Running head: AFRICAN MATHEMATICS

African Mathematics

Jimmie Powell

History of Mathematics

Jennifer McCarthy

Abstract

Almost six thousand miles away from the capital of North Carolina is the Heart of Africa.

Many amazing things have spawned from this country that most people else where

think is a desert waste land. Africa for years has been a melting pot for many influential

mathematicians thanks to Egypt and it's northern countries. Through research and

exploration it can easily been seen that there is an even deeper history and

mathematical background in all of Africa and not only in Egypt and this background has

even laid ground to some of the most modern mathematical advances. The origin of our

Hindu-Arabic numerals came from Northern Africa

Egyptian Mathematics

Of all ancient languages, writings and math, the Egyptians are most famous. The Egyptians wrote in hieroglyphics. They also did math in hieroglyphics. Hieroglyphics are markings and symbols used to represent words and numbers. Egyptian numbers were written as:

Staff	❘	**1**
Heel Bone	∩	**10**
Scroll	ꝑ	**100**
Lotus Flowe	𓆼	**1000**
Pointing Finge	𓂽	**10,000**
Whale	🐋	**100,000**
Astonished Person	𓁨	**1,000,000**

To the Egyptians this system of writing numerals was easy. But with thousands of other symbols, numbers and words could easily get mixed up. Without a zero or place holder it makes some calculations difficult and sometimes confusing also the number of symbols. For example;

935+945= 1880

From the example, the one written in Hindu-Arabic numerals has a zero so it is clear that it is 1,880. Unless you understand where the placeholder should be it can be confusing, along with the carrying. Complicated math we can do today virtually would take hours even days to do. But the use of math was for measuring (unit fractions), adding (subtracting etc.), and building pyramids.

The pyramids are an interesting topic because the Egyptians didn't write down elaborate formulas in numbers but in words. But in context to the times it was very hard to complete such a task and they did it so many times. One thing they we really good at was breaking fractions down into unit fractions. They did this because they believed that it was 1) easier to use, 2) other fractions were wrong.

Ex; 4/9 to convert it to unit fractions subtract 1/3 because 4 goes into 9 evenly twice but you always add one more (denominator) when you do this you should get 1/9. So, 4/9= 1/3+1/9

Ancient African Counting Techniques

Although it is one of the least documented topics in mathematics history African civilizations have long had counting systems to represent numbers. In ancient African mathematics markings were used to do math. This math was done on sticks but mostly was a recording device. In some of the recovered sticks you can see the markings but they did not represent a single number always. In the least of mathematical cases these markings represented groups of numbers. For example if there were seven marks it may actually mean seven groups of one, two, three etc.

In normal life, as in inventory, measurements, hunting, the group markings would be used. There is not any exact indication of any written arithmetic done by the other

Ancient African Civilizations. The main difference between the use of these techniques and methods of math and those of the Egyptians is that most of the math, symbols, and explanations of what it is you are looking at is missing. Which would explain why in most cases why other Ancient Civilizations aren't gone over because there isn't much proof of any math other than sticks with markings which, without modern researchers and geologists, could mean anything.

An example of how they would do addition is just basically tallying on how many more they needed. To subtract they would mark out with an "X" to show how many was taken away and the ones left without being marked out was the answer.

Modern Number Systems In Africa

In this continent there are over 2,000 languages and almost in each different language there are different ways that numbers are spoke and thought of. Standardized throughout Africa is a base 2, base 5, and a base 10 system. This works based on nature and the body, each hand having 5 fingers and together having 10. The base two is used when building villages based on fractals.

People of the Zulu are located mainly in South Africa. They have all of the numbers we have (including zero) but instead of us just knowing and counting something as a whole, any number that isn't a multiple of ten is either 10+, 20+, 30+… This differs because in our system we treat 11 as eleven but in Zulu mathematics 11 would be written as ishumi nanye (10+1). This is the same for all numbers in the Zulu

language. The mathematics of the Zulu language is simple because it can be done on

base-2, 5, or ten.

("Number Systems of the World)

Number	Reading	Meaning
0	iqanda	0
1	ukunye	1
2	isibili	2
3	kuthathu	3
4	okune	4
5	isihlanu	5
6	isithupha	6
7	isikhombisa	7
8	isishiyagalombili	8
9	isishiyagalolunye	9
10	ishumi	10
11	ishumi nanye	$10 + 1^*$
12	ishumi nambili	$10 + 2^*$

The most popular language in Africa is Yoruba, which is mainly found in Nigeria

and the Congo. The number system in this language is similar to the Zulu language

except for numbers above the 4 of a set of 10 over 10 (14= 4+10, 15=5-20). In this

system numbers are then subtracted from base numbers to get a number. There is also

no zero in Yoruba language.

Number	Reading	Meaning
0	sifuri	0
1	ikan	1
2	meji	2
3	meta	3
4	merin	4
5	marun	5
6	mefa	6
7	meje	7
8	mejo	8
9	mesan	9
10	mewa	10
11	mokanla	1 + 10[†]
12	mejila	2 + 10[†]
13	metala	3 + 10[†]
14	merinla	4 + 10[†]
15	medogun	5 from 20

("Number Systems of the World)

The Swahili language, of the three, is the most established one out side of Africa. The first time anyone outside of Africa was when it was recorded in Arabic scrolls. The language and the numbers first really got exposed to the masses when Arabic traders delivered some of the writings in other places in Europe and Asia. The Swahilian number system includes a zero and has a digit for every number 1-9 and for every number over a multiple of ten it is that plus the number (21= 20+1).

1	moja	1
2	mbili	2
3	tatu	3
4	nne	4
5	tano	5
6	sita	6
7	saba	7
8	nane	8
9	tisa	9
10	kumi	10
11	kumi na moja	10 and 1
12	kumi na mbili	10 and 2

(Number Systems of the World)

Critical Advancements in Africa

Although not all African civilization contributed directly to the development of Hindu-Arabic numerals the northern parts did. In Northern Africa there was a very large Arab population. Years before however mathematicians in India created the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. They then shared this information with Persians in India and it was subsequently passed onto Arabs in the west (Africa). They shared this information with those they traded with and the numerals were then known as Arabic numerals throughout Europe. In the course of history as many know, when the English spread they took the numbers with them to the Americas. In the previous section you can see the pronunciation of the numbers but the way they would be written would be in Arabic numerals.

Measurements

Although there are no really important things modern math has gotten from this. The

Egyptians had extensive measurements based on body parts and the length of pretty

standard items:

Egyptian Measure	US Measure
1 Finger	.72 inches
1 Palm	2.95 inches
1 Hand	3.7 inches
1 Fist	4.4 inches
1 Span	8.96 inches
1 Foot	.98 feet
1 Remen	1.23 feet
1 Cubit	1.48 feet
1 Royal Cubit	1.72 feet
1 Nibw	1.97 feet
1 Double Remen	2.46 feet
1 Rod	17.22 feet
1 Ht	57.4 yards
1 Minute of March	200.85 yards
1 Hour of March	6.85 miles

(Tour Egypt)

Other African civilizations mainly used nature to measure things out. They recognized
patterns in items and based what they wanted on that.

Fractals?
        Yes, there are fractals in African villages both in ancient times and now. A fractal

is an object that displays self-similarity. The best example for a fractal is the length of a

coastline measured with different length rulers. The shorter the ruler, the longer the

length measured, this is called the Coastline Paradox. The main idea behind these

fractals was not necessarily mathematical but natural.

Like in the Roman civilization the Africans realized the symmetry in nature and used it to

produced villages in fractals. They knew about and understood the whole rectangle

within a rectangle concept. They not only used fractals in architecture but also in art and

religion (i.e., the Ethiopian Cross)They applied this to when they built villages and

palaces for an example like

this one in Logone. Though

there isn't a lot of information

about these fractals and

designs besides the fact that

they are there, it shows how

things evolve. Like how a lot

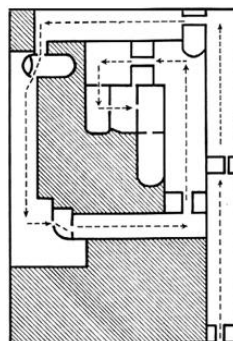of math concepts evolved out of nature and culture.
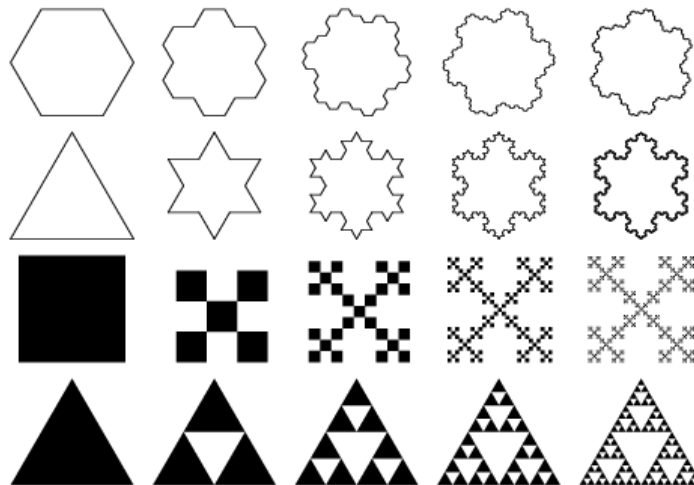
The Africans really weren't as aware of the math part but they did look into
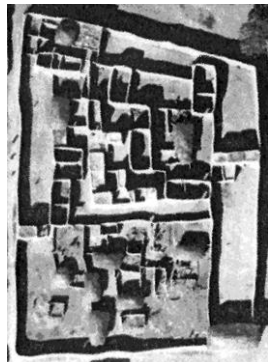
Palace of
Chiefs

Path through
Palace

Royal Insignia

tems

nonies

such a

geomancy (tossing sand, rocks, or pebbles and interpreting the shapes that it makes).

In addition to many other mathematicians they were able to produce a composite binary

system which led to the construction of most of our modern day technology. Now

computers run on binary systems, even the on and off switches on things is in binary.

Binary Number	Value
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	10
1011	11
1100	12

(A.K.E. Labs)

Conclusion

Despite perceived notions about the continent of Africa, it

has provided the modern world the numbers that it values so much

and a number system that holds all of our information and

technology together. Africa is a land full of knowledge and history dating back to the

Egyptians. From fractals and hieroglyphics to binary number systems. Without Africa

our number system wouldn't be in place and the machine used to type this paper

wouldn't work.

Work Cited:

Distance from Raleigh to Lagos. (2010). Retrieved from http://www.timeanddate.com/worldclock/distanceresult.html?p1=207&p2=125

Number systems of the world. (n.d.). Retrieved from http://www.sf.airnet.ne.jp/~ts/language/number.html

Chapter 7 number systems. (1995). Retrieved from http://www.rpi.edu/~eglash/eglash.dir/hit.dir/afch7.dir/afch7.htm

Project three: the yoruba number system. (1998). Retrieved from http://www.prenhall.com/divisions/esm/app/ph-elem/multicult/html/chap3.html

Base valued numbers. (1998, October 11). Retrieved from http://www.psinvention.com/zoetic/basenumb.htm

Karanja, J.K. (2009, June 30). *African mathematics*. Retrieved from http://johnkaranja.com/2009/06/30/african-mathematics/

Keshwani, S.K. (n.d.). *Teaching mathematics using african cultural numerical history*. Retrieved from http://hti.math.uh.edu/curriculum/units/2008/03/08.03.05.pdf

Egyptian numerals. (n.d.). Retrieved from http://www.liz.richards.btinternet.co.uk/enumchart.gif

Binary table. (n.d.). Retrieved from http://www.akelabs.com/images/binarytable.gif