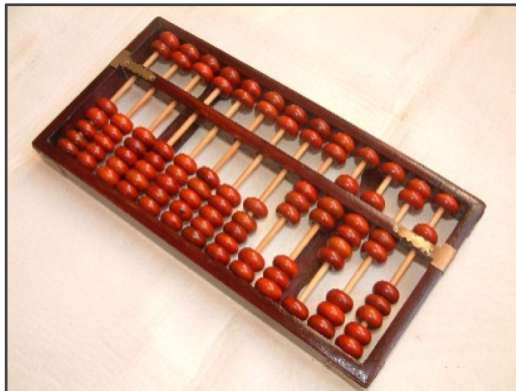# The History of Computing Leading up to the Digital Age

By Caleb Froelich and Travis Stanger

Early computing systems —   (2500 BC - 200 BC)


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- Sticks, stones, cones and clay spheres. All were used to tally things in ancient civilizations.
- **Abacus** — First seen in *Sumerian culture* (circa 2500 BC). Consisted of lines in the sand with pebbles or shells. In the 2nd century BC the Chinese developed the abacus that we are familiar with.
- The Chinese abacus could perform *addition*, *subtraction*, *division* and *multiplication* and could be used to extract square roots and cube roots.

Gears drive innovation —

(circa. 100 AD)

- **Antikythera mechanism** — Built by the Greeks around 100 AD. Regarded as "*the first analog computer*".
- Modeled the movement of planets.
- **Hero of Alexander** — Engineer, mathematician, inventor. His designs, recorded in the books "Automata and Pneumatica" describes a counting device that uses an analog train of gear wheels.

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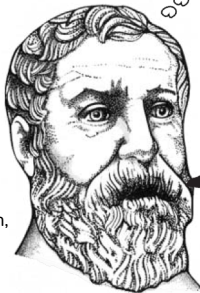
Eureka!
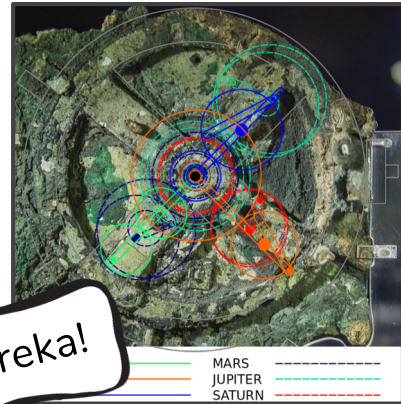
MARS
JUPITER
SATURN

Seymour, B. (2015). Antikythera Mechanism. photograph, Athens, Greece. Retrieved from https://www.smithsonianmag.com/history/decoding-antikythera-mechanism-first-computer-180953979/

First mechanical calculator —

(1642)

- **Pascaline** — A gear driven, mechanical calculator designed by Blaise Pascal in 1642.
- **Subtraction** — 9's complement
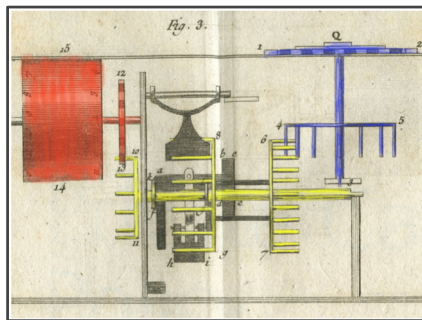
By unknown, printed in 1779 - Oeuvres de Blaise Pascal, Chez Detune, La Haye, Public Domain, https://commons.wikimedia.org/w/index.php?curid=22585041
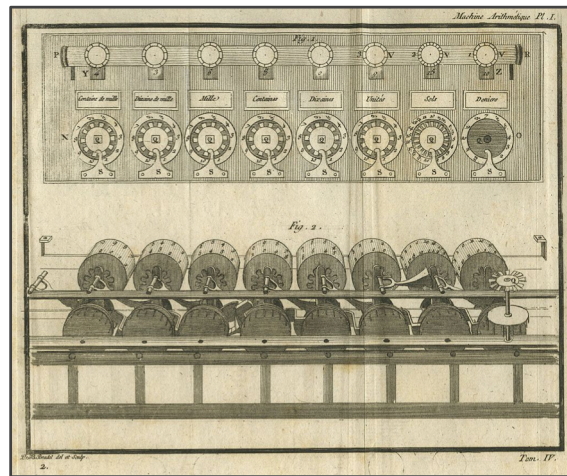
By Unknown - Oeuvres de Blaise Pascal, Chez Detune, La Haye, Public Domain, https://commons.wikimedia.org/w/index.php?curid=11910414

Binary arithmetic formalized — (17th century)

- **Gottfried Leibniz** — Famous philosopher and mathematician.
- His paper "Explication de l'Arithmétique Binaire" fully documented the modern binary arithmetic in the 17th century "foundation of virtually all modern computer architectures."

Above: By Christoph Bernhard Francke - Herzog Anton Ulrich-Museum, online, Public Domain, https://commons.wikimedia.org/w/index.php?curid=53159699

Left: By Gottfried Wilhelm Leibniz, Public Domain, https://commons.wikimedia.org/wiki/File:Leibniz_binary_system_1703.png

The "Father of the Computer" — (early 1800's)

- **Charles Babbage** — English mathematician, inventor and mechanical engineer.
- **Difference Engine** — designed to tabulate polynomial functions. Difference Engine No. 2, built to the original specs, consists of 8,000 parts, weighs 5 tons, and measures 11 feet long.
- **Analytical Engine** — four components
  1. *Input:* Data read using punch-cards,
  2. *Output:* An analog printer created punch cards for output.
  3. *Memory:* "store." Capacity of 1000 numbers with 40 decimal digits.
  4. *CPU:* "mill" stored numbers in registers and operation were controlled by microprograms.

"I wish to God that these calculations had been done with steam" ~ Charles Babbage

Above: By suzueri - online, CC by 2.5, https://zoker.tumblr.com/post/17941177963/suzueri-バベッジの階差機関全体charles-babbages

Far Left: By Unknown - Public Domain, https://commons.wikimedia.org/w/index.php?curid=15392737

The "First Programmer" —

(early 1800's)

- **Ada Lovelace** — Daughter of poet Lord Byron, Ada was a gifted mathematician.
- Translated an article on Babbage's Analytical Engine that had been written by a Italian engineer and added her own notes.
- Described how codes could be implemented to handed letters and symbols along with numbers.
- Formalized the concept of looping and discussed how looping could be enacted on Babbage's machine..

By Alfred Edward Chalon - Science Museum Group, Public Domain,
https://commons.wikimedia.org/w/index.php?curid=28131684

IBM Innovator —

(1890's)
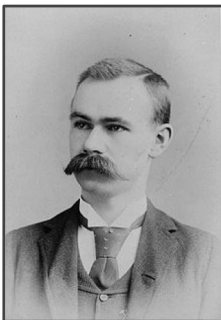
- **Henry Hollerith** — Regarded as the "Father of modern automatic computing."
- After the 1880 US Census data took over 7-years to compile, Hollerith started the design of his **Census Tabulator**.
- Basic function: count/add from punched cards and then produce results (visible counters, print on paper, or seperate card punch).
- Could be rewired to perform a different task. A large step towards programming as we know it!
- Hollerith also inverted the automatic card-feed mechanism and the first key punch.

"The apparatus works as unerringly as the mills of the gods, but beats them hollow as to speed" ~ The Electrical Engineer 11 Nov. 1891
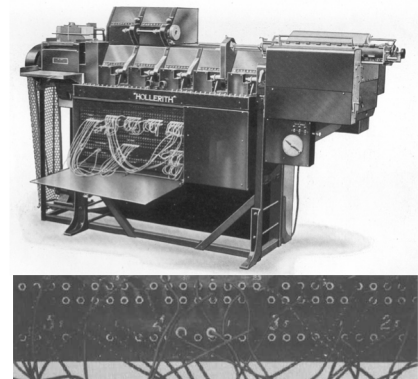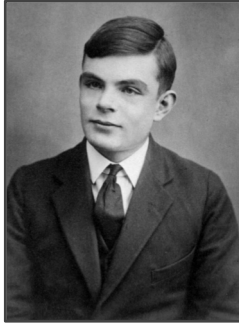
Top: Monthly Notices of the Royal Astronomical Society (MNRAS), Vol.92, No.7 (1932)

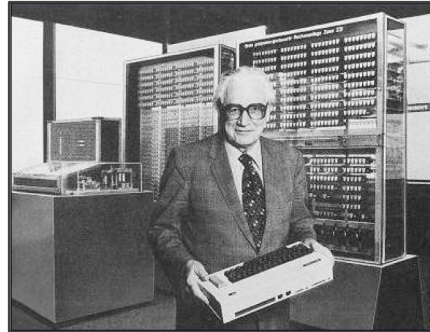**Far Left:** By Bell, C. M. (Charles Milton), ca. 1849-1893, Public Domain,
https://commons.wikimedia.org/w/index.php?curid=31281

Dawn of Digital —

(1930's-1940's)

- **Alan Turing** — Pioneer in computer science. Wrote a scholarly paper on computer programming and architecture.

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- **Konrad Zuse** — Designed a binary electrically driven mechanical calculator. Developed the first complete high-level language.

  Konrad Zuse, Retrieved from, https://chantellemanicaro.wordpress.com/2016/10/30/the-human-factor-b/

Resources —

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