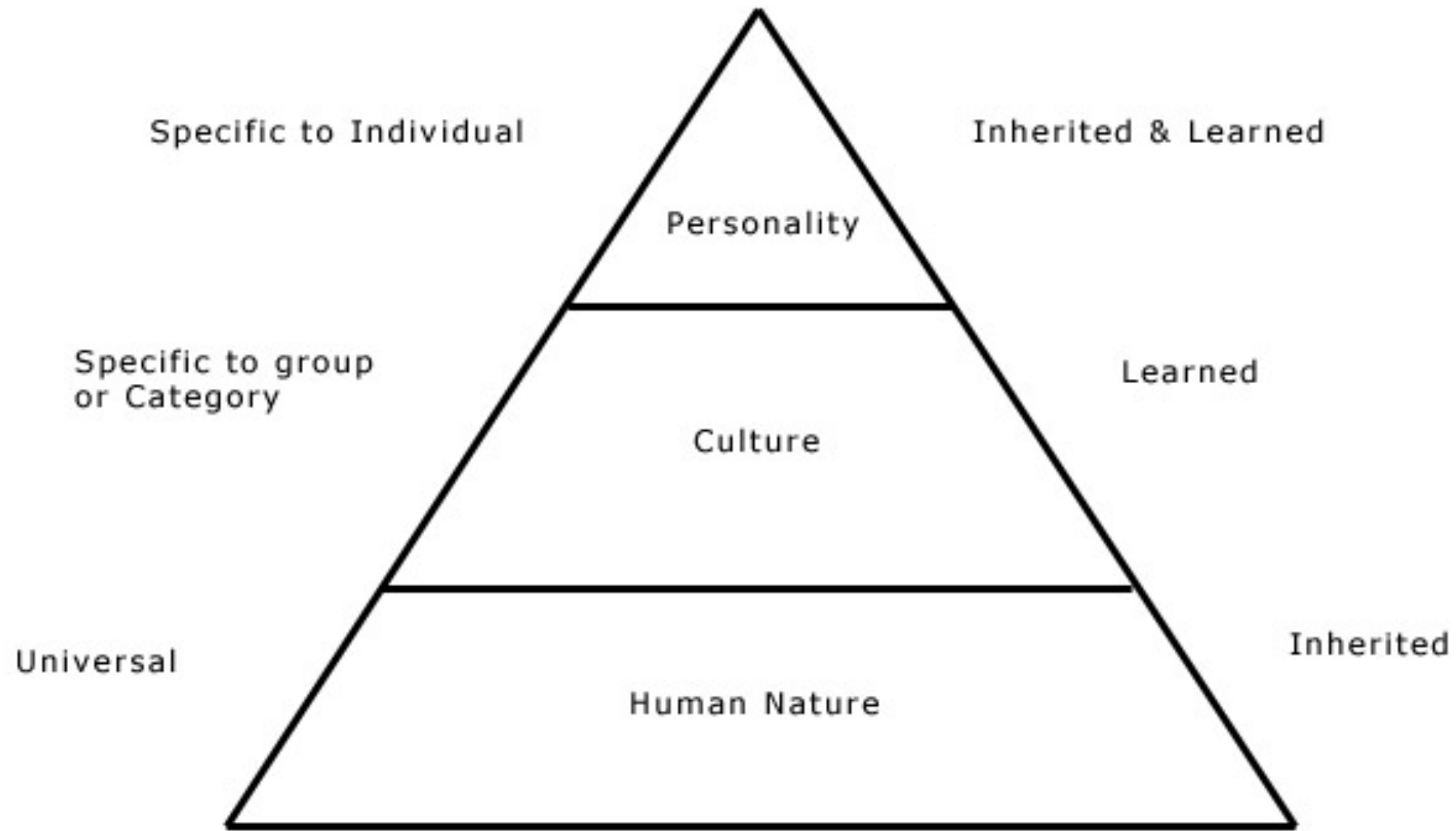


# What is “socio-technical analysis?”

- An evaluation of the intersection of man and machine
  - The individual
  - The group
  - Society
  - Culture
  - Government
  - World

# What is “socio-technical analysis?”

- What is culture?
  - Collective
  - Part of the ‘Human Nature – Culture – Personality’ pyramid

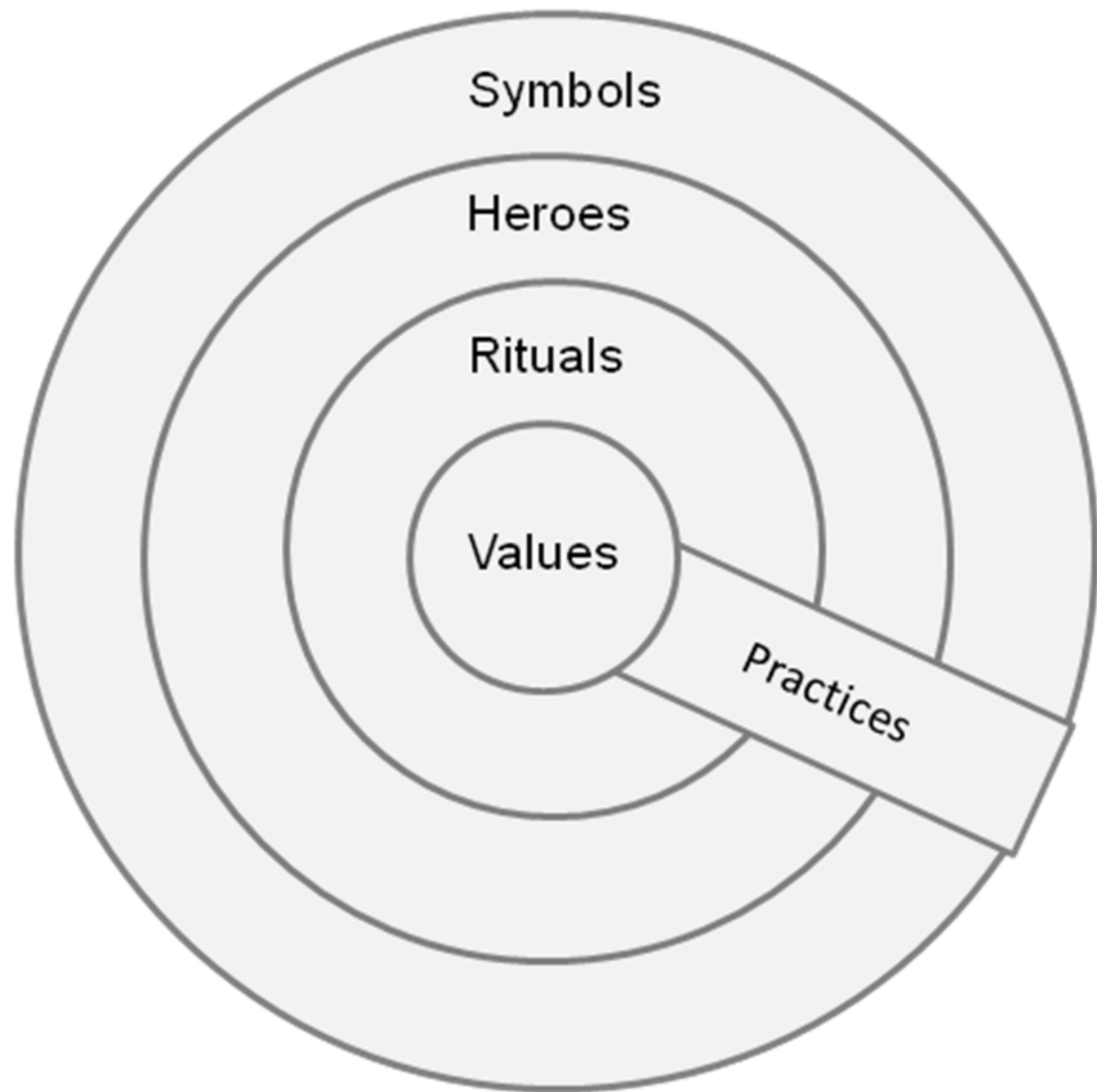


# What is “socio-technical analysis?”

- What is culture?
  - Collective
  - Dimensions of Culture
    - Power Distance Index (PDI)
    - Individualism Index
    - Masculinity Index
    - Uncertainty Index
    - Orientation Index
    - Indulgence Index

# What is “socio-technical analysis?”

- What is culture?
  - Collective
  - Onion Model



# What is “socio-technical analysis?”

- Music (Not so much songs)
  - Classical music
  - Beatles / Elvis Presley
  - Vietnam / Woodstock
  - Disco / Gospel / Country / Rap / Heavy Metal
  - The tritone
  - Accusations of delinquency

# What is “socio-technical analysis?”

- Music
  - Some songs are notable
    - National anthems
    - Toccata en Fugue
    - 1812 overture
    - Rock and Roll All Night
    - Thriller
    - Tubular Bells



# What is “socio-technical analysis?”

- Movies
  - Can reflect or impact society
    - To Kill a Mockingbird / Gone With the Wind / Birth of A Nation
    - Apocalypse Now / Night of the Living Dead
    - Them! / Godzilla
    - Psycho
    - The Exorcist
    - Citizen Kane

# What is “socio-technical analysis?”

- Vast, and overarching
- Covers many topics and ideas
- Especially important today
- Technology impacts all of us at both micro and macro levels
- What are the consequences of technology at these levels?

# What is “socio-technical analysis?”

- What are the consequences of technology at these levels?
  - Economic
  - Cultural
  - Political
  - Technological

# What is “socio-technical analysis?”

- PEST Analysis
  - Political
  - Economic
  - Social
  - Technical
- Organizationally, and with other tools, very effective
- Socially, more complex

# A Brief History of Technology

- What does the word technology mean?
- Where did the word originate?
- When did it come in to common use?
- An examination of technology through the ages.

# A Brief History of Technology

- We don't mean digital technology, at least not yet
- Even so, the evolution of digital technology can seem like a lifetime when early and current technology is compared side by side
- For example:

# A Brief History of Technology



# A Brief History of Technology





# Intro, and A Brief History

- “Technology” comes from the Greek words “Techne” and “-logia”
  - Techne: Art, Craft, Skill
  - -logia: The study of
- Also need to consider Episteme
  - “Knowledge”
  - Can’t have “Techne” without “Episteme”
- Now, we even have knowledge workers
- Implicit v. Explicit knowledge

# Intro, and A Brief History

- Some additional important terms
  - Data
  - Information
  - Computer system
  - Information system
  - User

# A Brief History of Technology

- Technology has always impacted society in significant ways.
- Generally used to automate, improve, inform, or destroy (Can be combinations).
- These causes have pushed technological innovation from prehistoric times until now.
- There have always been benefits and consequences.
- The pace of, and impact of, technological change has become almost instantaneous.

# A Brief History of Technology

- Three main time periods
  - Stone age
  - Bronze age
  - Iron age
- What age are we in now?

# A Brief History of Technology

- Stone age (early man)
  - Oldowan
  - Acheulean
  - Tool creation and use by these groups

# Oldowan tool creation and use

## Olduwan chopper



Source: University of Missouri Museum of  
Anthropology

# Oldowan tool creation and use

## Olduwan chopper



Source: University of California, San Diego, David  
K. Jordan, Professor Emeritus

# Acheulean tool creation and use

## Acheulean hand axe



Source: Bradshaw Foundation



# Acheulean tool creation and use

## Acheulean hand axe



# A Brief History of Technology

- Bronze age (Smelting)
  - Most technology was outside the metals
    - Early writing
    - Basic government
    - Trade
    - Agriculture and ox-plows
    - The wheel
    - The Loom
    - Bronze (Not so much for weapons / armor)

# Bronze age tool creation and use

## Bronze hand axe



Source: BBC

# Bronze age tool creation and use

## Various bronze items



Source: Scottish Heritage Hub

# A Brief History of Technology

- Iron age
  - Much better for weapons and armor
    - Very abundant, and inexpensive
    - Allowed for more permanent settlement
    - Better militaries
  - However, also put weapons in the hands of the populace for the first time



# Iron age tool creation and use

(Actually, steel is better)



Source: Some guy that drew it

# Iron age tool creation and use

Also, irons



# A Brief History of Technology

- Industrial Revolution (@1750 – 1850)
  - England
  - Large-scale automation comes into being
  - Factories and mass-production processes
  - Increased use of steel
  - Advancements in transportation



# A Brief History of Technology

- Information age?
  - Information is the most important commodity
  - With it, everything else falls in to place
  - Information helps you make decisions
  - Information for decisions is the prime use of technology

# A Brief History of Technology

Some early technologies, and their impact

- Writing
  - Bronze age development
  - Not a full writing system
    - Hieroglyphics (Egypt)
    - Cuneiform (Mesopotamian cultures)
  - Pictorial, specific
  - Very few could write
  - Now, information can be expressed in a myriad of ways

# Early writing

## Hieroglyphics



Source: Ancien-Egypt.org

# Early writing

## Cuneiform





# Early writing

## Information representation





# Early writing

## Information representation



# Early writing

## Information representation



# A Brief History of Technology

Some early technologies, and their impact

- Abacus
  - Used in many early cultures, still used today
  - China, Japan, Russia, Rome, Greece
  - Uses beads to represent numbers
  - Lack of paper and writing implements, as well as need to work with large numbers
  - Allowed for large trades, accurate calculations, negotiations



# Abacus



Source: [computer-history.org](http://computer-history.org)

# A Brief History of Technology

Some early technologies, and their impact

- Water wheel
  - Can automate many process already known
  - Water has been used for millenia
  - Grinding, crushing, weighing
  - Frees up and is more efficient than human labor
  - Abundant and inexpensive
  - Starting to see more rapid technological improvement

# A Brief History of Technology

Some early technologies, and their impact

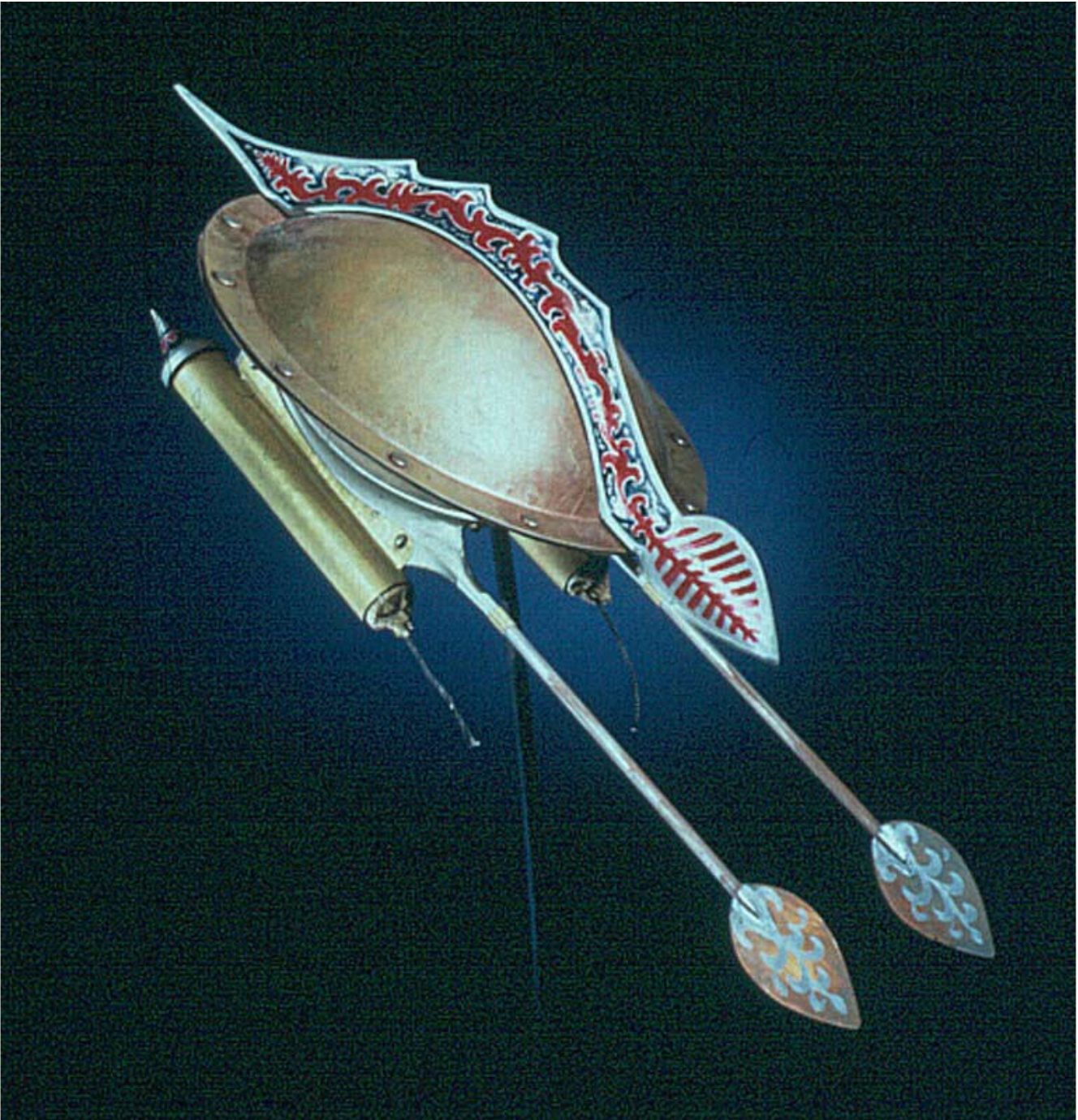
- Many ancient cultures contributed significant technologies
  - China
    - Paper
    - Moveable-type printing
    - Gunpowder (and rockets / fireworks)
    - Crossbow
    - Seed planters and crop planting in rows
    - Compass
    - Wheelbarrow

# A Brief History of Technology

Some early technologies, and their impact

- Many ancient cultures contributed significant technologies
  - Islamic world
    - Coffee
    - Pin-hole camera (and the word 'camera')
    - The first parachute
    - Many medical devices and discoveries
    - Military gunpowder
    - Torpedo





# A Brief History of Technology

Some early technologies, and their impact

- Actually, many ancient cultures contributed significant technologies
  - Egypt / Mesopotamia
    - Writing
    - Calendar (close to the 365-day)
    - Targeted irrigation
    - Mathematics
    - Bowling
    - Toothpaste

# A Brief History of Technology

Some early technologies, and their impact

- Actually, many ancient cultures contributed significant technologies
  - Rome and Greece
    - Many technologies, including medicine, cryptography, warfare, infrastructure, communication, and material

# A Brief History of Technology

Some early technologies, and their impact

- Antikythera mechanism
  - Discovered in 1900 off the coast of Antikythera, Greece
  - Believed to be 2,000 years old
  - Contains ~30 gears, 2,000 inscriptions
  - Predates anything similar by 1,000 years
  - Took 120 years to solve



# Antikythera Mechanism



Source: techtimes.com

# Antikythera Mechanism

[INSIDE THE ANTIKYTHERA MECHANISM]

## Astronomical Clockwork

**ZODIAC DIAL**  
Showed the 12 constellations along the ecliptic, the sun's path in the sky.

**EGYPTIAN CALENDAR DIAL**  
Displayed 365 days of a year.



**LUNAR POINTER**  
Showed the position of the moon with respect to the constellations on the zodiac dial.

**FRONT-PLATE INSCRIPTIONS**  
Described the rising and setting times of important stars throughout the year.

This exploded view of the mechanism shows all but one of the 30 known gears, plus a few that have been hypothesized. Turning a crank on the side activated all the gears in the mechanism and moved pointers on the front and back dials; the arrows colored blue, red and yellow explain how the motion transmitted from one gear to the next. The user would choose a date on the Egyptian, 365-day calendar dial on the front or on the Metonic, 235-lunar-month calendar

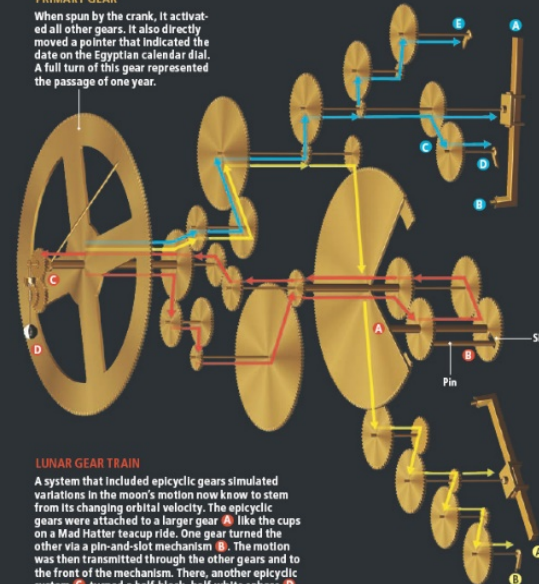
dial on the back and then read the astronomical predictions for that time—such as the position and phases of the moon—from the other dials. Alternatively, one could turn the crank to set a particular event on an astronomical dial and then see on what date it would occur. Other gears, now lost, may have calculated the positions of the sun and of some or all of the five planets known in antiquity and displayed them via pointers on the zodiac dial.

### METONIC GEAR TRAIN

Calculated the month in the Metonic calendar, made of 235 lunar months, and displayed it via a pointer **A** on the Metonic calendar dial on the back. A pin **B** at the pointer's tip followed the spiral groove, and the pointer extended in length as it reached months marked on successive, outer twists. Auxiliary gears **C** turned a pointer **D** on a smaller dial indicating four-year cycles of Olympiads and other games. Other gears moved a pointer on another small dial **E**, which may have indicated a 76-year cycle.

### PRIMARY GEAR

When spun by the crank, it activated all other gears. It also directly moved a pointer that indicated the date on the Egyptian calendar dial. A full turn of this gear represented the passage of one year.

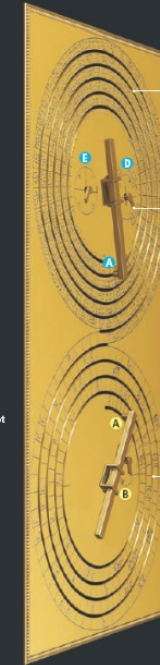


### LUNAR GEAR TRAIN

A system that included epicyclic gears simulated variations in the moon's motion now known to stem from its changing orbital velocity. The epicyclic gears were attached to a larger gear **A** like the cups on a Mad Hatter teacup ride. One gear turned the other via a pin-and-slot mechanism **B**. The motion was then transmitted through the other gears and to the front of the mechanism. There, another epicyclic system **C** turned a half-black, half-white sphere **D** to show the lunar phases, and a pointer **E** showed the position of the moon on the zodiac dial.

### ECLIPSE GEAR TRAIN

Calculated the month in the 223-lunar-month Saros cycle of recurring eclipses. It displayed the month on the Saros dial with an extensible pointer **A** similar to the one on the Metonic dial. Auxiliary gears moved a pointer **B** on a smaller dial. That pointer made one third of a turn for each 223-month cycle to indicate that the corresponding eclipse time would be offset by eight hours.

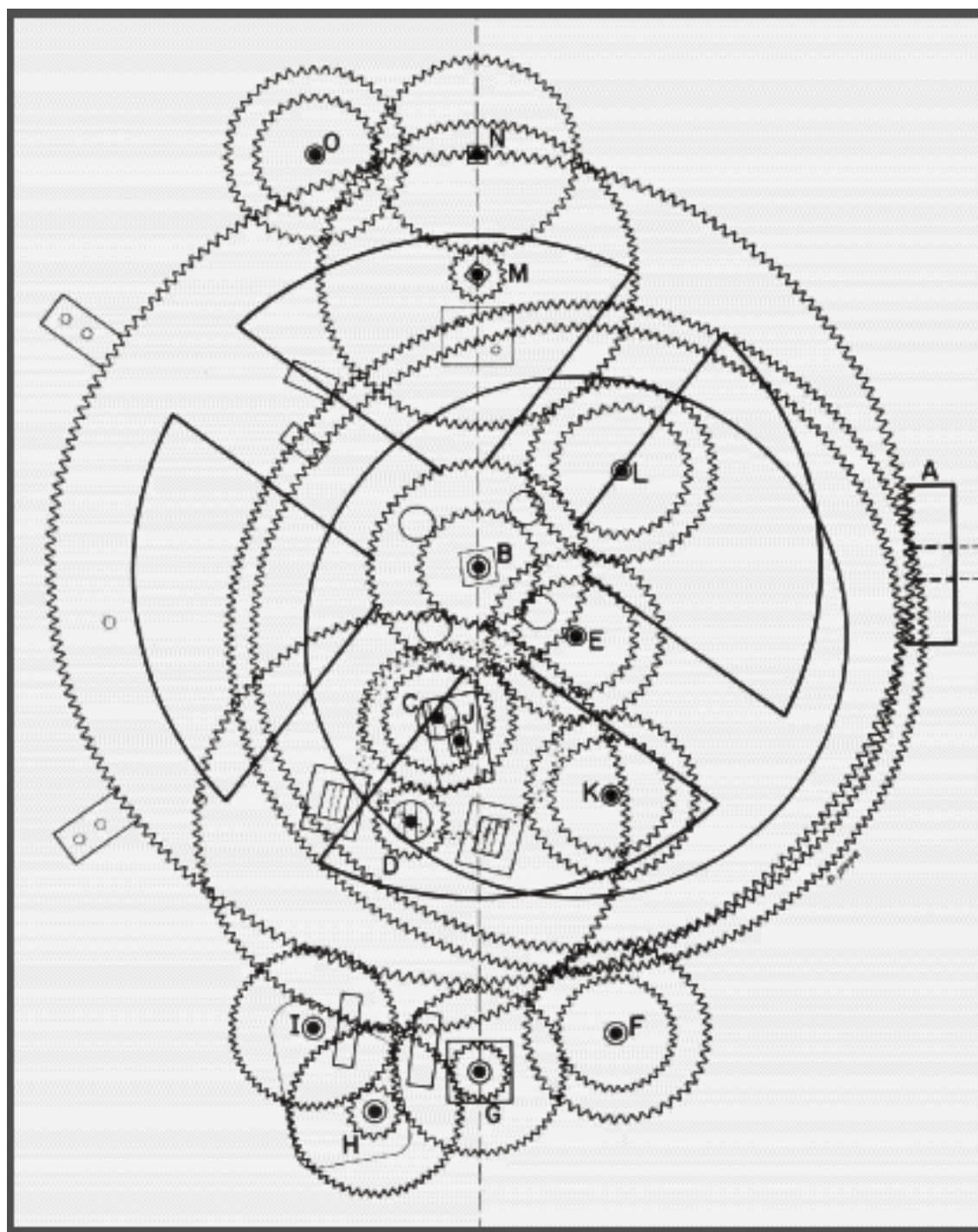


**METONIC CALENDAR DIAL**  
Displayed the month on a 235-lunar-month cycle arranged on a spiral.

**OLYMPIAD DIAL**  
Indicated the years of the ancient Olympics and other games.

**SAROS LUNAR ECLIPSE DIAL**  
Inscriptions on this spiral indicated the months in which lunar and solar eclipses can occur.

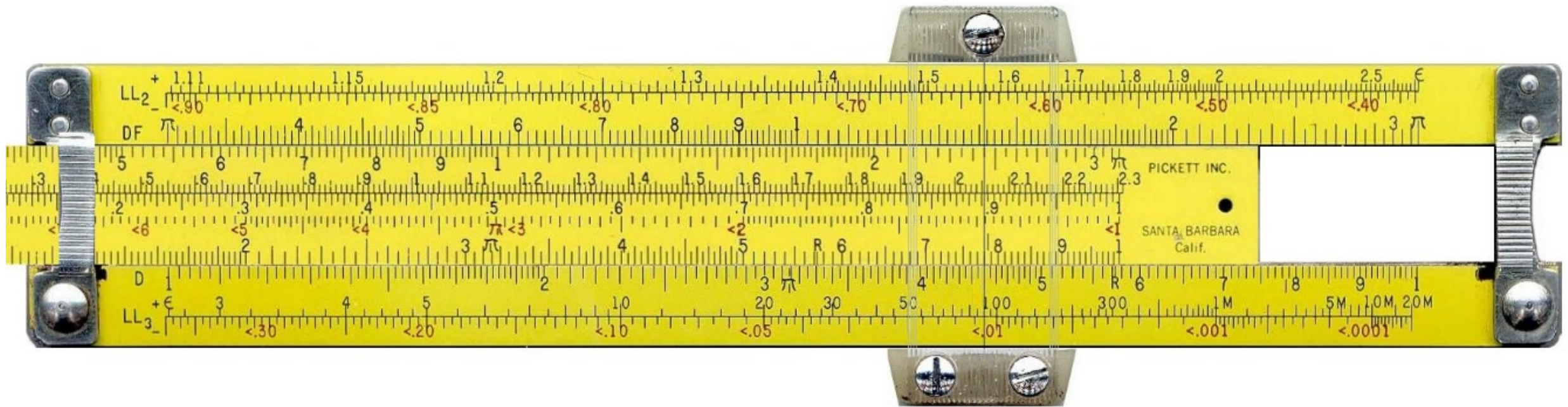




# A Brief History of Technology

Some early technologies, and their impact

- Slide rule



# A Brief History of Technology

More modern technologies, and their impact

- Telegraph / Telephone
  - Long-distance communication previously done by runners, drums, smoke, even water
  - 1843 / 1876
  - Allowed for very fast communication and dissemination of information
  - The impacts of information could now be felt much more rapidly
  - Phone based on telegraph

# A Brief History of Technology

More modern technologies, and their impact

- Radio
  - 1921
  - Marconi, Tesla, Bose, Stubblefield
  - Very fast mass-transmission of information
  - Could impact and influence large groups of people at once
  - Radio reporters and entertainment
  - War of the Worlds

# Radio



# A Brief History of Technology

More modern technologies, and their impact

- Television
  - 1939, RCA, New York World's Fair
  - Speech by Roosevelt
  - College baseball game
  - Like radio:
    - Very fast mass-transmission of information
    - Could impact and influence large groups of people at once
  - Election of John F. Kennedy



# Television

TRK-5, RCA, 1939, \$295



# A Brief History of Technology

More modern technologies, and their impact

- The Enigma Machine / Le Bombe
  - The future of humanity rode on these
  - If the Enigma code couldn't be broken, the Nazis could have won the war
  - Their true importance wasn't known until later
  - Both devices were mechanical, not digital
  - Not the first use of cyphertext, however

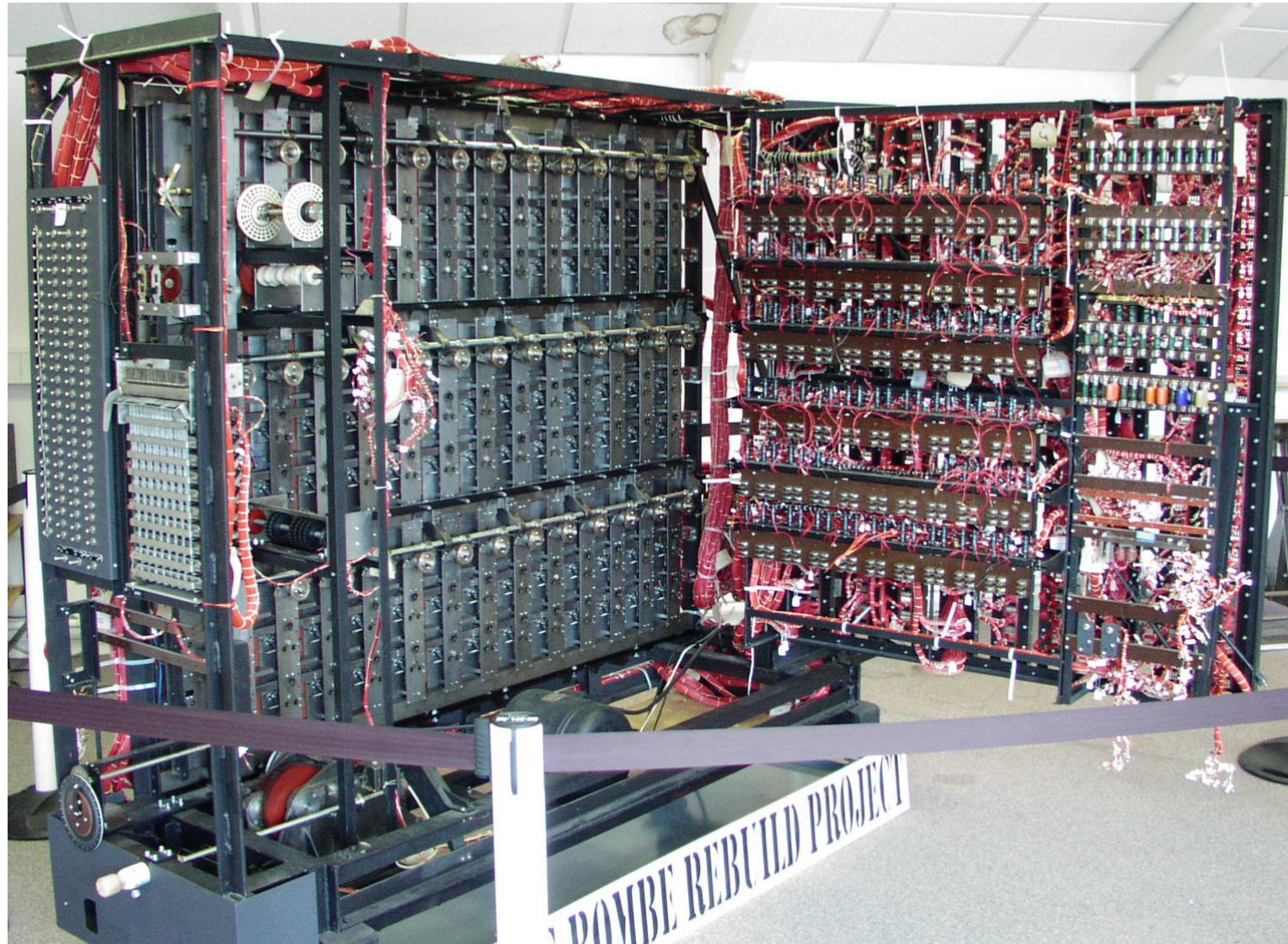
# Enigma machine



Source: ilord.com



# Le Bombe



# A Brief History of Technology

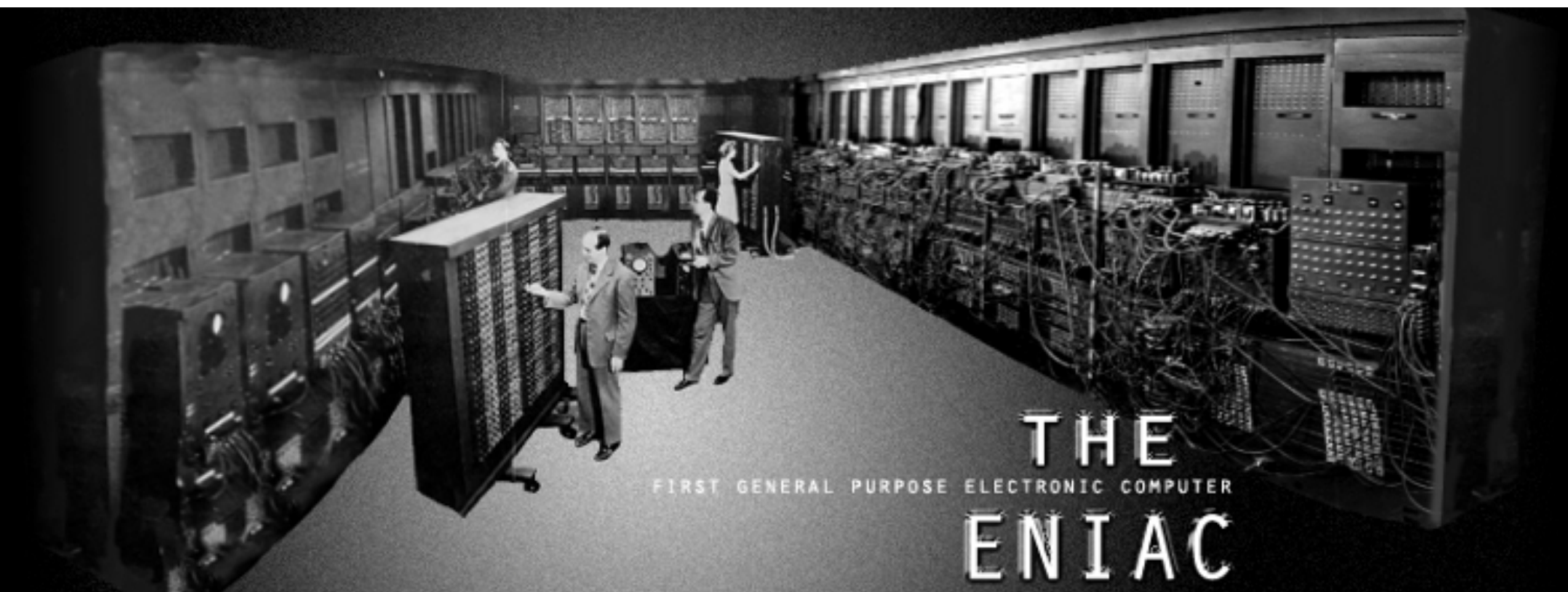
More modern technologies, and their impact

- ENIAC / Transistor / Integrated circuit
  - ENIAC used tubes, and was built around them (bug)
  - Bell labs (Shockley, Bardeen and Brattain) developed the transistor in 1948
  - In 1958, Texas Instruments and Fairchild Semiconductor (Noyce) developed the Integrated Circuit
  - That led to replacement of the vacuum tube, miniaturization, and PC development





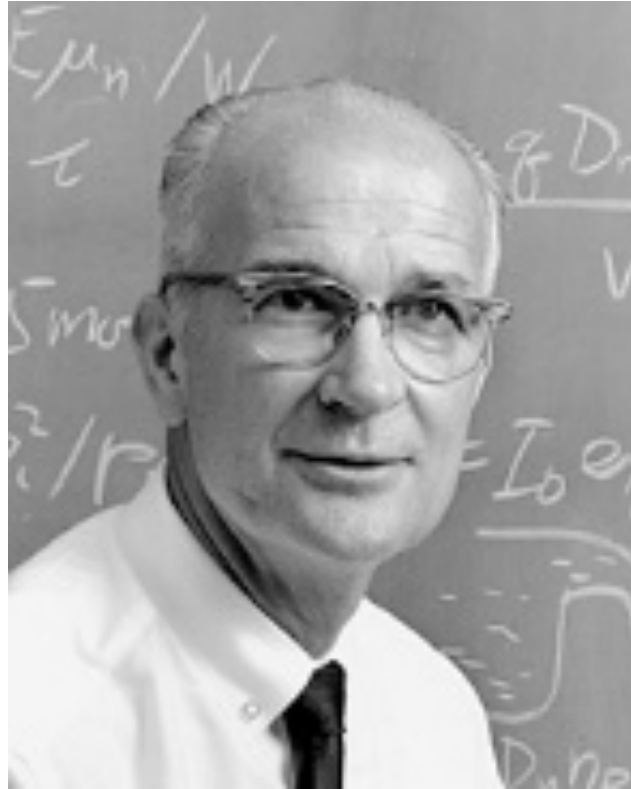




FIRST GENERAL PURPOSE ELECTRONIC COMPUTER

# THE ENIAC

# Shockley and Noyce



William Shockley



Robert Noyce



# A Brief History of Technology

More modern technologies, and their impact

- The PC
  - CPM (Gary Kildall)
  - QDOS
  - IBM
  - Bill Gates / Paul Allen (Microsoft)
  - Steve Wozniak / Steve Jobs (Apple)
  - The 'killer app'
  - Spawned everything else

# A Brief History of Technology

More modern technologies, and their impact

- A final note:
  - What does the future look like?
  - How do we interpret technology and society of the future?
  - Often discussed through the lens of pop culture (movies, music, books, television, games)
  - Are utopian, or dystopian









# A Brief History of Technology

More modern technologies, and their impact

- A final note:
  - What does the future look like?
  - How do we interpret technology and society of the future?
  - Often discussed through the lens of pop culture (movies, music, books, television)
  - Are utopian, or dystopian
  - How could technology help or hinder this progress?
  - Depictions often dependent on our current technology