

Major Themes in the History of Computing

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CSE 301

What is computing really about?

- It's as old as civilization, and it's all about managing information:
 - Collecting information and saving it
 - Reproducing information and sharing it
 - Performing calculations and storing the results
 - Who owns the data and how it is used
- Advances in computing come from both theoretical and technological inventions

Recording information

- From the outset of civilization, societies needed to keep track of all kinds of information:
 - Seasons, time, weather
 - Inventories such as food supplies, livestock, and manufactured goods
 - Population figures and genealogies
 - Transactions

The evolution of data storage

- Early civilizations placed a high emphasis on the durability of records
 - Etched in stone monuments
- The amount of data increased with the growth of the population and the sophistication of the society
- Ease of recording, reproduction, portability, and storage of records played an ever more important role
 - Clay tablets, wax tablets
 - Papyrus scrolls
 - Ink and paper
 - Printing press

Tablet computing



The Phaistos Disk



Papyrus scrolls



Illuminated manuscripts



Gutenberg press



Information exchange

- Advanced civilizations ventured further from their origins and traded with other cultures. Information needed to be more universal.
 - Phonetic alphabets replace pictograms
 - Ancient Greek adds vowels
 - Different numeric systems emerged – binary and later decimal
 - Discoveries in mathematics provide a universal set of functions for performing calculations

Phonetic alphabets

✱ '
 ⤴ B
 ⤵ G
 ⚠ D
 ≡ H
 Y W
 I Z
 □ Ch

⊗ T
 ⤴ Y
 ✈ K
 C L
 ≡ M
 4 N
 ≡ S
 O '
 ' (circled)

∪ P
 ⤴ C
 ⊗ Q
 ⚠ R
 ≡ Š, Š̂
 x Th

Performing calculations

- In tandem with the growth of record keeping was the increasing need to manipulate data:
 - For trade (eg. tallying purchases in a marketplace with an abacus)
 - For agriculture (eg. calculating plot yields)
 - For government (eg. collecting tribute)
 - For building (eg. laying out foundations and estimating materials)

Calculators

- Computers were initially *people* with numeric skills, such as accountants
 - Double-entry bookkeeping was an advance of the Medici in Renaissance Venice
- Many mechanical devices were invented to calculate astronomical data, and measure time
 - Antikythera mechanism
 - Clocks
 - Astrolabe (astronomical data and ocean navigation)

Antikythera mechanism



Astrolabe



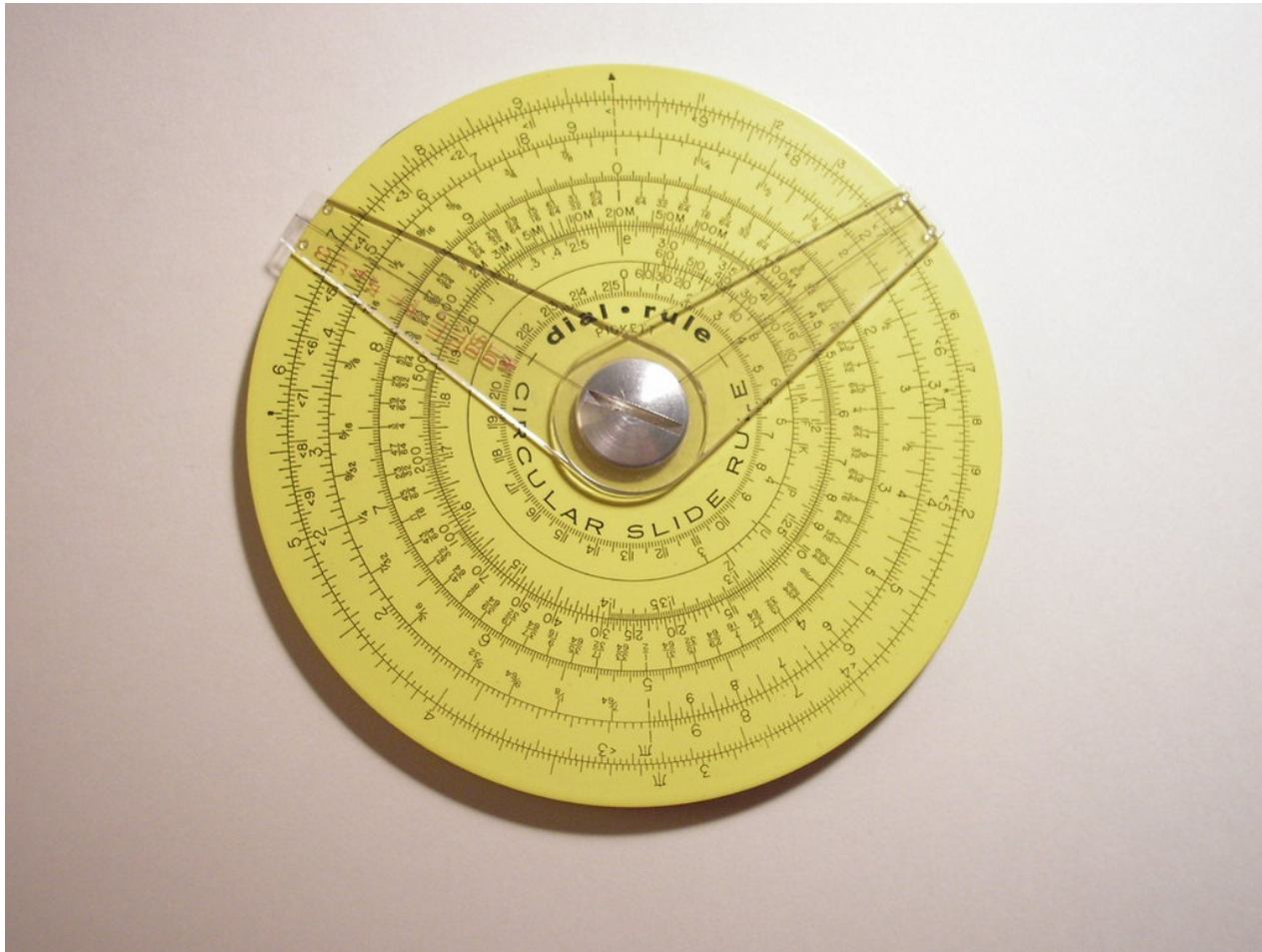
Increasing complexity

- As societies grew ever more complex, so did their need for calculation
 - Napier's Rods were developed to multiply, divide and find cube roots
 - Oughtred's slide rule could do logarithmic and trigonometric functions
 - Newton and Leibniz develop integral calculus

Napier's bones



Slide rule



Criteria for managing information

- Recording data:
 - Permanence of the records
 - Ease of recording and reproduction
 - Storage space
 - Accuracy
- Sharing information:
 - Universality and portability
- Calculation:
 - Speed
 - Sophistication of problems to be solved
 - Accuracy
- And, of course, cost

Information ownership

- The costs of information management have always been high historically, and computing has been a rare skill in the workforce.
- Control of information therefore traditionally resided mostly with wealthy, educated elites.
- Applications of computing tracked the interests of the elite, in commerce and warfare.

Ballistics

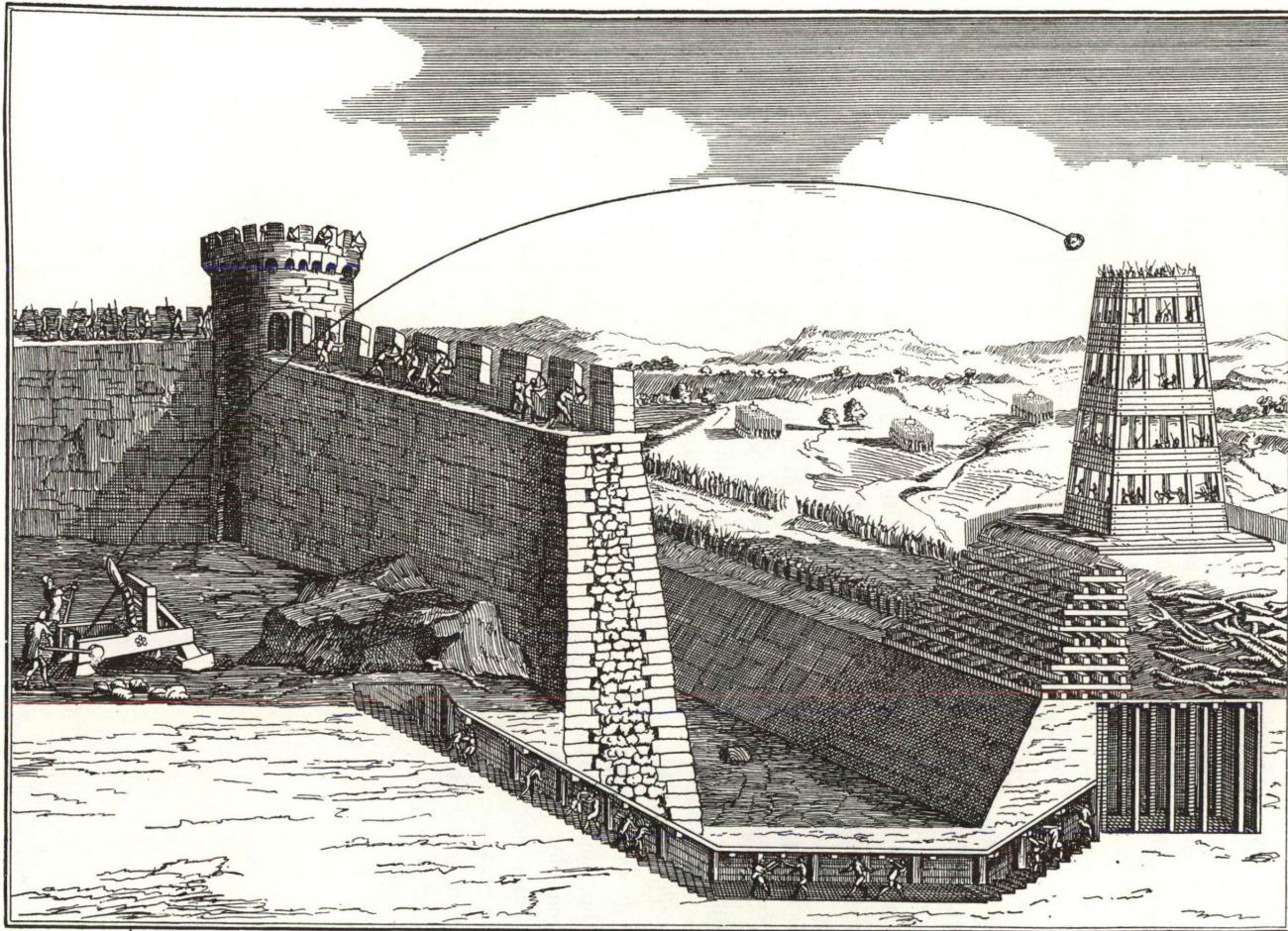


FIG. 183.—A SIEGE.

Criticism.—The picture is open to the spectator in order that he may see both defenders and besiegers at work. The besieged have just cast a stone from a catapult. The stone is falling on the movable tower belonging to the attacking side. The catapult is, however, too small, and could not cast a stone of the size shown.

Scriptorium



SCRIPTORIUM MONK AT WORK. (From *Lacroix*.)

Democratizing information

- As computing systems became more efficient and inexpensive, information became more widely available to larger populations.
 - The printing press contributed to a dramatic increase in literacy in Europe, which in turn led to profound social changes.
- The sharing of information in turn fostered further breakthroughs in computing, democratizing information even further.

Summary of the evolution of computing

- More and more data, but less storage space
- Faster and more sophisticated, but more efficient and less expensive
- Increasingly smaller and more portable
- Increasingly universal technologies
- Information democratizes in an accelerating feedback loop

For example...



GIZMODO

iMac Bondi

Power	14.2 Mflops/s
Weight	34.8 pounds
RAM	32MB
Storage	4GB
Price	\$1,299

iPhone 4

Power	36.09 Mflop/s
Weight	4.83 ounces
RAM	512MB
Storage	32GB
Price	\$699

Other big themes

- Pioneer's Curse
 - Many of the inventors of breakthrough computing technologies did not personally profit from their inventions.
- Top-down Vs. Bottom-up development
 - How does innovation happen best?
- What is intelligence?
 - Can a “thinking machine” exist, or is “artificial intelligence” an oxymoron?