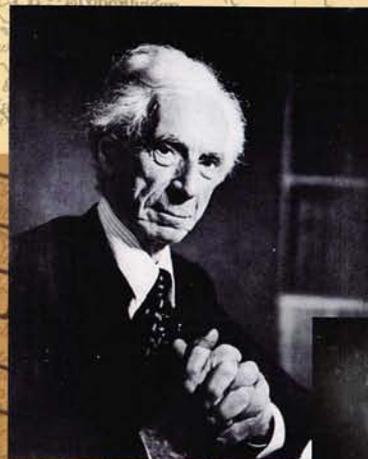


The Search for Certainty

A Journey Through the History of Mathematics
from 1800–2000



EDITED BY **FRANK J. SWETZ**

HISTORICAL EXHIBIT 4

A Chronological Outline of the Evolution of Computing Devices

SINCE VERY EARLY TIMES, humans have sought to simplify the tasks of numerical record keeping and computation by using physical devices. These devices have varied greatly in scope and context from the adaption of personal body parts such as fingers and toes for simple 1:1 tallying to the use of inanimate objects, notched sticks, and knotted cords for numerical record keeping to the operation of complex mechanical and electrical machines for scientific calculations. Today's high-speed digital computers can trace their origins to the finger manipulations of our ancient ancestors. The path of this evolution is outlined in the list of accomplishments and names of individuals given below.

Date	Accomplishment or Event
?	Use of hands and fingers to communicate numerical facts
ca. 30,000 B.C.	Tally bones recovered from European sites
ca. 8000 B.C.	Clay tokens used in Babylonia for numerical record keeping
ca. 600 B.C.	Abacus used in Classical Greece
ca. 500 B.C.	Computing rods and counting board introduced in China
ca. A.D. 600	With the collapse of Imperial Rome, use of the column abacus dominates European computing. In European setting evolves into a line abacus computing table which remains in use until time of late Renaissance.
ca. A.D. 1400	Quipu used by Inca people of pre-Columbian America
A.D. 1614	John Napier develops logarithms, invents Napier's rods for carrying out multiplication
1620	Edmund Gunter develops logarithmic scale basis for slide rule capable of performing four basic operations
1623	Wilhelm Schickard invents computing machine that can perform four operations
1642	Blaise Pascal builds gear-driven computer that can perform addition and subtraction with six-digit numbers
1671	Gottfried Wilhelm Leibniz refines design of gear computer to include "stepped cylinders" allowing for operation of multiplication and division by repeated additions or subtraction.
1673	Sir Samuel Morland invents multiplying machines in England
1805	Joseph Marie Jacquard develops punch card input for textile looms
1820	Thomas de Colmar standardizes design for mechanical computing machines

Date	Accomplishment or Event
1830	Charles Babbage conceives of great computing engines capable of 26-digit computations. Babbage's designs incorporate specifications of modern digital computers, i.e., input, processing unit, output.
1875	Frank Baldwin obtains American patent for popular calculating machine
1941	Konrad Zuse develops Z3, a relay calculator possessing 64 word memory
1944	Automatic Sequence Controlled Calculator (ASCC) built at Harvard
1945	Electronic Numerical Integrator and Computer (ENIAC) begins operation at University of Pennsylvania, contains 18,000 vacuum tubes, performs 360 multiplication/sec.
	John von Neumann develops Electronic Discrete Variable Calculator (EDVAC) at University of Pennsylvania.
1947	Transistor developed at Bell Laboratories
1951	U.S. Census Bureau accepts delivery of Remington Rand UNIVAC 1. The computer contains 5000 vacuum tubes and performs 1000 calculations/sec.
1953	Magnetic core memory introduced into computers
1957	Fortran programming language introduced
1959	Concept of integrated circuits conceived by Robert Noyce
1960	Cobol language introduced
1964	IBM 360 marketed, employs binary addressing, introduces cheap feasible time-sharing and virtual memory.
	Basic language introduced
1968	First Ph.D. in computer science awarded at University of Pennsylvania
1969	UNIX operating system introduced
	Edgar Codd proposes relational database model to IBM
	Intel develops microprocessor
1970	Floppy disc introduced
1971	Pascal language introduced
	First pocket calculators appear
1975	Microcomputers marketed
1976	Cray 1 supercomputer becomes operational
	Kenneth Appel and Wolfgang Haken resolve 4-color conjecture using a computer
1980	Ada language introduced
1985	The Connection Machine developed by Thinking Machines Corporation, a highly parallel supercomputer possessing 65,536 processors
1988	Computer networking well established

Date	Accomplishment or Event
1990	Introduction of Windows 3.0 by Bill Gates and Microsoft
1993	Intel Pentium released
1995	Java Script development announced by Netscape
1996	Netscape Navigator 2.0 released
1997	IBM's Deep Blue beats Chess Champion Gary Kasparov
1999	Linux Kernel 2.2.0 released important operating system in Unix world
2001	Apple releases Mac OSX
2002	Edgar Dykstra dies—noted for shortest path algorithm (1956)
2003	Sir Tim Berners-Lee knighted in recognition of creation of World Wide Web

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Authoritative and highly readable, this global survey is suited to those with no background in math as well as more informed readers and teachers. Presented in a chronological and thematic manner, these twenty-six absorbing and entertaining essays focus on the era from 1800 to 2000.

Contributors such as Henri Poincaré, Judith V. Grabiner, and H. S. M. Coxeter discuss topics ranging from logic and infinity to Fermat's Last Theorem. Additional subjects include the evolution of group theory, the development of modern statistics, and ENIAC, the first computer. Each of the brief, self-contained articles features an illuminating introduction and an extensive bibliography. Numerous relevant and provocative illustrations appear throughout the book.

Dover (2012) new selection from the work *From Five Fingers to Infinity: A Journey Through the History of Mathematics*, published by the Open Court Publishing Company, Chicago, 1994. Historical Exhibit 5 and Chapters 3 and 6 have been added to this edition.



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