other human languages, as given by Sanusi (1998, 14) in Table 2:

Table 2: Numerals in Hausa and Igbo (Sanusi 1998, 14)

|       | HAUSA | IGBO¹ |
|-------|-------|-------|
| 1.    | Daya  | otu (ofu) |
| 2.    | Biyu  | Abua  |
| 3.    | Uku   | ato (ito; eto) |
| 4.    | Hudu  | ano (ino; eno) |
| 5.    | Biyar | ise (iso) |
| 6.    | Shida | Isii  |
| 7.    | Bakwaii | asaa (isaa; esaa) |
| 8.    | Takwas | asato (isato; esato) |
| 9.    | Tara  | ileghete (itenaani; esato) |
| 10.   | Goma  | iri (ili) |

The concept of base in number

Many researchers have noted that the numeral system in most African languages is based on either 5, decimal (base 10) or vigesimal (base 20). Oduoye (1969) illuminates the reason for this that in counting on fingers and toes, the first point of rest is at the number 5, the number of fingers on one hand; 10 is another point of rest being the
number of fingers on the two upper limbs; and 20 completes the system of counting on fingers and toes. *The Oxford English Dictionary* (1933, 102) defines a *base* as a number or symbol which is made on the basis of a scale of numeration, or an original word or form from which other words are derived.

In the early stages of development, notes Spencer (1976), the counting process became systematised when it was necessary to make more extensive counts. This was done by arranging the numbers into convenient basic groups, hence the introduction of number bases. Spencer (1976, 42) further observes that:

> Today some South American tribes count by hands, base 5. The base 12 was used in prehistoric times, chiefly in relation to measurements. The American Indian and Mayan tribes used a base 20 number system. The ancient Babylonians used a number system based on 60. This system is still used when measuring time and angles in minutes and seconds. A base, then, is the number of distinct digits required by a system of numeric notation.

Among the popular types of number bases, Girling (1958, 70) recognises the following:

(i) binary (base 2)
(ii) quaternary (base 4)
(iii) quinary (base 5)
(iv) denary (base 10)
(v) vigesimal (base 20)

The decimal system of Arabic numerals (i.e. base 10) that people are most familiar with, was said to have been introduced into Europe by Adelard of Bath in about 110 AD, and by 1600 AD, it was in almost universal use (see Mitchell 1976, 31). Having seen the pattern of counting system in other cultures, how is it done in Yoruba?

**Yoruba counting system**

The Yoruba counting system will be examined under several headings in consonance with how things are classified and positioned, namely, cardinal and ordinal numbers. Cardinal is a term used for the grammatical description referring to the class of numerals like one, two, three, and so on, while ordinal is used to refer to the class of numerals like first, second, third, and so on. According to Oduoye (1969), Oyebade (2010) and Lounge (2011), the numeral system in most African languages is based on either base 5, decimal (base 10), or vigesimal (base 20). For instance, Nupe and Ebira use the base 5 system of counting, while Igbo and Esan adopt the decimal system.
Yoruba adopts the base 5, decimal (base 10) and vigesimal (base 20) counting systems and the language has a rather elaborate vigesimal numeral system that involves both addition and subtraction and multiplication. Vigesimal systems, by their nature, often combine with other base systems to provide a comprehensive counting system. This is exemplified in the habitual counting of fingers using 5, 10 and the toes totalling 20 as contained in Table 3:

Table 3: Counting using 5, 10 and 20

| Arabic | The counting pattern | Cardinals | Ordinals |
|--------|----------------------|-----------|----------|
| 1      | ení / oókan          | ìwé kan 'one book' | ipò kinní = i/èkinní |
| 2      | éjí / ééjí           | ,, méjí 'two books' | ,, keji = i/èkeji |
| 3      | èta / ëta            | ,, méta      | ,, këta = i/èkëta |
| 4      | érin / ëërin         | ,, mèrin     | ,, kèrin = i/èkerin |
| 5      | àrùn / aárù-ùn       | ,, márùn-ùn | ,, karùn-ùn = i/èkarùn-ùn |
| 6      | èfà / ëefà           | ,, mèfà      | ,, kefà = i/èkefà |
| 7      | èje / ééje           | ,, méje      | ,, keje = i/èkeje |
| 8      | èjọ / ëëjọ           | ,, méjọ      | ,, kejọ = i/èkejọ |
| 9      | èsàn / eësàn-án       | ,, mèsàn-án  | ,, kèsàn-án = i/èkèsàn-án |
| 10     | ëwá / ëwàá          | ìwé mèwáá   | ipó këwáá = i/èkëwáá |
| 11 = 10 + 1 | òkànlá / oòkànlá | ,, mòkànlá   | ,, mòkànlá = i/èmòkànlá |
| 12 = 10 + 2 | ëjìlá / ëëjìlá | ,, méjìlá    | ,, kejìlá = i/èkejìlá |
| 13 = 10 + 3 | ëtàlá / ëëtàlá | ,, mètàlá    | ,, ketàlá = i/èketàlá |
| 14 = 10 + 4 | ërinlá / ëërinlá | ,, mèrinlá   | ,, keitàlá = i/èkeitàlá |
| 15 = 20 – 5 | àrùndìnlógún / aárùndìnlógún | ,, mèdìnlógún | ,, karùndìnlógún = i/èkarùndìnlógún |
| 16 = 20 – 4 | ërìndìnlógún / ëërìndìnlógún | ,, mèríndìnlógún | ,, keríndìnlógún = i/èkeríndìnlógún |
| 17 = 20 – 3 | ëtàdìnlógún / ëëtàdìnlógún | ,, mètàdìnlógún | ,, ketàdìnlógún = i/èketàdìnlógún |
| 18 = 20 – 2 | ëjìdínlógún / ëëjìdínlógún | ,, mèjìdínlógún | ,, kejìdínlógún = i/èkejìdínlógún |
| 19 = 20 – 1 | òkàndìnlógún / oòkàndìnlógún | ,, mòkàndìnlógún | ,, mòkàndìnlógún = i/èmòkàndìnlógún |
| 20 = 10 + 10 | ogùn / okòó | ,, ogùn / ogùn | ,, ogùn |
Note:

11 = mọkànlà ‘i.e. mú ọkan la ẹwa’
‘take one surpass ten’
‘one plus ten’

12 = mêjılı ‘i.e. mu eéji la ẹwá’
‘take two surpass ten’
‘twelve’

-dìn- means ‘less than’, that is, àrùndínlógún means àrún (5) din (less than) ni/lo (out of) ogún (20): 20 – 5 = 15

An explicit explanation of the denasalisation of ni is given under the section on the denasalisation process below. The method Yoruba people adopt in their counting system shall be examined in the next section.

Yoruba counting techniques

Close observation will show that 6, 7, 8, 9, 30, 300, 400, that is, ‘méfà, mèje, mêjo, mèsàn-án, ogbọn, òódünrnún, irinwó’, respectively are not used recurrently for the derivation of higher numbers. There are conventional terms used to designate ‘less than’ (dìn.../dìn ní...) and ‘more than’ (lé ní...) For instance, dìn... / dìn ní... (reduces by) is used to count from 15 mêdógún, that is, mú-àrùn-dìn-ní-ogún (twenty less than five) to 19 mòkàndínológún, that is, mú-òkan-dìn-ní-ogún (twenty less than one). The Yoruba meaning given here is in cardinals. According to Esiri (2011), ogún is the basic word for 20 and okòó is used for 20 when counting objects. According to Esiri, each of the decades is coded; units in 1 to 4 are derived by adding to these, while units in 5 to 9 are formed by subtracting from the next decade. The odd decades are derived by subtracting 10 from the next even decade as found in the Danish language. In other words, lé ní... (increases by...) is from 1 to 4, that is, adding to 10, while ó dìn ní... (decreases by...) is from 5 to 9, that is, subtracting from 10. The number of increases counted after the previous 10 is 4. In other words, from any number higher than 10, the first four units are added to the previous decimal and the next five are subtracted from the subsequent decimal number as in (1):

(1) 11 to 14
21 to 24
31 to 34 and so on (add 1 to 4)
while the number of decreases counted before another 10 is 5 as in:
15 to 19
25 to 29
35 to 39 and so on

The meaning of 10 is not found in 20. In other words, ogún (20) in Yoruba is a monomorphemic base and it is not constructed with 10. From 21 to 24, the counting pattern changes from what is observed from 11 to 14. The numbers 11 through 14 are counted in the pattern given in Table 3, but 21 to 24 are counted as mokànélélógún, that is, mú-ókan-lé-ní-ogún (21); mêjìlélógún, that is, mú-èjì-lé-ní-ogún (22); metélélógún, that is, mú-èta-lé-ní-ogún (23); and mèrinlélógún, that is, mú-èrin-lé-ní-ogún (24). Apparently, the meanings of counting from 21 to 24 are not difficult to decipher like 11 to 12.

From 25 the counting is ... dìn lógbọ̀n (... less than thirty). For example, 25 is märùn-ùn-dìn-ní-ogbọn/mèdọgbọn (five less than thirty) up to 29 mòkàndìnlgbọn (one less than thirty) and 30 is Ògbọn. The same procedure is followed in counting from 31 to 50. Ògbọn as noted has no semantic connection with either 20 or 40, but 40 has. In fact from 40, which is coded ogoji, henceforth, there is evidence of some semantic import of several previous numbers and, more importantly, the significance of arithmetic concepts such as division, multiplication, subtraction, addition.

\[
\begin{align*}
(2) \quad 20 \times 2 & = 40 \text{ i.e. (}20 + 20) \\
\text{‘ogún’} & \quad \text{‘méjì/èjì’} \\
\text{‘ógójì/ogún-méjì’}.
\end{align*}
\]

From àádọ́ta (50) to àádọ́wàá (190), the prefix àádọ́- is used to imply ‘dìn méwàá’ (–10 or less than 10) as against Jeje (1979) who says it is from 50 to 180 as shown in (3) to (5):

\[
\begin{align*}
(3) \quad 60 - 10 & = 50 \\
\text{‘ọgọta/ogún mẹ́ta’} & \quad \text{‘èwá’} & \quad \text{‘àádọ́ta’} \\
(20 \times 3) - 10 \\
(4) \quad 80 - 10 & = 70 \\
\text{‘ọgórìn/ogún mèrin’} & \quad \text{‘èwá’} & \quad \text{‘àádórin’} \\
(20 \times 4) - 10 \\
(5) \quad 100 - 10 & = 90 \\
\text{‘ọgórùn-ùn/ogún márùn-ùn’} & \quad \text{‘èwá’} & \quad \text{‘àádórìn’}
\end{align*}
\]

The prefix ogó-/ọgọ́- (20) is used to show figures which are divisible by 20 like:

\[
\begin{align*}
(6) \quad 40 \div 20 & = 2 \\
\text{‘ógójì/ogún mèjì’} & \quad \text{‘ogún’} & \quad \text{‘èjì’ i.e. ‘40 is divisible by 20 twice’} \\
(7) \quad 60 \div 20 & = 3 \\
\text{‘ọgọta/ogún mẹ́ta’} & \quad \text{‘ogún’} & \quad \text{‘èta’ i.e. ‘60 is divisible by 20 three times’}
\end{align*}
\]
\( \frac{80}{20} = 4 \)

'ogórin/ogún mérin' 'ogún' 'mérin' i.e. '80 is divisible by 20 four times'

The choice of either of the two variations \( \text{o}g\text{ó}/\text{o}g\text{ó}^- \) is largely dependent on the articulatory parameter of the first vowel (V1) of the root word \( è\text{t}\text{à} \) (3), \( è\text{rin} \) (4), èje (7). That is, if the first vowel of the root word is a front mid-closed vowel, such as \([e]\), the vowel of the prefix would be a mid-close vowel either \([e]\) or \([o]\) as in \( \text{o}g\text{ó}/(\text{o}g\text{ó}^- + è\text{je} = \text{o}g\text{ò}jè \) (70)). If the first vowel of the root word is a front mid-open vowel, such as \([ɛ]\), the vowel of the prefix would be a mid-open vowel either \([ɛ]\) or \([ɔ]\) as in \( \text{o}g\text{ó}/(\text{o}g\text{ó}^- + è\text{rin} = \text{o}g\text{ò}rìn \) (80)).

Whatever \( \text{o}g\text{ó}/\text{o}g\text{ó}^- \) or \( è\text{á}d\text{ó}^- \) is affixed to can equally be more or less as shown in (9):

(9)  
41 'mọkànélógójì/mù ọkàn lè ní ogójì' i.e. ‘forty increases by one’
42 'mèjìlélógójì/mù èjì lè ní ogójì' i.e. ‘forty increases by two’
45 'màrùndínlàádìọtäa/mù ètä lè ní ogójì' i.e. ‘fifty decreases by five’
46 'mèrùndínlàádìọtäa/mù èrìn lè ní ogójì' i.e. ‘fifty decreases by four’

\( \text{o}g\text{ó}wàà/\text{o}g\text{ù}n \) méwàà (20 x 10 = 200) is conventionally coded ‘igba’. From 200 above, 20 is no longer expressed as \( \text{o}g\text{ù}n \) as noted above but as \( \text{okòò} \) as seen in (10):

(10)  
220 ‘okòò-lé-ní-igba/okòòléèrùgba’ i.e. ‘twenty more than 200’
280 ‘okòò-dìn-l-òódùnrùn’ ‘twenty less than 300’ ‘300 is òódùnrùn’
420 ‘okòò-lé-ní-ìrinwò’ ‘twenty more than 400’ ‘400 is ìrinwò’
480 ‘okòò-dìn-l-èèdègbètà’ ‘twenty less than 500’ ‘500 is èèdègbètà’

From 500, a new pattern that replaces 10 and 20 with 100 and 200 respectively as computation bases begins. From 500 the pattern of counting by prefixing \( è\text{é}dè^- \) to any number that is less by 100 changes. This shows that centuries larger than 200 are derived by either subtracting 100 from the next bicentenary or by multiplying 200 by the appropriate unit as shown in (11) to (13):

(11)  
600 – 100 = 500
‘ègbètä/igba méta’ ‘ógorùn-ùn/ogún märùn-ùn’
(20 x 3) (20 x 5)

(12)  
800 – 100 = 700
‘ègbèrìn/igba mérin’ ‘ógorùn-ùn/ogún märùn-ùn’
(20 x 4) (20 x 5)

(13)  
1 000 – 100 = 900
‘ègbèrùn/igba märùn-ùn’ ‘ógorùn-ùn’
(20 x 5)
 Whereas ẹ̀ẹ́dẹ́- is less by 100, ẹgbẹ̀-(i.e. a derivation of ighaba) is affixed to any number that is divisible by 200 as shown in (14) to (16):

(14) \[\begin{array}{c}
600 \div 200 = 3 \\
\text{‘egbẹ̀ta/igba méta’} \quad \text{‘igba’} \quad \text{‘ọta’}
\end{array}\]

(15) \[\begin{array}{c}
800 \div 200 = 4 \\
\text{‘egbẹ̀rin/igba mérin’} \quad \text{‘igba’} \quad \text{‘èrin/mérin’}
\end{array}\]

(16) \[\begin{array}{c}
1000 \div 200 = 5 \\
\text{‘egbẹ̀rún/igba márùn-ún’} \quad \text{‘igba’} \quad \text{‘márùn-ún’}
\end{array}\]

As observed in ogó-/ogó-, ‘a derivative of ogún’ and áádọ́ above, whatever ẹ̀ẹ́dẹ́- and ẹgbẹ̀- are attached to can equally decrease or increase as shown in (17):

(17) ejí-lè-ní-ẹ̀ẹ́dẹ́-egbẹ̀ta ‘502’ i.e. 600 – 100 (+ 2)
    òjí-lè-ní-ẹ̀ẹ́dẹ́-egbẹ̀ta ‘540’ i.e. 600 – 100 (+ 40)
    okóó-lé-ní-egbẹ̀ta ‘620’ i.e. 600 + 20
    òtà-lè-legbẹ̀rin/ọjí-dín-lèdè-egbẹ̀rún 860’ i.e. 60 + 800 or 900 – 40
    àrùn-dín-légbẹ̀rún ‘995’ i.e. 1 000 – 5

The convention behind the Yoruba numerals especially at this point is: you can use ẹgbàwá/ẹgbáá-(2000), that is, igba mewàá (200 x 10) as a prefix attached to describe any figure that is divisible by 2000 as shown in (18) to (21):

(18) \[\begin{array}{c}
4000 \div 2000 = 2 \\
\text{‘egbááj/egbáá méjí’} \quad \text{‘egbáá’} \quad \text{‘méjí’}
\end{array}\]

(19) \[\begin{array}{c}
6000 \div 2000 = 3 \\
\text{‘egbááta/egbáá méta’} \quad \text{‘egbáá’} \quad \text{‘méta’}
\end{array}\]

(20) \[\begin{array}{c}
8000 \div 2000 = 4 \\
\text{‘egbáárín/egbáá mérin’} \quad \text{‘egbáá’} \quad \text{‘mérin’}
\end{array}\]

(21) \[\begin{array}{c}
10,000 \div 2000 = 5 \\
\text{‘egbáárún-ún/egbáá márùn-ún’} \quad \text{‘egbáá’} \quad \text{‘márùn-ún’}
\end{array}\]

If the number is also less by 1000, ẹ̀ẹ́dẹ́- is attached as shown in (22) to (25):

(22) \[\int \text{i.e 4000} \quad \text{–} \quad \text{1000 or 200} \times \text{15} \]
    \text{‘ẹ̀ẹ́dẹ́-egbááj/egbẹ̀dógún’} \quad \text{‘egbááj’} \quad \text{‘egbẹ̀rún’} \quad \text{‘igba’}
    \text{‘mèdógún’}
The data provided reveal that Yoruba adopts both the decimal (1 to 10) and vigesimal (multiples of 20 to 200) systems of counting. Besides, from the mathematical analysis, it is evident that Yoruba computes from right-to-left unlike English which computes from left-to-right. Oyebade (2010) notes that, to a large extent, Yoruba numerals are anticipatory since subtraction is done in anticipation of the next decimal or centennial number. Yoruba operates subtraction in a base 5 system and this is done at each decimal junction. This view is aptly captured by Esiri (2011) who reports that the Yoruba numeral system attests to the system that relies heavily on subtraction for the derivation of odd numerals. There have been several observations, suggestions and proposals aimed at addressing this seemingly complex numeral system. One of such is the adoption of the decimal system into the language.

Suffice it to say here that the difficulties and the consequent discouragement that greeted the learning and usage of the counting system in Yoruba may not have been unconnected with the mathematical applications therein and the correct use and interpretation of the affixes like àádọ-, ọgọ-/ogó-, ëéde-, ëgbẹ-, ëgbẹẹ-, ëgbáá-, and so on. Even the use of base 5 as a computing strategy for decimals with the sequence reverse equally contributes in some way to its frustrating nature. This observation, that the derivation of numerals in most African languages is quite tiresome and complicated, is aptly captured by Awobulu (1994).

Meanwhile, the descriptive analysis undertaken in this section reveals a pocket of phonological and morphological processes coupled with syntactic structures which deserve explicit description. This is the scope of the succeeding section.

**Linguistic analysis of Yoruba numerals**

Greenberg (1978) observes that numerals interact with the rest of grammar and may have unique morphosyntactic structures and rules. Nevertheless, numerals are often either neglected or completely ignored in many grammars. The structure of any language is amenable to three different levels, namely: sound level (phonology); form/
structure level (morphology and syntax); and meaning level (semantics). There are issues of linguistic interest in the numerals of the Yoruba language whose analysis will give plenty of insight about the counting system in the language. These issues will further enhance the teaching and learning of the Yoruba language and its comparison with some other languages.

**Phonological structure**

Phonology is a distinct aspect of language study because of its centrality to the development of any language. There are some salient phonological observations which are of significant interest in the counting system of Yoruba. These observations can only be explained via the analysis of its linguistic structure. Some of these issues are phonological processes like consonant deletion, vowel elision (segment and suprasegment), assimilation, coalescence, denasalisation and even free variation (phoneme identification).

**Coalescence**

This is a phonological process where two segments merge together to produce an entirely new segment distinct from the input. Coalescence is a term used in linguistics to refer to the coming together of linguistic units which were originally distinguishable. Bamgbose (1990) defines vowel coalescence as a combination of two contiguous (underlying) vowels whose output is a different vowel entirely, as in (26):

(26)  (i)  \[ \text{ògùn} + \text{ èjì} = \text{ògòjì} \]
      ‘twenty’  ‘two’  ‘forty’

(ii)  \[ \text{ògùn} + \text{ ìta} = \text{ògòta} \]
      ‘twenty’  ‘three’  ‘sixty’

In the examples, the underlined segments at the underlying level (nasalised and oral vowels) merge to produce the oral vowels underlined at the surface level. Awobuluyi (1983, 1987) refers to this type of coalescence as coalescence by assimilation with the skeletal format shown in (27):

(27)  \[ \begin{array}{c}
\text{un}\\
\text{high}\\
\text{back}\\
\text{rounded}\\
\text{nasal}
\end{array} \rightarrow \begin{array}{c}
\text{e}\\
\text{mid-high}\\
\text{front}\\
\text{unrounded}\\
\text{oral}
\end{array} \rightarrow \begin{array}{c}
\text{o}\\
\text{high}\\
\text{back}\\
\text{rounded}\\
\text{oral}
\end{array} \]
Deletion

Oyebade (2011) notes that deletion is one of the most obvious phonological processes in language. He further notes that the process in Yoruba came about as a result of Yoruba preference for the shape and constitution of words. It is a term used to refer to the omission of sounds in connected speech. Both vowels and consonants may be affected.

Consonant deletion

Example (28i) shows that the consonant \( w \) is deleted amidst two vowels since the two vowels are rounded according to Oyebade (2011). Though there is an instance of vowel deletion too. In example (28ii), the consonant \( r \) is deleted, but at the beginning of the word unlike the assumption that it is usually in the last syllable of the word, as in example (28iii) where the consonant \( r \) is deleted in the last syllable (in fact the entire last syllable is deleted).

\[
\text{(28) (i) } \text{irin owo } \rightarrow \text{ irin_wo } \rightarrow \text{ irino } \quad \text{‘400’} \\
\text{(ii) } \text{mẹ́rnlá } \rightarrow \text{ mênlá } \quad \text{‘14’} \\
\text{(iii) } \text{ọ̀ọ́dúnrún } \rightarrow \text{ ọ̀dún } \quad \text{‘300’}
\]

Vowel elision

The following examples will illustrate that a consonant segment /\( r \)/ is deleted in the first two examples while a vowel sound /\( u \)/ is elided to derive unit forms of the numerals. The /\( u \)/ sound in \( μ\) is elided. Its floating high tone is docked on the first vowel of the root having assimilated the low tone on the first vowel of the root word as given by the tonal structure/hierarchy in the Yoruba language. The elision of sound may have been borne out of the desire to ensure easy production of speech.

\[
\text{(29) } \text{ọgọ́- + ọ̀rún } \rightarrow \text{ ọgórún-ún} \\
\text{20 x 5 } \quad \text{100}
\]

The elision here is predictable; the first vowel of the root is elided with its low tone:

\[
\text{mẹ́rindlnlógún } \rightarrow \text{ mêндlnlógún } \quad \text{‘16’} \\
\text{merinlelogun } \rightarrow \text{ mênlélógún } \quad \text{‘24’} \\
\text{mú } + \text{ èjì } = \text{ méjì } \quad \text{‘two’} \\
\text{mú } + \text{ èta } = \text{ métà } \quad \text{‘three’}
\]
**Tonal sandhi**

The sequence of adjacent tones may influence each other either phonetically or phonologically. In other words, a word which in isolation would have low tone may be given a higher tone if a high-tone word follows. This phenomenon, according to Crystal (2003), is referred to as tonal sandhi, as seen in (30):

(30) Mú ọkan lé ní ogún → mókànlélógóún ‘21’

**Tonal changes**

There is no definite order for the occurrence of tone in Yoruba. According to Oyebade (2011), tones occur indiscriminately. The pattern of tonal changes observed in the Yoruba counting system deserves some attention. It should be noted that cardinal numbers in the language (apart from *kan* ‘one’) start with high tones, while ordinal numbers begin with low tones as shown in Table 3.

(31) | Cardinal numbers | Ordinal numbers |
|------------------|-----------------|
| méjì              | l/èkejì        |
| métá             | l/èkèta        |
| márùn-ùn         | l/èkarùn-ùn    |
| méjì-ní-ogún     | méjìnlógùn     ‘18’ |

There is an alternation of n / l as in:

ní ogún → lógún

It has been argued that /l/ exists as an underlying segment having [n] and [l] as its surface variants. The [n] is converted to its oral (lateral) counterpart in an environment
of an oral sound. The high tones on the deleted vowels [u] and [i] were docked on the
contiguous vowel sound (after displacing the low tone on [e] in the first deletion) since
tones are not deleted with the segment. Tones are on a different tier independent of the
segmental tier (Goldsmith 1976).

**Vowel assimilation**

Oyebade (1998) says assimilation refers to a situation where two contiguous sounds that
have different ways of producing them become identical in some or all of the features
of their production, as seen in (33):

(33) (i) \( \text{igba} \ \dot{e}j\o \rightarrow \text{egbe}\dot{j}o \) ‘1600’
200 x 8
(ii) \( \text{igba} \ \dot{e}t\alpha l\alpha \rightarrow \text{egbe}\dot{t}\alpha l\alpha \) ‘2600’
200 x 13
(iii) \( \text{igba} \ \dot{e}je \rightarrow \text{egbe}\dot{e} \) ‘1400’
200 x 7

It can be observed from the examples that the first vowel /\( \dot{e} /\) and /\( \dot{e} /\) of the second
words assimilates the first vowel /\( i /\) of the first word igba; the second vowel /\( a /\) of the
first word igba is then elided as evident by the number of the syllables (four syllables
at the underlying level and three at the surface level).

This type of vowel assimilation, notes Oyebade (2010), is referred to as non-contiguous
assimilation and it is regressive in direction.

**Free variation**

This is one of the phonological methods of identifying phonemes in a given language.
It is a term used in phonology, referring to the substitutability of one sound for another
in a given environment, with no consequent change in the word’s meaning. Examples
of this phenomenon are found in the Yoruba numerals as shown in (34):

(34) (i) \( \text{ikinni} \) one
\(/i, e/ \ \text{ekinni} \)
\( \text{iketa} \) three
(ii) \( /i, e/ \ \text{eketa} \)
Morphological structure

Clipping

Clipping is a morphological phenomenon whereby a word is shortened. The reduction could be at any part of the word such as the middle as in the examples in (35):

(35)  oókànléwáá  =  oókànlá  ‘11’ i.e. one higher than ten’
      méjíléléwáá  =  méjílá  ‘12’ i.e. two higher than ten’
      métàléléwáá  =  métálá  ‘13’ i.e. three higher than ten’

Prefixation

It is observed that affixes (bound morphemes) play a crucial role in the counting system of the Yoruba language. Two types of affixes are attested in Yoruba, namely, prefixes and interfixes. Prefixes feature prominently in signalling increase by or decrease by a certain number. They are prefixes not only because their inherent meanings become apparent when they are attached to the root, but because they occur at the initial position of the root to which they are affixed, as seen in the examples in (36):

(36)  (i)  àádó-, as in:
       àádó-  óta  =  àádó-  óta  ‘50’
       10  =  (20 x 3)
       60  =  10  =  50

(ii)  àádó-  -  òrin  =  àádórin  ‘70’
       10  =  (20 x 4)
       80  =  10  =  70

(iii)  ogó-/ọgó-, as in:
       ogó-  x  èje  =  ogóje
       20  x  7  =  140

(iv)  ọgọ-  x  èfà  =  ọgọfà
       20  x  6  =  120

(v)   ẹgbẹ-, as in:
       ẹgbẹ-  x  èfà  =  ẹgbẹfà
       200  x  6  =  600

(vi)  èèdè- as in:
       èèdè-  +  ẹgbẹjo  =  èèdègbẹjo
       100  =  (200 x 8)
       1600  =  100  =  1500
Language typology

A pocket of examples so far can testify to the fact that the Yoruba language, to a large extent, is an agglutinative language according to August Schlegel’s 1818 morphological classification of languages. This is justified by the fact that morphemes combined in the sentential derivation are separable and they retain their distinct meanings, as in the examples in (37):

(37) (i) \textit{mú òkan dín ní ogún} ‘17’

‘take one less in twenty’

(ii) \textit{mú èrin lé ní ogbọn} ‘34’

‘take four more in thirty’

Syntactic structure

There are examples of numerals performing the function of attributive position. However, the adjectives are known to occur after the noun which they are modifying in the Yoruba language unlike the English language where they occur before the noun as follows:

(38) (i) \textit{iwé ogún ni mo rà} \textit{ilé ogbọn ni mo kó} ‘I bought twenty books’ \textit{I built thirty houses’}

But there are counter-examples where the numeral adjectives are found before the noun they modify:

(ii) \textit{ogún iwé ni mo rà} \textit{ogbọn ilé ni mo kó} ‘It is twenty books that I bought’ ‘It is thirty houses that I built’

Semantic structure

Almost all the numerals in Yoruba have meanings that can be analysed on a morphemic basis. However, there are some numerals whose meanings appear arbitrary; there is no direct connection between them and the figure they depict. They are assigned basic status. According to Oyebade (2010), Yoruba has 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 200 and 400 as basic elements. They are not formed from other numbers. The meanings of some of them may have been borne out of their monetary implication which requires an
excursion into the diachronic analysis of the Yoruba naira and kobo monetary system. Examples of such numbers are:

(39) (i) igba ‘200’
     irinwó ‘400’
     ọ̀ọ́dúǹrún ‘300’

Whereas irinwó could be analysed as:

(ii) irin owó
     ‘iron money’

The intuitive knowledge of a native speaker of the language is required to show that irinwó means ‘a huge amount of money’. But oókan-ẹ̀wá (1 – 10), ogún (20), ọgbòn (30), igba (200) and ọ̀ọ́dúǹrún (300) cannot be analysed. Their meanings are basically conventional.

**Ambiguity**

Semantic ambiguity is equally observed in the Yoruba numerals as shown in (40):

(40) ogún ‘20’
     ogún ‘inheritance’

This ambiguity can create some communication problem for the second language learner.

**Summary of findings and conclusion**

The article has presented a detailed description of the derivational processes in the Yoruba numeral system with explanations on the derivational history of certain numerals whose meanings are not very obvious in the language as well as certain changes that have occurred in the system over time.

It is indeed a truism that every language is rule-governed. The article has shown that numerals in Yoruba require some arithmetic in a way that stimulates people’s intelligence. This might be one of the reasons why many people are not interested in learning the system. Besides, counting in Yoruba often appeals to people’s competence to know which affix to be attached to what number while counting the numbers that are divisible and those that are indivisible. It is equally observed that the choice of either of the two variations ogó-/ọgọ- is largely dependent on the nature of the articulatory parameter of the first vowel (V1) of the root word. The Yoruba counting system is from right-to-left. In addition, Yoruba uses base five, decimal, and vigesimal (base twenty) counting system. The meaning of 10 is not seen in 20. Ogún (20) in Yoruba is a monomorphemic base and it is not constructed with 10. In addition, Yoruba operates
subtraction in a base five system and this is done at each decimal junction. Moreover, the Yoruba language is arbitrary and conventional. Its arbitrariness is borne out of the fact that there are some numbers whose meanings have no connection of any sort with the arithmetical calculations that produce them. Their acceptance is conventional. However, a good percentage of the numbers have meanings that are conceptual in form and their understanding could be interesting. The article has also shown that there are a number of linguistic insights in the structure of Yoruba numerals. And these linguistic features enrich the linguistic database of the language and facilitate the teaching and learning of the grammar of the language.

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