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Proposal for a Yoruba Decimal Counting System

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Abstract

Human activities involve the use of numbers everyday but there are only few explanations on how numbers came into existence. The Yoruba traditional number system, unlike other languages, employs the use of addition, multiplication and subtraction which makes calculation complex, complicated and cumbersome. This has led many users-elites, traders, school children and the educated to abandon its use. Today, alternative ways are being sought to Yoruba traditional counting and this paper presents the decimal number system and how to count in it up to one million with ease. It eliminates the subtractive numerals thus making counting in Yoruba easy and straight forward.

Introduction

The Yorubas are people predominantly resident in the Southwestern part of Nigeria. They effectively occupy Oyo, Osun, Ogun, Ondo, Ekiti and Lagos States and parts of Kwara, Kogi and Edo States. Apart from Nigeria, the Yoruba people can be found in other parts of West African sub-region of Republic of Benin, Togo, Cote D'Ivoire and in the Caribbean and South American countries of Trinidad and Tobago, Cuba, Venezuela and Brazil (Atanda, 1996; Alade, 1997; Olatunji, 2000). The existence of the Yoruba race dates back early in man's history and its etymology is shrouded in mystery (Atanda, 1980; Olowookere & Adewole, 1998).

There are various submissions, mostly oral, on the fact that Oduduwa is the progenitor of the Yoruba, hence the appellation 'Omo Oduduwa' (child of Oduduwa). It is also believed that Ile-Ife was the cradle of the Yoruba because of the belief in oral and written records by some schools of thought that it was the place where Oduduwa landed when he was coming to earth (Ojo, 1971)

It is a truism that the name Yoruba was not arrived at suddenly but there is no specific record of submission on how and when it came into existence. Hair (1967), however,

points out that Yoruba and all its variants (Yariba, Yoruba, etc) seem to be the most difficult to identify among all the languages in its sub-group. The language has been intensively studied since 1819 when Bowdich published the numerals he collected in Ashanti two years earlier (Williamson, 1989). Awoniyi(1978), however, records that it was a loan word from Hausa.

The currently used Yoruba numerical system is non-decimal. It is, according to Armstrong (1962) and Longe (1997) vigesimal. This means that it uses a number base of twenty. At the time the vigesimal number was invented, there was no system of writing in Yorubaland. Knowledge was transmitted by oral tradition only. The vigesimal number system, according to the account of Longe, was invented by Orunmila because there are altogether twenty fingers and toes on the hands and feet of a person and these could conveniently be used for counting. Longe's submission must have been premised on a similar explanation offered by Johnson (1921).

Review of the Related Literature

An attempt shall be made to make a brief review of previous attempts by researchers on traditional numerals in Hausa and Igbo, two of the three major Nigerian Languages recognised by the constitution of Nigeria. These Nigerian languages (Hausa and Igbo) also had traditional ways of numeration before they adopted the decimal system of numeration. It was observed that the old or traditional system of numeration had subtractive numerals which made counting complex and cumbersome especially at higher numerals.

Counting in Hausa

The units, tens, hundreds and thousands in Hausa are conventional and are pronounced thus in the old or traditional system as observed by Lowry and Eleanor (1966) Mohammed, Sanusi, Ibrahim and Sabitu (2001).

Units	Tens	Hundreds	Thousands
1. daya	10 goma	100 dari	1,000 dubu, alif
2. biyu	20 ashirin	200 metin/metan	2,000 alfyar, alfin
3. uku	30 talatin	300 dari uku	3,000 talata
4. hudu	40 arba'in	400 arbaninya	4,000 arba
5. biya	50 hamsin	500 hamsamina	5,000 hamsa
6. shida	60 sittin	600 dari shida	6,000 sitta
7. bakwai	70 saba'in	700 dari bakwai	7,000 saba'a
8. takwas	80 tamanin	800 daritakwas	8,000 tamaniy
9. tara	90 tis'in/casa'i	900 dari tara	9,000 dubhi tara/zamabar tara

From the table above, it could be observed that some numbers (300, 600, 700, 800 and 900, which are in hundreds, employ multiplication which signifies that these numbers are derived by multiplying one hundred by three, six, seven, eight and nine respectively in the traditional system.

Meanwhile, Hausa numerals employ addition numbers from 11 to 17, 21 to 27, 31 to 37 etc by the use of "sha" and "da". Sha is used only for figures 11 to 17 but all numbers above 20 employ "da" rather than "sha" (Kraft and Kirk-Green, 1973). For example:

11	Goma sha daya	(10 + 1)
12	Goma sha biyu	(10 + 2)
17	Goma sha bakwai	(10 + 7)
21	Ashirin da daya	(20 + 1)
36	Talatin da shida	(80 + 6)

In the case of 18, 19, 28, 29, 38, 39 and other numbers in tens, Hausa language employs subtractive numerals hence:

18	Ashirin biyu babu	(20 - 2)
19	Ashirin daya babu	(20 - 1)
28	Talatin biyu babu	(30 - 2)
39	Arba'in daya babu	(40 - 1)

In the modern Hausa number system, there is an inclusion of zero, the exclusion and replacement of the subtraction and simple multiplication of the remaining old numbers in the hundreds. This new system of numeration in Hausa eliminates the old names given to some numbers and makes counting easier. Numbers 1 to 17 retain their old names while numbers 18 to 29 in the new Hausa system is as follows:

18	-	Goma sha takwas	(10 + 8)
19	-	Goma sha tara	(10 + 9)
20	-	Ashirin	
21	-	Ashirin da daya	(20 + 1)
24	-	Ashirin da hudu	(20 + 4)
27	-	Ashirin da bakwai	(20 + 7)
29	-	Ashirin da tara	(20 + 9)

The numbers in hundreds in the new Hausa counting system will now be in multiples of one hundred thus:

100	Dari	
200	Dari biyu	(100 x 2)
300	Dari uku	(100 x 3)
400	Dari hudu	(100 x 4)
500	Dari biyar	(100 x 5)

In the thousands, Hausa number system also employs multiplication in the new counting thereby eliminating the old names thus:

1,000	Dubu	
2,000	Dubu biyu	(1,000 x 2)
3,000	Dubu uku	(1,000 x 3)
6,000	Dubu shida	(1,000 x 6)
9,000	Dubu tara	(1,000 x 9)

Counting in Igbo

The scope of Igbo numeral, according to Ogbalu (1974) and Dom-Anyanwu (2001), is limited. This is because in their original primitive society, the Igbos did not need to count a vast row of things ranging up to millions as in modern times.

After a number of nnus (400s), they merely regard other things as uncountable or aguts – onu nnu, nnu, kwuru nnu. Igbo traditional counting system was 10 – based up to twenty and 20 – based up to four hundred which was the highest single number possible in the system.

The significant landmarks in the traditional system were out/ofu “one”, ogu “twenty” and nnu “four hundred”. However, through an intricate manipulation of these numbers with others in the system, it was possible to express some high numbers (Emenanjo, 1978). For example:

$$160,100 = nnu, nnu na ogu iri \text{ (i.e. } 400 \times 400 + 100)$$

but this process was not only demanding, it was replete with ambiguities and many inadequacies. For instance:

$$Nnu \ nnu \ na \ ogu \ iri \ na \ isii \ \text{could be either } 160, 106 \text{ or } 160, 320$$

On account of the limitation in the Igbo numeral system regarding extent, ambiguity and confusion between certain numbers, a system of counting in tens only, known as Igbometric system (Ogbalu, 1974) is now being used. The modern Igbo numeral is further preferable to the old system in order to cope with the requirements of the modern technological world and decimalize it. The first nine numerals are:

1.	Otu	-	(ofu)
2.	Abua	-	(abua : ibua)
3.	Ato	-	(ito : eto)
4.	Ano	-	(ino : eno)
5.	Ise	-	(iso)
6.	Isii		
7.	Asaa	-	(isaa : esaa)
8.	Asato	-	(isato : esato)
9.	Iteghete	-	(itenaani : itoolu : toolu)

Counting in tens in the modern Igbo numerals goes thus:

10	Iri (ili)	
20	Iri abuo	(10 x 2)
30	Iri ato	(10 x 3)
40	Iri awo	(10 x 4)
50	Iri ise	(10 x 5)
60	Iri isii	(10 x 6)
70	Iri asaa	(10 x 7)
80	Iri asato	(10 x 8)
90	Iri iteghete	(10 x 9)

In counting in hundreds, modern Igbo numerals will be:

100	Nnari	
200	Nnai abuo	(100 x 2)
300	Nnari ato	(100 x 3)
400	Nnari ano	(100 x 4)
500	Nnari ise	(100 x 5)
600	Nnari iteghete	(100 x 9)

To count in thousands in Igbo, we have:

1,000	(Otu) Puku	
2,000	Puku abuo	(1,000 x 2)
3,000	Puku ato	(1,000 x 3)
6,000	Puku Isii	(1,000 x 6)

The numbers in between are derived by mere calculation with the use of "naÓ" which means "in addition toÓ. The landmarks of the modern Igbo decimal system are:

Otu (Ofu)	-	One
Iri (ili)	-	Ten
Nnari	-	Hundred
Puku	-	One Thousand
Nde	-	One Million
Ijeri	-	One Billion

Thus, the modern Igbo numeral system is a spectacular improvement on the traditional one. This is because one can express very high numbers through a combination of the landmarks in the system together with other numerals.

Yoruba Traditional Numerals

The first ten numbers in Yoruba are basic numerals because they are the commonest and most often used (Armstrong, 1962). There are four principal series of Yoruba numerals, according to Armstrong's classification.

	Cardinal	Counting	Adjectival	Ordinal
1.	okan	Ookan/eni	kan	ekinni
2.	eji	Eeji	meji	ekeji
3.	eta	Eeta	meta	eketa
4.	erin	Eerin	merin	ekerin
5.	arun	Aarun-un	marun-un	ekarun-un
6.	efa	Eefa	mefa	ekefa
7.	eje	Eeje	meje	ekeje
8.	ejo	Eejo	mejo	ekejo
9.	esan	Eesan-an	mesan-an	ekesan-an
10.	ewa	Eewaa	mewaa	ekewaa

While addition and multiplication are the only operations used in counting in English, Yoruba use addition, subtraction and multiplication. For example, words used for the numerals from 11 to 14 are compound words which are formed by adding the appropriate to ten thus:

11.	okanla	-	Ookanla	(1 + 10) ookan le ewa	- one added to ten
12.	ejila	-	Eejila	(2 + 10) eeji le ewa	- two added to ten
13.	etala	-	Eetala	(3 + 10) eeta le ewa	- three added to ten
14.	erinla	-	Eerinla	(4 + 10) eerin le ewa	- four added to ten

The 'laa' is a contraction of 'lewaa' which is itself a contraction of 'le ewa' (i.e. plus ten). The same thing applies to all the figures reckoned by tens. The numerals 15 to 19 are reckoned by subtraction thus:

15.	eedogun	-	(5 from 20) aarun-un din ogun	- five less twenty
16.	eerindinlogun	-	(4 from 20) eerin din ogun	- four less twenty
17.	eetadinlogun	-	(3 from 20) eeta din ogun	- three less twenty
18.	eejidinlogun	-	(2 from 20) eeji din ogun	- two less twenty
19.	ookandinlogun	-	(1 from 20) ookan din ogun	- one less twenty

Apart from the alternate application of addition and subtraction, multiplication and subtraction are also alternatively applied in distinguishing between even and odd bases from 40 up to 180. The even tens are formed by multiplying 20 by 2, 3, 4 etc thus:

40	-	ogoji	(20 x 2) two twenties
60	-	ogota	(20 x 3) three twenties
80	-	ogorin	(20 x 4) four twenties

While the odd tens are formed by contracted subtraction of ten from the next higher even ten thus:

- 50 - aadota (20 x 3-10) ewa din ogun meta – ten less three twenties
 70 - aadorin (20 x 4-10) ewa din ogun merin – ten less four twenties
 90 - aadorun-un (20 x 5-10) ewa din ogun marun-un – ten five twenties

Counting from one hundred to three thousand in Yoruba traditional system goes thus:

- 100 - ogorun-un (20 x 5) ogun marun-un
 200 - igba
 300 - oodunrun
 400 - irinwo
 500 - eedegbeta (200 x 3 = 100) ogorun-un din igba meta
 hundred less three two hundreds
 600 - egbeta (200 x 3) igba meta three two hundreds
 700 - eedegberin (200 x 4 – 100) ogorun-un din igba merin hundred
 less four two hundreds
 800 - egberin (200 x) igba merin four two hundreds
 900 - eedegberun (200 x 5 – 100) ogorun-un din igba marun-un
 hundred less five two hundreds
 1,000 - egberun (200 x 5) igba mewaa ten two hundreds
 2,000 - egbewa / egbaa (200 x 10) ten two hundreds
 3,000 - egbeedogun (200 x 15) igba meedogun fifteen two hundreds

It would be discovered that some numerals have their traditional names as we can see in 200, 300 and 400. They are root words whose etymology is unknown. While some numerals are derived by multiplying the multiplicand (200) by a certain unit of number, some are derived the same way but by subtracting 100.

In counting in thousands in Yoruba, we have:

- 4,000 - egbaaji (2,000 x 2)
 5,000 - eedegbaata (2,000 x 3 – 1,000)
 6,000 - egbaata (2,000 x 3)
 7,000 - eedegbaarin (2,000 x 4)
 8,000 - egbaarin (2,000 x 4)
 9,000 - eedegbaarun (2,000 x 5 – 1,000)
 10,000 - egbaarun-un (2,000 x 5)

There is now the need for much larger integers such as 1,000,000 and 1,000,000,000 which for lack of traditional names, are called 'milionu kan' and 'bilionu kan' which are adaptations from English. Opinions differ among scholars as to what names to give these numbers. Fafunwa (1989) offers two suggestions : using the Yoruba version if 'milionu kan' or the word 'okerun-un mewaa' (i.e. 20,000 x 5 x 10) which can be contracted to 'Okerun-unwaa'. The first suggestion seems to have a wider acceptance. He was, however, silent over what one billion should be called.

The Yoruba vigesimal number system becomes very complicated as one gets into higher numbers. This is due to the complications of arithmetical processes involved in the use of the numbers. While it is true that three of the four fundamental arithmetical operations—addition, subtraction and multiplication are used, they way they are applied and the various changes in the morphological shape of the number that accompany the derived words for the numbers have always been the major problem (Omole, 1997).

Today most educated Yoruba have abandoned the use of the Yoruba traditional counting system. They now carry out their counting and accounting in English thus placing the ordinary Yoruba man and woman at a serious disadvantage because they are not numerate in English language. Fakinlede (2001, 2006) submits that the traditional numeral in Yoruba is complex and this has made it difficult to use as a tool for communication of science and in everyday life. It is obvious that man cannot do without counting and if the Yoruba system of counting is simplified, it will help to regain the lost ground in Yoruba counting.

Nowadays, market men and women have got an alternative way of counting to prove that the Yoruba traditional numeral system is complex, complicated and cumbersome. The image of a former military Head of State in Nigeria, the Late General Murtala Muhammed, which is on the Nigerian twenty naira has become a yardstick for counting. The prefix in the name 'Murtala' (Muri) is now being used in counting in multiples of twenty in Yoruba. Hence, we hear:

Muri kan	-	(20 x 1) for twenty naira
Muri meji	-	(20 x 2) for forty naira
Muri marun-un	-	(20 x 5) for one hundred naira
Muri mejo	-	(20 x 8) for one hundred and sixty naira

What the escape route portends is that Yoruba people realize the indispensability of numerals in spite of its complexities hence the need to have an easier way of counting and accounting in the language.

The Decimal Number System in Yoruba

The efforts of Armstrong (1962), Olutoye (1981), Bamgbose (1986), Longe (1997) and Fakinlede (2001, 2003, 2006) in proffering solution to the basic problem in indigenous Yoruba calculus cannot go unmentioned. Scholars are still offering suggestions and carrying out studies that will end this lingering challenge in Yoruba studies.

Armstrong suggests counting that eliminates subtraction in Yoruba. He retains the old names in first ten numerals and suggests new names for counting in tens, hundreds, thousands, ten thousands and one hundred thousands. It should, however, be noted that Armstrong's study did not totally eliminate the Yoruba traditional system of counting because he retains 20 (ogun) and 30 (ogbon) in their old forms, thus making his proposal a subject of controversy.

Olutoye (1981) recognises and points out the different ways the mass media express higher Yoruba traditional numerals especially during budget presentation. She observes

that any numeral above a thousand poses a problem to both literates and illiterates today. She recounts the traditional way of numeration and suggests a modern way of numeration. She proposes eight segments of counting and gives names to each as:

1 - 10	-	eyo (she retains the old way of counting)
10 - 100	-	ewa de ogorun-un
100	-	ogogorun-un
1,000	-	egbeegberun
10,000	-	oru
100,000	-	koto
1,000,00	-	odu
1,000,000,000	-	agba

Olutoye also eliminates the subtractive and multiplicative numerals in her proposal and suggests only addition. This paper, however, discovers that her proposal still retains the old forms of counting 20, 30, 40 up till 100. The greatest challenge of Olutoye's proposals is that higher numerals would be very lengthy when pronouncing them, for example:

120,440	-	koto kan, oru meji, ogorun-un merin ati ogoji
3,248	-	egberun meta, ogorun-un meji o le ogoji ati mejo

Bamgbose (1986) only explains how best to eliminate the subtractive numerals from eleven to nineteen. He suggests that we add the lower numerals to base ten to derive our new numeral thus:

11	-	okanla
12	-	ejila
15	-	aranla
18	-	ejola
19	-	esanwa

Longe (1997) offers two ways of counting – counting in tens in which he gives examples up to ninety and counting in twenties in which he gives examples up to one hundred and eighty. He did not disclose what one hundred will be if we count in tens. Will it be “ewawa”? What will we call one hundred and ten and other numerals in multiples of ten? Longe also eliminates all vigesimal counting names while counting in multiples of ten but retains them while counting in multiples of twenty.

Fakinlede (2001, 2003, 2006) also proposes new names for segments of Yoruba. He recognizes zero and adopts addition and multiplication of Yoruba numerals thus:

10	-	idi kan
100	-	apo kan
1,000	-	oke kan
1,000,000	-	odu kan

1,000,000,000	-	eeru kan
1,000,000,000,000	-	oke eeru kan

This proposal, as good and practicable as it is, did not explain how to count lower numerals and numerals in between the segments. Another challenge that this model poses is that counting in higher numerals will be lengthy as identified in Olutoye's model. Based on these proposals, Adeyinka (2005) attempted to offer a simpler way of decimal counting in Yoruba which this paper examines.

The decimal number system in Yoruba will eliminate the use of subtraction in the numeral and give new names to some root numbers in order to allow for decimation. The first ten numbers will retain their names while zero, which, though implied yet not added at the beginning of any numeral, will be added and called thus:

0	-	Ofo / odo
1	-	Ookan / eni
2	-	Eeji
3	-	Eeta
4	-	Eerin
5	-	Aarun-un
6	-	Eefa
7	-	Eeje
8	-	Eejo
9	-	Eesan-an
10	-	Eewaa

From 11 to 19, there will be simple addition thus:

11	-	Ookanla	(10 + 1)
12	-	Eejila	(10 + 2)
13	-	Eetala	(10 + 3)
14	-	Eerinla	(10 + 4)
15	-	Aarunla	(10 + 5)
16	-	Eefala	(10 + 6)
17	-	Eejela	(10 + 8)
18	-	Eejola	(10 + 8)
19	-	Eesanla	(10 + 9)

In counting in tens up to one hundred, the decimal Yoruba numerals will be

10	-	Eewaa	
20	-	Eewaaji	(10 x 2)
30	-	Eewaata	(10 x 3)
40	-	Eewarin	(10 x 4)
50	-	Eewaarun-un	(10 x 5)

60	-	Eewaafa	(10 x 6)
70	-	Eewaaje	(10 x 7)
80	-	Eewaajo	(10 x 8)
90	-	Eewaasa-an	(10 x 9)
100	-	Orun	

Counting in hundreds following the modern system of counting in Yoruba would be:

100	-	Orun	
200	-	Orunji	(100 x 2)
300	-	Orunta	(100 x 3)
400	-	Orunrin	(100 x 4)
500	-	Orunrun-un	(100 x 5)
600	-	Orunfa	(100 x 6)
700	-	Orunje	(100 x 7)
800	-	Orunjo	(100 x 8)
900	-	Orunsan-an	(100 x 9)
1,000	-	Orunwaa	(100 x 10)

When counting in thousands, following the decimal system, we would have:

1,000	-	Orunwaa	
2,000	-	Orunwaaji	(orunwaa meji)
3,000	-	Orunwaata	(orunwaa meta)
4,000	-	Orunwaarin	(orunwaa merin)
5,000	-	Orunwaarun-un	(orunwaa marun-un)
6,000	-	Orunwaafa	(orunwaa mefa)
7,000	-	Orunwaafa	(orunwaa mefa)
8,000	-	Orunwaajo	(orunwaa mejo)
9,000	-	Orunwaasan-an	(orunwaa mesan-an)
10,000	-	Orunwaawaa	(orunwaa mewaa)

Having got a landmark name for 1,000 (orunwaa), we can now begin to multiply by the number we want to derive. Hence, to name numerals in tens of thousands we have:

10,000	-	Orunwaawaa	(orunwaa mewaa)
20,000	-	Orunwaa eewaaji	
30,000	-	Orunwaa eewaata	
40,000	-	Orunwaa eewaarin	
50,000	-	Orunwaa eewaarin-un	
60,000	-	Orunwaa eewaafa	
70,000	-	Orunwaa eeaaje	
80,000	-	Orunwaa eewaajo	
90,000	-	Orunwaa eewaasan-an	
100,000	-	Orunwaa orun	

The next stage or multiple of counting in the Yoruba decimal number system is in one hundred thousands which goes thus:

100,000	-	Orunwaa orun
200,000	-	Orunwaa orunki
300,000	-	Orunwaa orunta
400,000	-	Orunwaa orunrin
500,000	-	Orunwaa orunrun-un
600,000	-	Orunwaa orunfa
700,000	-	Orunwaa orunje
800,000	-	Orunwaa orunjo
900,000	-	Orunwaa orunsan-an
1,000,000	-	Orunwaa orunwaa

From the analysis above, it could be deduced that the decimal system of numeration in Yoruba is much preferable to the vigesimal because it is simple, easy and straight forward. It helps to eliminate subtraction and helps in simple addition thus eliminating completely the fears that the old system has instilled in the minds of people.

The study on the Yoruba decimal number system has established the fact that alternative way of numeration is possible. This modern way of counting conforms with what obtains in other languages of the world such as English, French, German, Arabic etc. It is also justified by the fact that the other two of the three major Nigerian languages, Igbo and Hausa, which were formerly using the traditional counting system, have changed to the modern decimal counting system. With the decimal system of counting, learners can learn and carry out calculations to billions with ease once the segments of calculation are understood.

Recommendations

Based on this study, the following recommendations are offered:

- (i) There is the need for both the federal and the state governments to ensure that the guidelines of the *National Policy on Education (2004)* on the use of mother-tongue as a medium of instruction in the early primary school and as a core subject at the secondary level is pursued and enforced.
- (ii) Yoruba decimal counting system should be introduced into the school curriculum and taught from primary level to senior secondary school level irrespective of students' socio-economic background.
- (iii) There is the need for refresher courses for teachers of Yoruba. It is observed that most Yoruba language teachers do not understand the traditional number system of the language and since an alternative and a better way had been proffered in this study, efforts should be made by the Ministry of Education to organize refresher courses for teachers of Yoruba during the holidays.

(iv) Examining bodies at the secondary level should re-introduce questions on numerals in the final school certificate examinations. This would enable teachers to teach numerals in schools and prepare students for it in examinations.

(v) It is hereby recommended that Yoruba decimal numeration system should be introduced into the curriculum of colleges of education and universities offering Yoruba. This should be incorporated into the culture component of Yoruba Studies.

Conclusion

This paper had served as an eye-opener to the problem of counting in Yoruba and has also indicated the fact that the old system of numeration is fast losing its place in commerce among the Yoruba. Even though people cannot do without counting in a day, Yoruba men and women are devising ways to solve this problem of complex and cumbersome numeration. Efforts should be geared toward introducing the decimal number system to pupils from primary level of education while the mass media could also serve as an avenue to propagate its easy use.

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