A (pre)history of computer science

Arno Pauly

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CS in BCE

about 87 BCE Mechanism of Antikythera

CS in the 17th-19th century

Leibnitz 1646–1716 Can we reduce logical reasoning to arithmetical calculations?

Babbage 1791–1871 Difference engine & Analytical Engine

Lovelace 1815–1852 Wrote the first computer algorithm

1851 Mass-production of the Arithmometer, a digital mechanical calculator starts

Analytical Engine

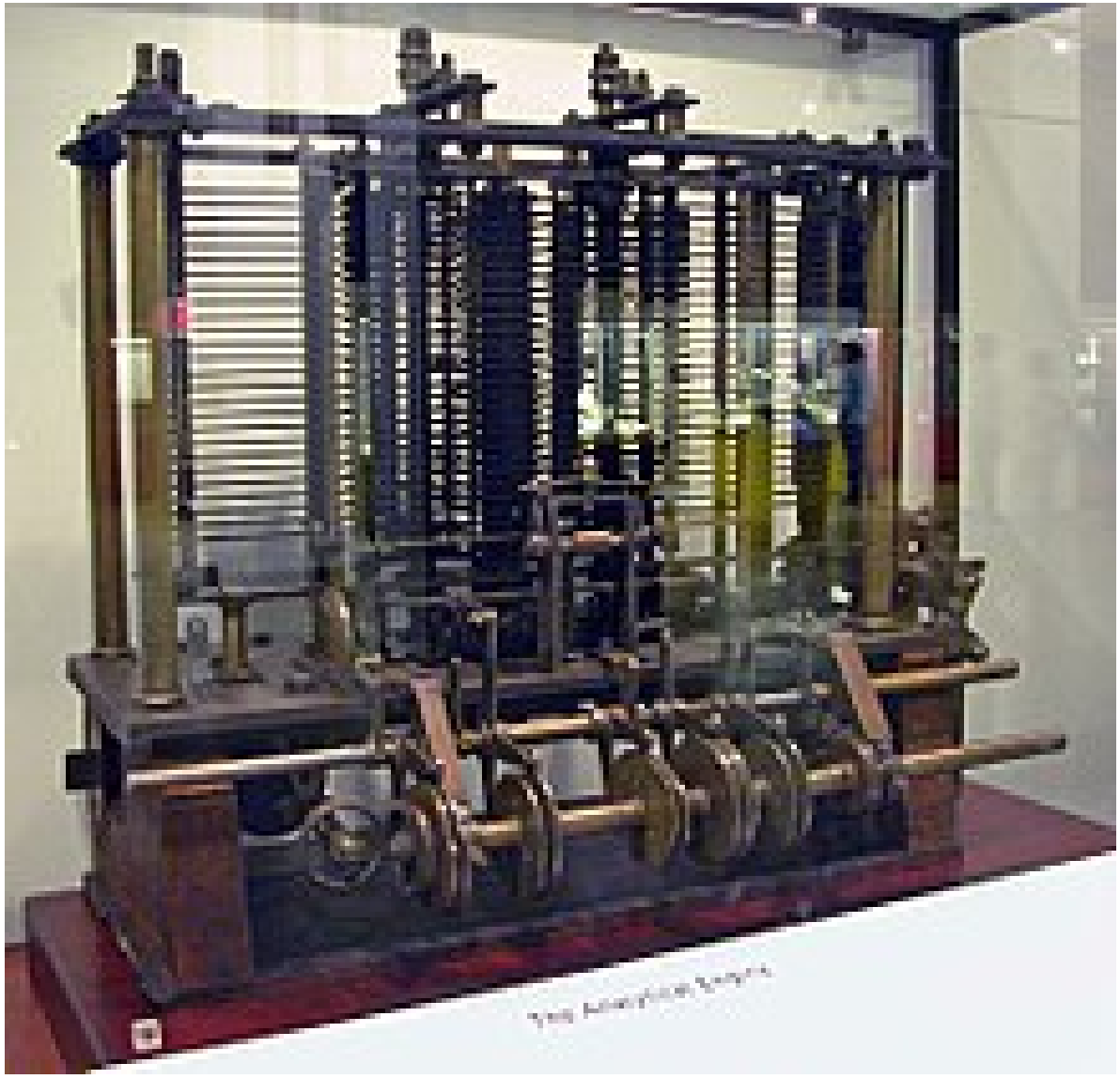

Figure: Part of the Analytical Engine, displayed at the Science Museum (London)

Arithmometer

Figure: An arithmometer built in 1887

Some novel suggestions

- Neil Stephenson, Baroque cycle
- Gibson & Sterling: The Difference Engine

The crisis of the foundations of math

1884 Frege publishes an attempt to provide an arithmetical foundation of mathematics – but Russell shows it to be inconsistent

1910 Whitehead and Russell publish *Principia Mathematica*

1928 Hilbert and Ackermann ask for an algorithm for the *Entscheidungsproblem*

1931 Gödel's incompleteness theorem: No "sane" and sufficiently expressive formal system can prove its own consistency.

1936 Turing (and Church) prove(s) that the *Entscheidungsproblem* is unsolvable.

What “computer” used to mean

Figure: The Harvard Computers, fin de siècle

The Turing machine

Turing conceptualized an abstract computation device capable of performing any possible computation. By making this idea formal, he was able to prove that some tasks (such as the Halting problem and the Entscheidungsproblem) are not computable.

The Turing Year 2012

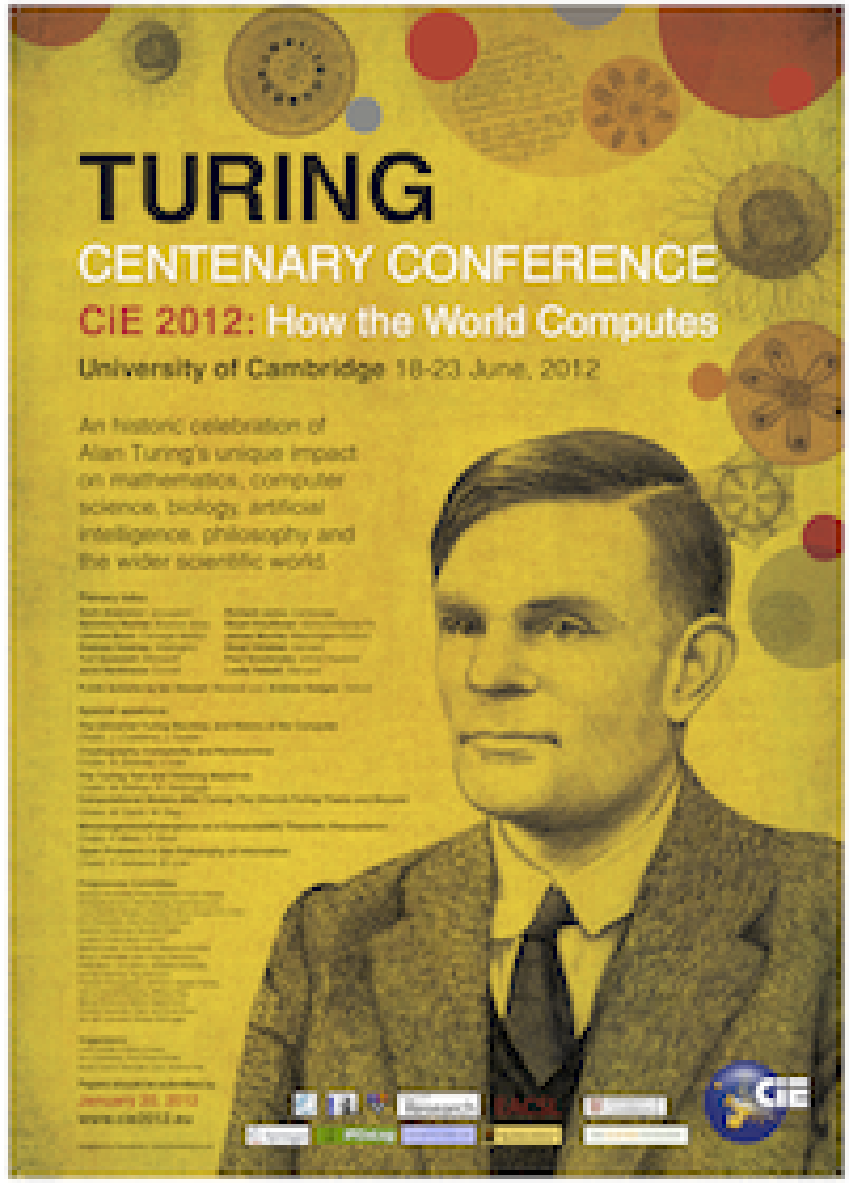

Figure: Poster for CiE 2012

WW2 & Bletchley Park

1939 Turing designs the first “Bombe” at Bletchley Park to decypher Enigma-codes.

1941 Konrad Zuse builds the Z3.

1944 The Colossus Mark 1 enters use, a digital electronic computer (but not stored program).

Computer architecture

1945 von Neumann sketches the internal architecture of a modern computer.

1946 Turing proposes a more detailed model.

Who built the first?

To this day, Cambridge and Manchester fight over the honour of having built the first digital stored-program computer in 1949, EDSAC vs Manchester Mark I.
Side note: The institution in Cambridge was the *Mathematical Laboratory*, which was only renamed to *Computer Laboratory* in 1970.

Further developments

1943	McCulloch and Pitts (two neuroscientists) propose the concept of finite automata
1956	Noam Chomsky pioneers the study of formal grammars
1959	Admiral Grace Hopper leads the invention of COBOL (and machine-independent programming in general)
1971-3	Cook, Levin and Karp start off complexity theory

Summary

Computer Science grew out of Mathematics, and many mathematical concepts and modes of reasoning are of crucial importance as guiding principles for computer science.