

Mayan Civilization and Mathematics



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History

- Civilization defined on 5 crucial discoveries:
 - Control fire
 - Plant seed and grow crops
 - Tame and use work animals (dog, ox, and horse)
 - Smelt iron and other ores to make tools and weapons
 - Use wheel to move heavy loads
- Each Indian civilization (by conquest) took achievements and culture of earlier ones

Contributions:

- Written language: Mayan hieroglyphics
 - Books on history, astronomy, astrology, religious rites, festivals, and their culture
- Artworks and jewelry
- Religion no less adequate for spiritual needs of society than the Christianity of conquistadores
- Calendar work and science surpass European scholars of same time period
- Arithmetic--1000 years more advanced than Europe
- Astronomy observations

Hieroglyphics:

- 3 main transcripts (Madrid, Dresden, and Paris)
 - All written records torched by Franciscan monk, Diego de Landa, in 1541 in Mani (Yucatan)
 - Penance: spend rest of life collecting by word of mouth from converted Mayans everything they knew about their culture
 - Wrote about in Spanish
- Our knowledge depends on the records
 - Mainly rely on Mayan monuments:
 - Building and cities in Yucatan and Guatemala rescued by archaeologists from jungle

Language:

- Still spoken
- After years of work, scholars succeeded in keying language to hieroglyphics
- 500 Mayan hieroglyphics (out of 800) translated
 - Many refer to calendar, astronomy, and to numbers
 - Landa's special interests!



CHAN
'sky'



WINIK
'person'



WITZ
'mountain'



K'IN
'sun'



B'ALAM
'jaguar'



K'AK'
'fire'



BAK
'bone'



WAY
'spirit'



JUUN
'book'



JA'
'water'



AJAW
'lord'



MUYAL
'cloud'



IX
'woman'



CH'AM
'to grab'



K'UK'
'quetzal'



CHAN
'snake'



CH'UL
'holy'



CHOK
'to scatter'



JAAB'
'year'



YAX
'blue/green'



PAKAL
'shield'



TOK
'flint'



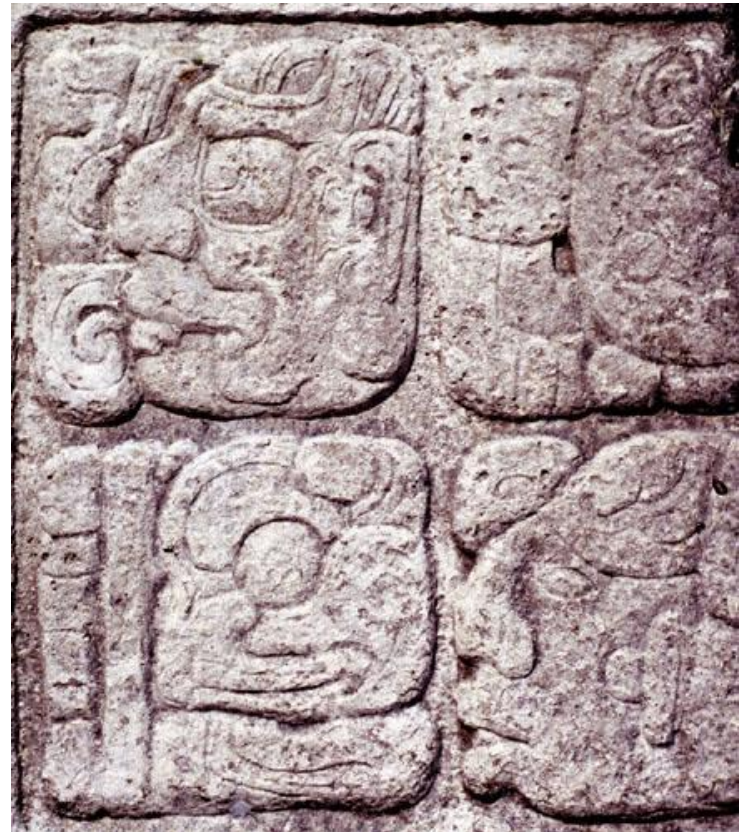
NAJ
'house'



K'AL
'twenty'

Hieroglyphics continued:

- Script known from inscribed stones in more than 120 sites in Central America
 - Made of several different signs enclosed in a boundary line
 - Depict heads of rulers, wives, and children
- Portraits: living people NOT gods!
 - Helped decipher hieroglyphics along with computer analysis
 - Dual function
 - About 60 syllables identified as phonetics



Number Symbolism:

- No written record--summary of probabilities of deductions
- Vigesimal system: base of 20 (not 10 like our decimal system)
- Written vertically with lowest denominations at bottom increasing as move to top
- Decimals place-values:
 - 1, 10, 100, 1000, 10,000 vs.
 - 1, 20, 400, 8000, 160,000 (vigesimal)

What does it mean?

- The number 1. 12. 3. 5. 1 stands for what?

= 1 times 160,000	-- 160,000
12 times 8000	-- 96,000
3 times 400	-- 1200
5 times 20	-- 100
1 times 1	-- <u>1</u>

Total: **257,301**

What does it stand for?

1. 10. 2. 14. 3

Answer:

1. 10. 2. 14. 3































$$\begin{array}{r} = 1 \text{ times } 160,000 \quad -- \quad 160,000 \\ 10 \text{ times } 8000 \quad -- \quad 80,000 \\ 2 \text{ times } 400 \quad -- \quad 800 \\ 14 \text{ times } 20 \quad -- \quad 280 \\ 3 \text{ times } 1 \quad -- \quad \underline{3} \end{array}$$

Total: **241, 083**

Mayan obsession with TIME:

- Revolve around their calendar, astronomy, and astrology
- Time worshipped as a god
- A passing stream:
 - Each number carried by a god
 - Each god with own personality and name
 - Temper fluctuated between good and bad which affected number
 - Under influence of 2 other gods:
 - Patron of the day-sign
 - Month to which number is attached
 - Cast daily horoscopes

Numeral system:

0 	1 	2 	3 	4 
5 	6 	7 	8 	9 
10 	11 	12 	13 	14 
15 	16 	17 	18 	19 
20 	21 	22 	23 	24 
25 	26 	27 	28 	29 
Mayan positional number system				

- 13 numbers of sacred-month calendar
- System important to monitor cosmic process
 - Some numbers more significant than others
 - ‘nodes’ of one kind or another playing a special role
- Zero fills empty spaces and has 2 sign forms
 - Clam shell or a head

Special numbers:



- **20**
 - Base number
 - Total of fingers and toes
- **5**
 - Digits on each hand or foot
 - Created by Hunab Ku (senior divinity who made all things)
- **13**
 - Original total of gods
 - Basis of sacred calendar
 - World/sky in 13 layers
- **52**
 - Number of years in a bundle (century)
- **400**
 - Number of gods of the night
- **1600**
 - Stars visible to Mayan priests at night

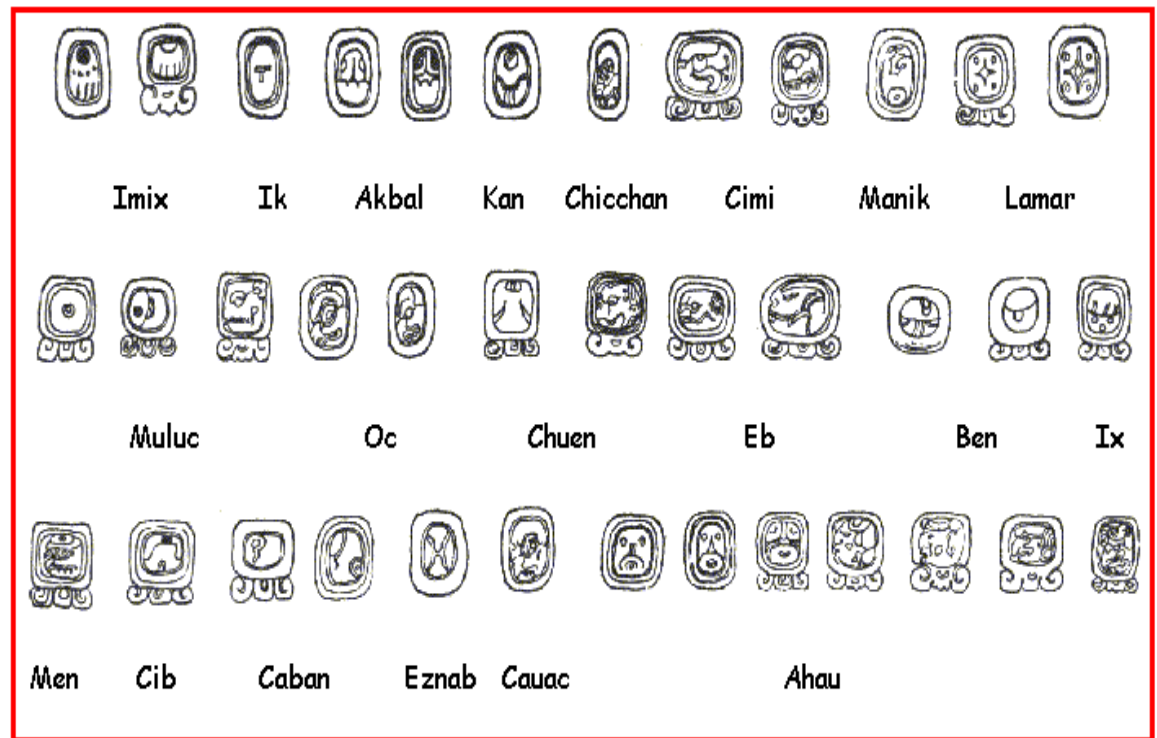
Calendar:

- Recorded religiously and daily
- Birthday sign determined fate in life
- Last five days of each year were dangerous (bad luck)
- Four fold index in defining each day in time:
 - Number of the day in the sacred calendar
 - The god of the day-sign
 - Its number in the year-calendar
 - God of the month in which it fell

Continued:

Ritual calendar

- First number:
 - Day between numbers 1 and 13
- Second number:
 - Name of god--one of 20 day-signs
- 260 days (13 x 20)
[13 days with the 20 gods]



Sacred calendar:

- Use of the 'vague year'
- Based on solar cycle
- Know to be 365.2422 days
- Mayans only used 360 days-vague year
 - Each year month with 20 days
 - 18 months with 20 days each = total of 360 days
 - Where last 5 days became 'dangerous' and of bad luck
 - Use of the leap year
 - Numer, tzolkin month; number, haab month
 - Use of dial



'Long count':

- Stems from creation myth
 - Gods dissatisfied with first 4 attempts at creation
 - Destroyed whole species each time
 - Last attempt: made of dough which 'took' but gods may destroy world again
 - Decision to be made on December 24th, 2011 (modern calendar)
- Begins not at day 1 but date written as 7.0.0.0.0
 - Gods 5th attempt to creation (3133 BC)



Units of time:

- A day is called *kin*
- Next place value is a *unial*--sacred calendar is not 20 *kins* but 18
 - For the vague year (in sacred calendar)
- Other places then move up by 20s
- 20 *kins* = 1 *unial*
 - Normal value
- 18 *unials* = 1 *tun*
 - 360, not 400 days
- 20 *tuns* = 1 *katun*
 - 7,200 days
- 20 *katuns* = 1 *baktun*
 - 144,000 days
- 20 *baktuns* = 1 *pictun*
 - 2,880,000 days

Conclusions:

- Parallels between Mayan and mediaeval Europe
- Calculations of priests and dates of ceremonial events
- No instruments yet made--naked eye observations of heavens
- Need to harmonize numbers with religious myth



Citation:

- D., McLeish, John Ph. Story of numbers. New York: Fawcett Columbine, 1994. Print.