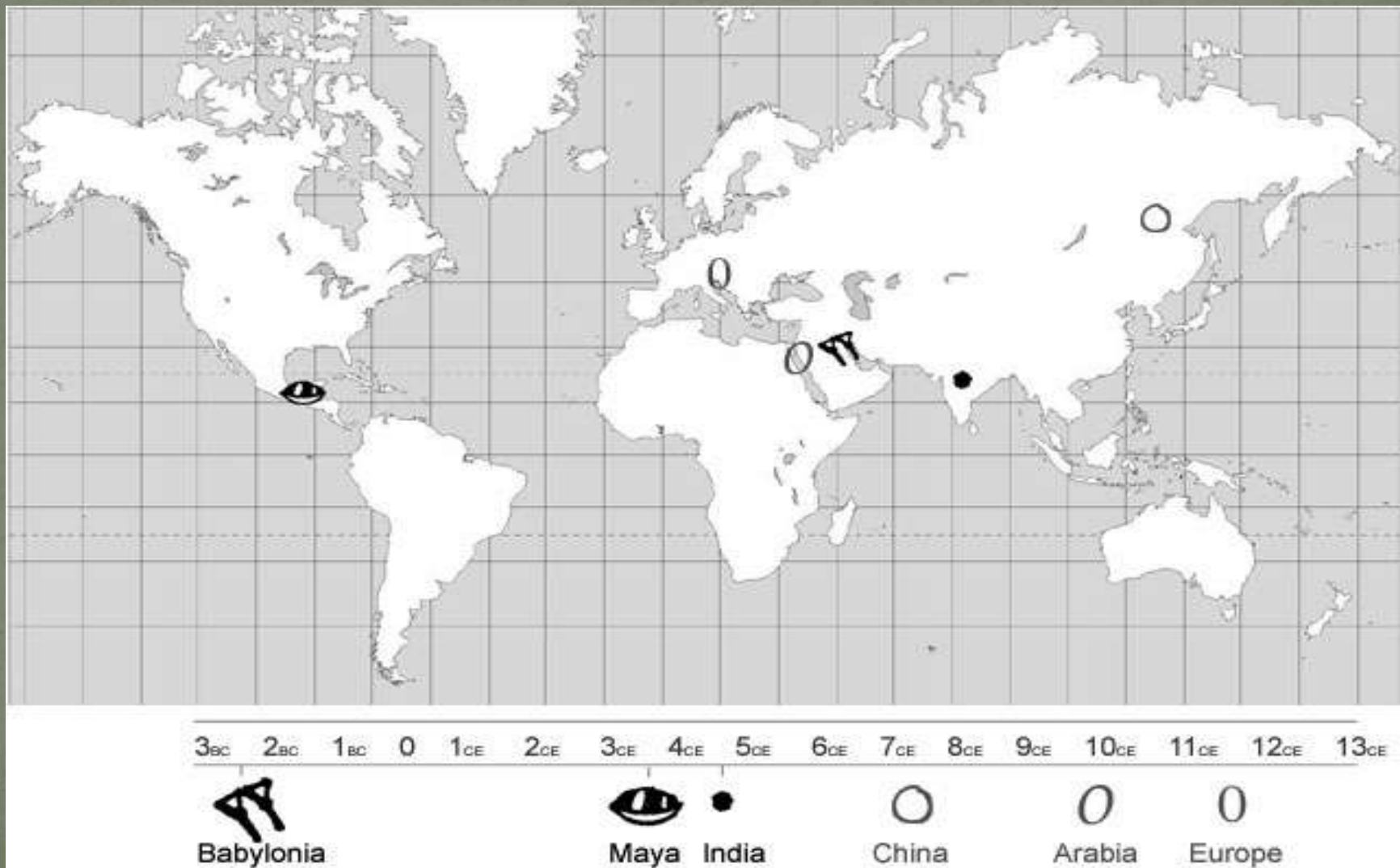


HISTORY of ZERO

KRISTINA GRUSSENMEYER
BEYTULLAH ARIKAN

Zero was independently invented only three times.

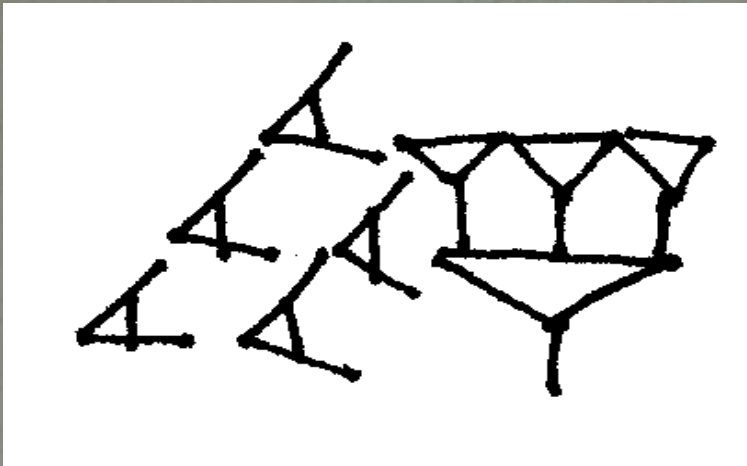


Timeline of Zero

- 1 Babylonians 3rd BC
- 2 Mayans 3rd AD
- 3 Indians 4th AD
- 4 China 7th AD
- 5 Islamic Countries 10th AD
- 6 Europe 12th AD

Babylonia: 300 B.C.

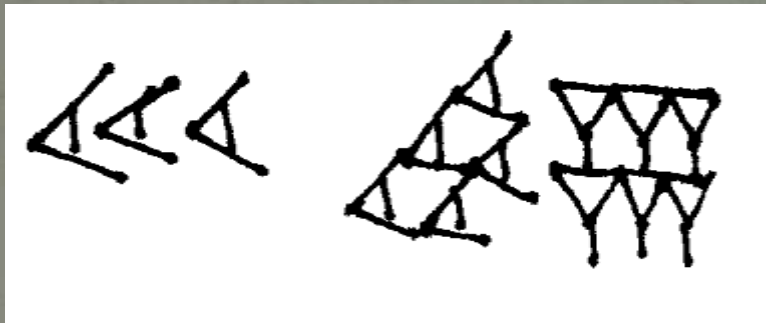
- Sexagesimal numeration- Base 60



5 crescents + 4 wedges = 54



The number 124 (2 sixties + 4 ones)



The number 1856 (30 sixties + 56 ones)

here's the challenge that leads to the invention of zero

- How would you show the number 64 ?
- How would you show the number 3604 ?
- 3604 is 1 "60 squared" + 4 ones but nothing in the sixties column.
- scribes started leaving a blank space
- sometimes it was a pretty small space
- One scribe put in a symbol that already existed as a separator in literature

here's the solution that leads to the
invention of zero



top: 64 (1 sixty + 4 ones)

bottom: 3604 (1 sixty² + 0 sixty + 4 ones)

Babylonians Continued

- Just a place holder
- Despite the invention of **zero** as a placeholder, the Babylonians never quite discovered **zero** as a number.
- Not a separate entity







































Central America: 350 CE

- The Mayans, native inhabitants of Central America, were highly skilled mathematicians, astronomers, artists and architects.
- They had a very complex calendar system and needed a placeholder in their elaborate date system. This led to their invention of **zero**—600 years and 12,000 miles removed from the Babylonians.

Mayan

- The Mayans had several calendars. There was a 365 day civil year, a 260 day religious year and, key to their invention of **zero**, the complicated Long Count calendar which measured time from the start of the Mayan civilization (August 12, 3113 B.C.) and completes a full cycle on December 21, 2012.
- The Mayan numerals were very complex in formal use—painted or carved heads or even full figures were used to represent numbers.

The zero was often represented by a shell shape.

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				

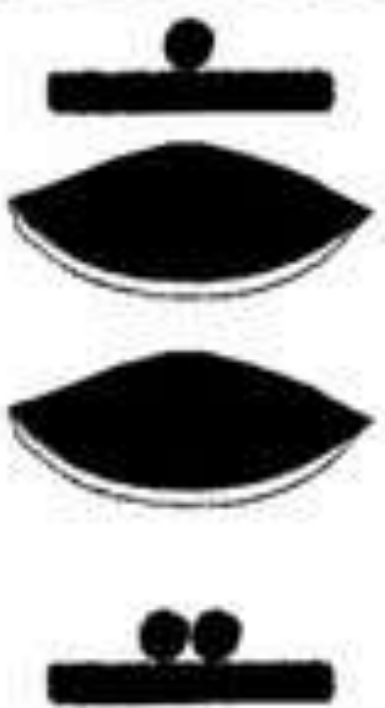
Visual Representations of Zero



The Babylonian zero symbols are represented by four distinct configurations of triangles. The first is a 2x3 grid of triangles. The second and third are single triangles pointing up and down respectively. The fourth is a 3x3 grid of triangles.

6 0 0 7

Babylonian Zero



The Mayan zero symbols are represented by four distinct configurations. The first is a horizontal bar with a single dot above it. The second and third are eye-shaped symbols. The fourth is a horizontal bar with two dots above it.

6
0
0
7

Mayan Zero

India: 458 A.D.

- Zero was used to denote an empty place.
- A striking note about the Hindu **zero** is that, unlike the Babylonian and Mayan **zero**, the Hindu **zero** symbol came to be understood as meaning “nothing.” This is probably because of the use of number words that preceded the symbolic **zero**.

Brahmagupta

- rules for arithmetic involving zero

$$0 - a = -a$$

$$0 / a = 0$$

$$0 + a = a$$

$$a / 0 = \text{undefined}$$

$$0 + 0 = 0$$

$$0 / 0 = \text{undefined}$$

$$0 - (-a) = a$$

$$a * 0 = 0$$

$$0 - (+a) = -a$$

$$a - 0 = a$$

$$0 - 0 = 0$$

Bhaskara

- Bhaskara wrote over 500 years after Brahmagupta. Despite the passage of time he is still struggling to explain division by zero.
- He tried to solve the problem by writing $n/0 = \infty$
- He correctly state other properties of zero, however, such as $0^2 = 0$, and $\sqrt{0} = 0$.

China

- The Indian ideas spread east to China.
- [Ch'in](#) In 1247 Chiu-Shao *Mathematical treatise in nine sections* which uses symbol 0 for zero
- [Zhu Shijie](#) wrote *Jade mirror of the four elements* which again uses the symbol 0 for zero.

- China independently invented place value: they didn't make the leap to **zero** until it was introduced to them by a Buddhist astronomer (by way of India) in 718.
- Although it seems strange to image a place value system with no place holder for “nothing,” it makes perfect sense when you see the Chinese method for writing and calculating numbers.
- The Chinese used a counting board to do their math, and an additive system to write their numbers.
- Any missing places were left blank on the counting board. After the introduction of the **zero** symbol, the counting board could be retired.

Islamic Countries: Modern Zero

- *Al'Khwarizmi* describes the Indian place-value system of numerals based on 1,2,3,4,5,6,7,8,9 and 0.
- This work was the first in what is now Iraq to use zero as a place holder in positional base notation.
- Many Europeans learned about essential role of zero and the decimal place value system from Latin translations of his books.

Europe

- The Hindu-Arabic numeral system (base 10) reached Europe in the 11th century, via the Iberian Peninsula through Spanish Muslims.
- Introduced in Europe in the Middle Ages
- Introduced in Europe by Leonardo Fibonacci.
Translation from Al-Khwarizmi

1 2 3 4 5 6 7 8 9 0

1 ۲ ۳ ۴ or ۱۰ ۵ or ۱۱ ۶ ۷ ۸ ۹ .

Timeline

- 3BC – 2BC Babylonia
- 3AD – 4AD Maya
- 4AD – 5AD India
- 7AD – 8AD China
- 9AD – 10AD Arabia
- 11AD – 12AD Europe

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