

Engineering, Ethics and Society: Computing Ethics 1- Simulation and Gaming

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Engineering 183EW, UCLA SEAS
Lecture 11

Computing Ethics Overview

Use Modality	Computing Technology			
	Simulation & Gaming	Artificial Intelligence & Robotics	Internet Connectivity	Databases & Surveillance
Personal	L	L	L	L
Societal	L	L	L	L

~~M = Medium Effect~~

L = Large Effect

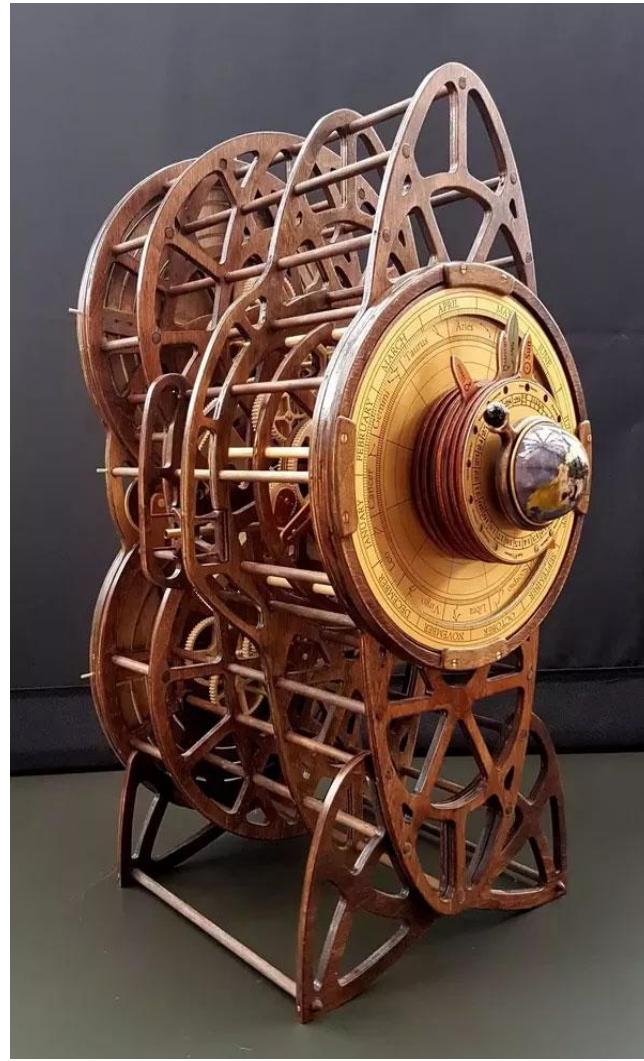
Profound Societal and Ethical Implications!

Lecture Contents

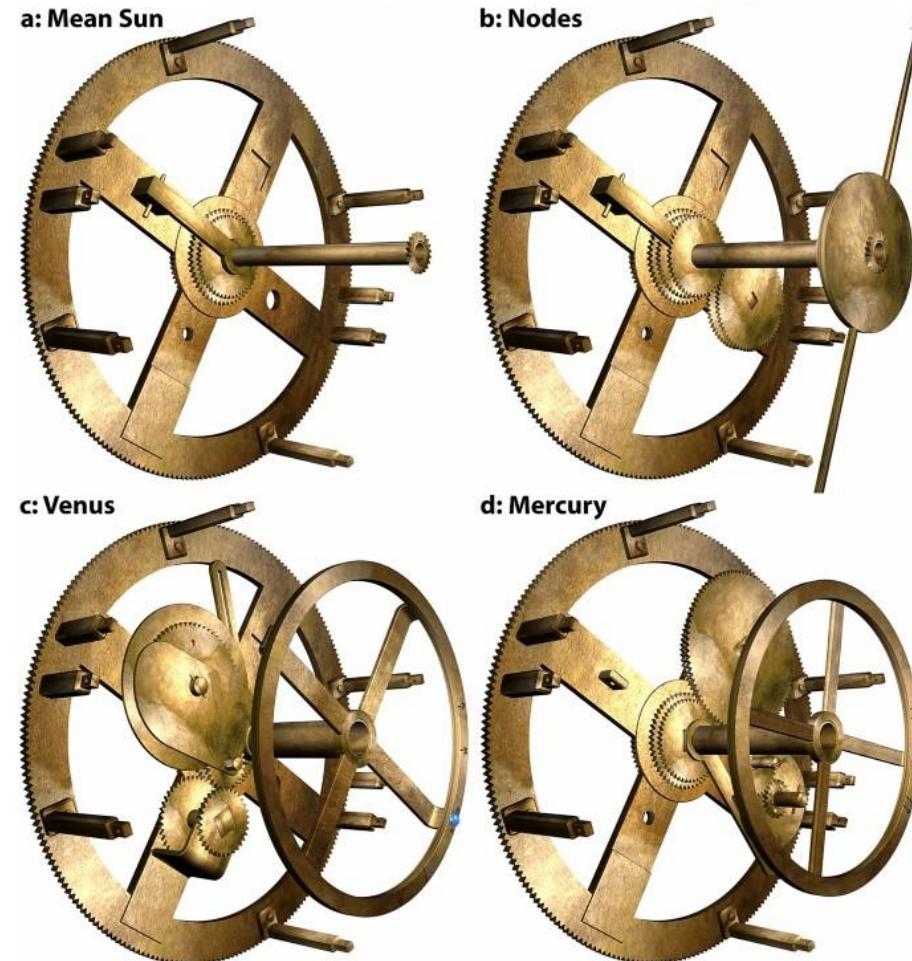
- Historical Timeline
 - Ancient Mechanisms
 - Mechanical Calculators
 - Modern Computer Configurations
 - Growth of Computing Power
- Ethical Case 1: Simulation
 - Power of Visualization
 - Basis of Transparency
 - Ethical Issues of Simulation
- Ethical Case 2: Gaming
 - Beginnings
 - Role Playing Implications
 - Bad and Good Examples
 - Game Developers' Ethical Code
 - Game Players' Ethics and Morality
- Ethical Take-Away

Ancient Analog Computer

Antikythera Mechanism (~70-60 BCE)



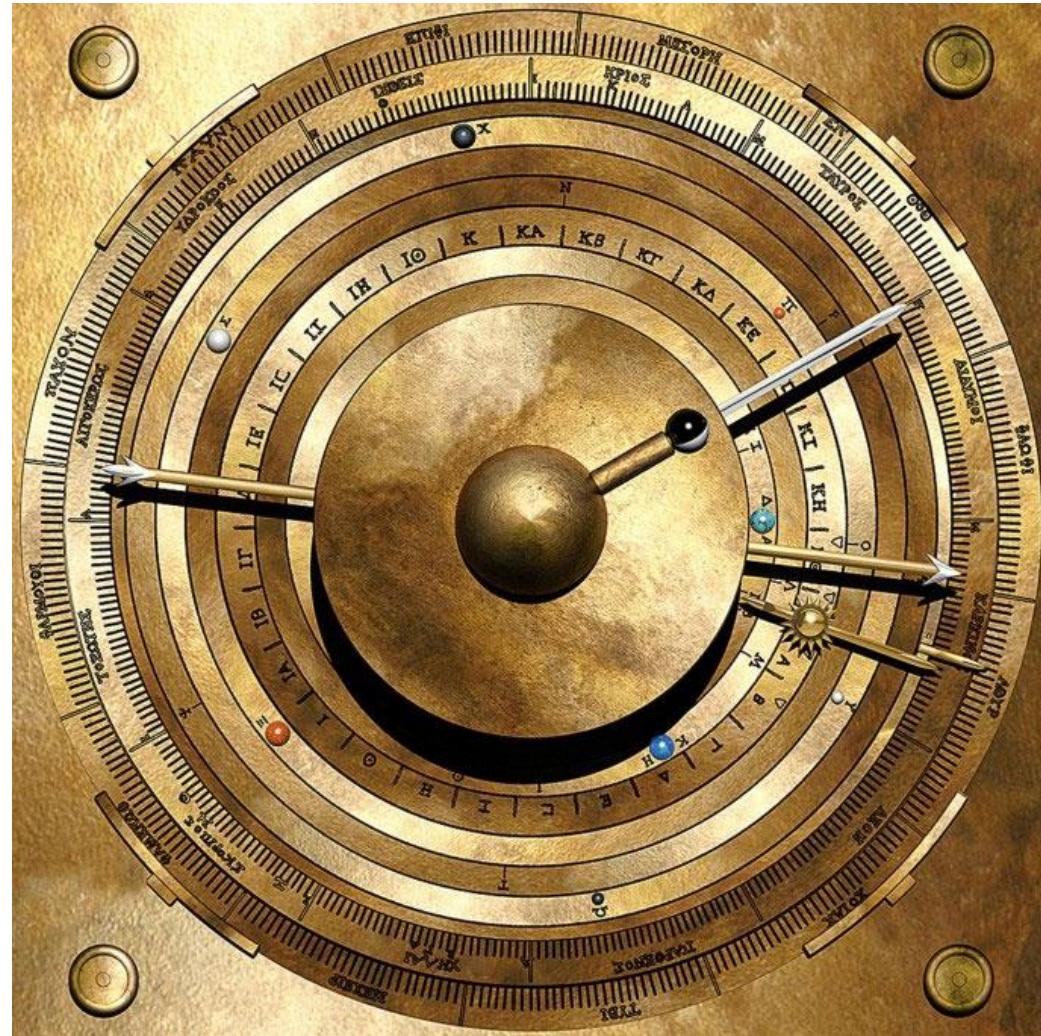
Ancient Analog Computer



<https://www.nature.com/articles/s41598-021-84310-w>

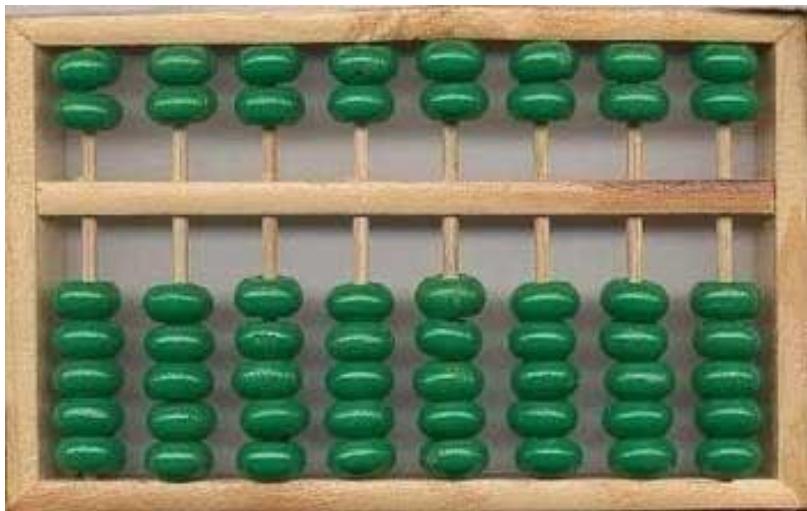
Ancient Analog Computer

"Computer model of the cosmos display. In the centre, the dome of the Earth, the phase of the Moon and its position in the Zodiac—then rings for *Mercury*, *Venus*, true *Sun*, *Mars*, *Jupiter*, *Saturn* and *Date*, with "little sphere" markers and smaller markers for oppositions. Scale marks and index letters for the synodic cycles of the planets are inscribed on the planet rings. Surrounding these, the *Zodiac* and the *Egyptian Calendar*. The true *Sun* ring has a "little golden sphere" with "pointer", as described in the BCI⁹. When the Moon and Sun pointers coincide, the Moon sphere shows black for New Moon; when the pointers are on opposite sides, the Moon sphere shows white for Full Moon."

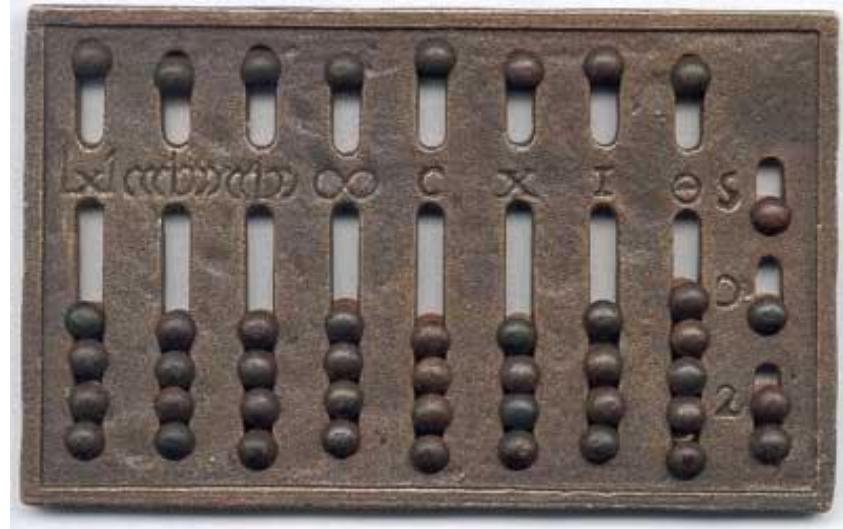


<https://www.nature.com/articles/s41598-021-84310-w>

Ancient Digital Counting Aids



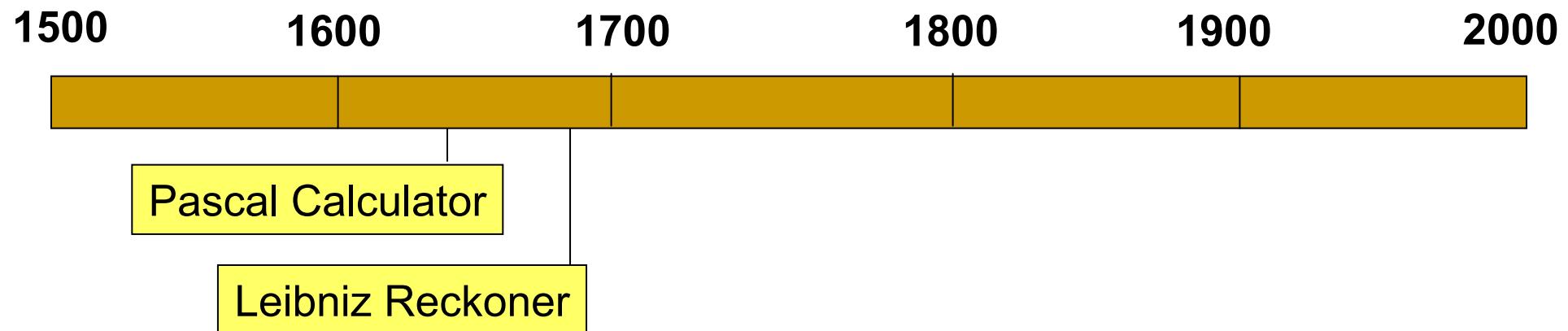
Chinese Abacus ~100 CE



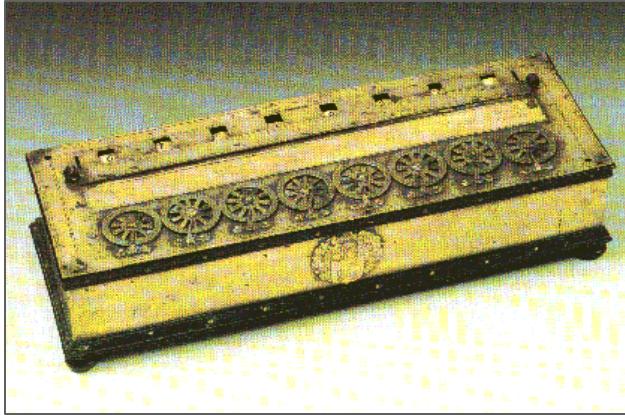
Roman Abacus ~100 CE

The abacus keeps a running count of numbers being added or subtracted; when the list is finished the total is immediately available, so a skilled abacus user is as fast as an electrical or mechanical calculator.

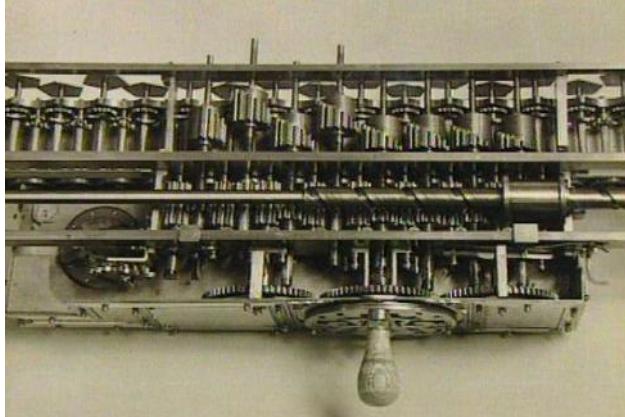
Digital Mechanical Calculators



Digital Mechanical Calculators

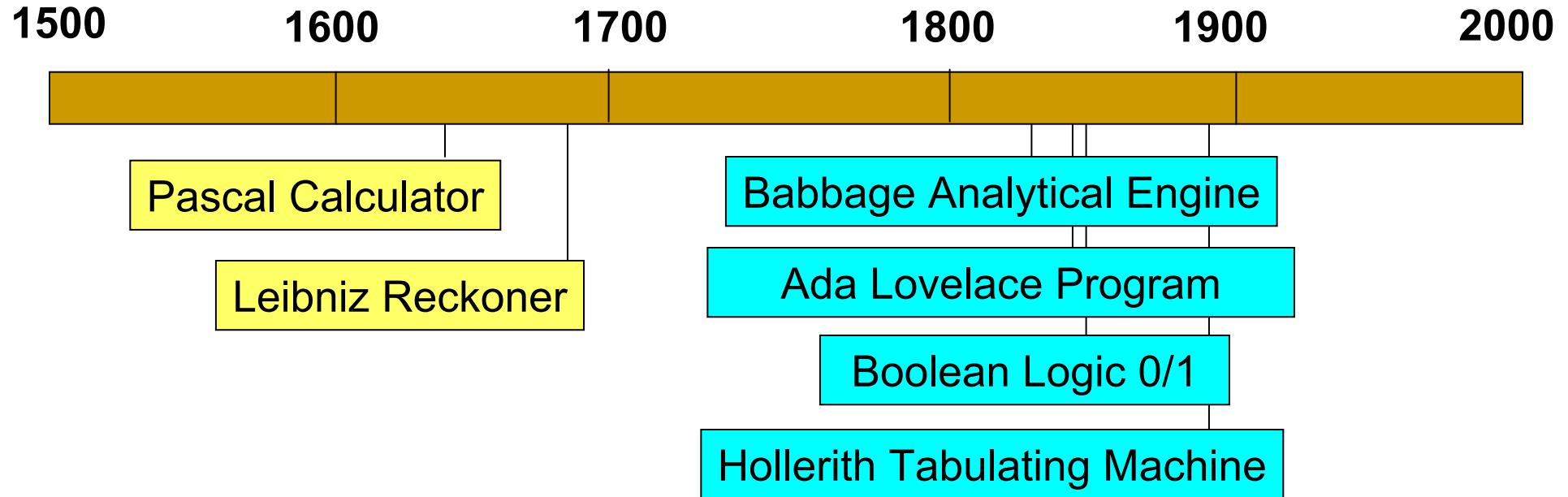


Blaise Pascal, a French mathematician, invented *the Pascaline calculator* in 1642. The device could add two decimal numbers. Pascal started production of his calculator and about 50 machines were produced, but there was no interest, so he had to stop.

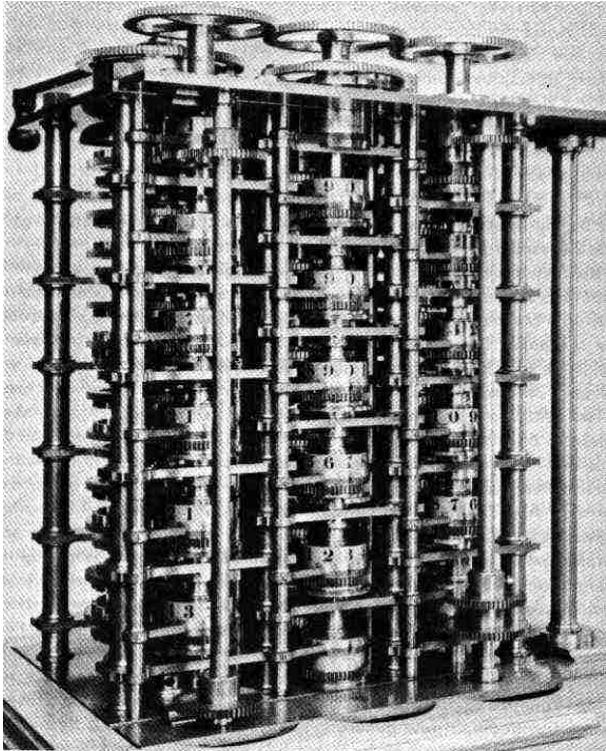


Gottfried Leibnitz, a German mathematician, produced *the Stepped Reckoner calculator* in 1673. It was more complex than Pascal's machine and could perform all four basic arithmetic functions.

Computer Concepts and Mechanisms

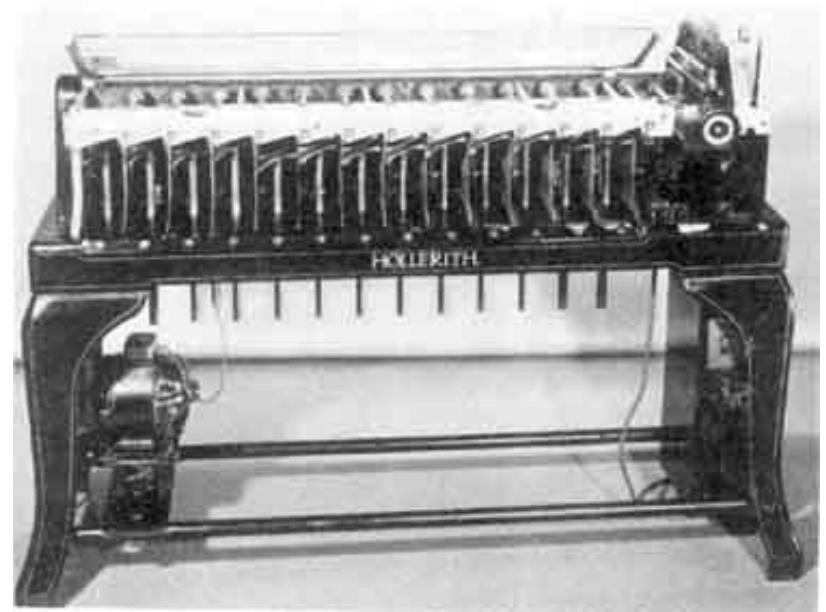


Computer Concepts and Mechanisms



Babbage Analytical Engine

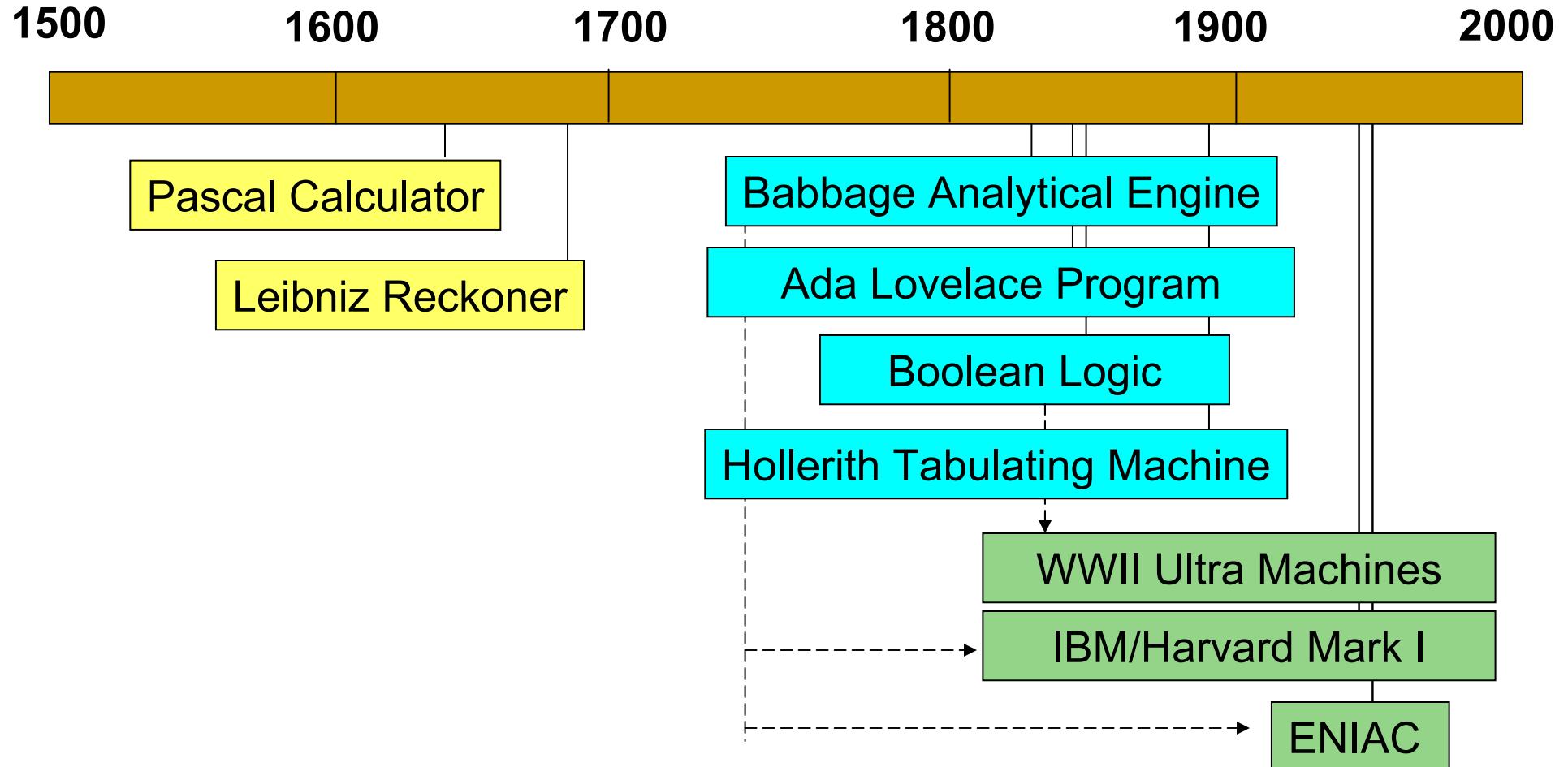
In the 1820s Charles Babbage built *Difference Engines* to compute tables of useful numbers using the difference method of polynomial approximation. A decade later he and Ada Lovelace proposed a novel machine featuring programmed inputs and printed output; they called it an *Analytical Engine* – but it was never fully completed.



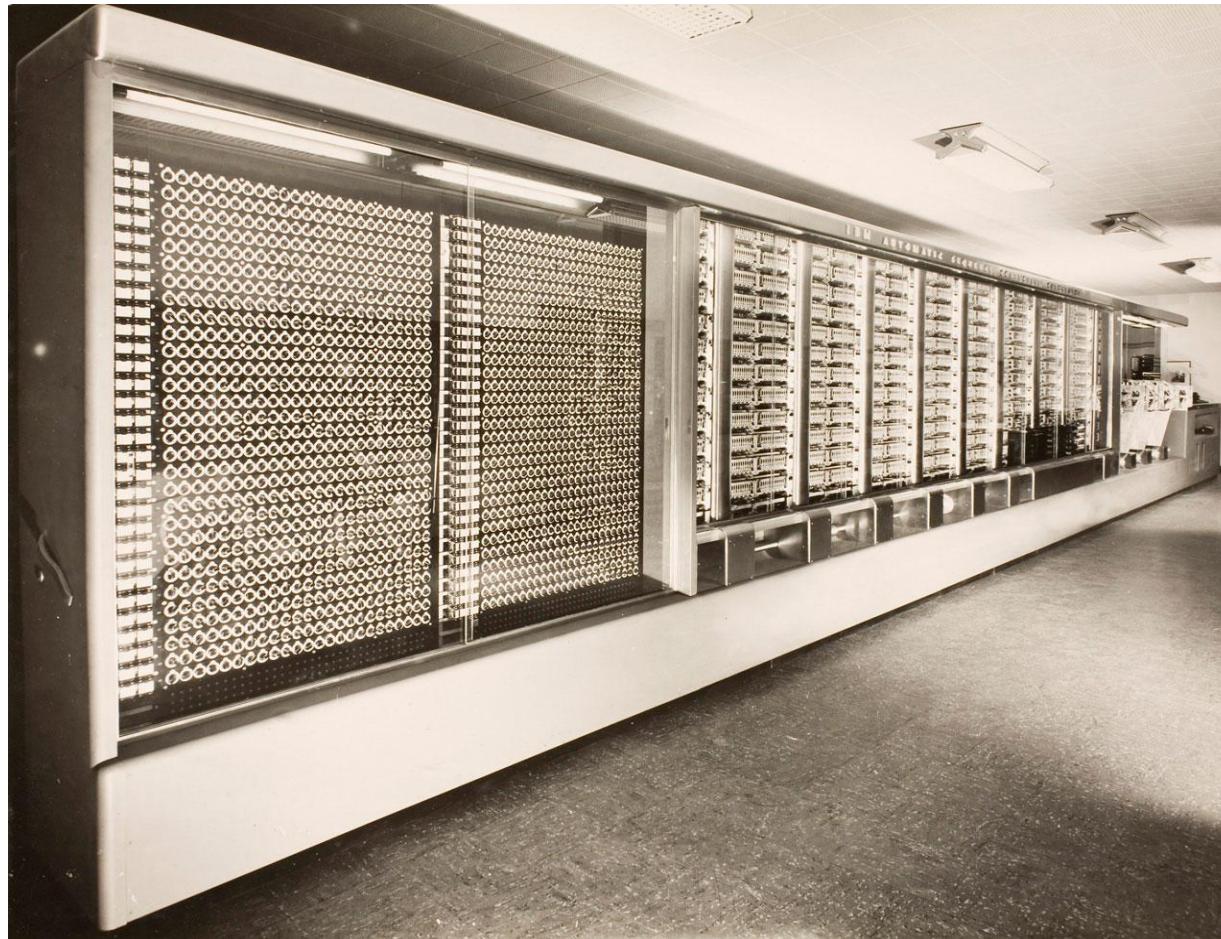
Hollerith Tabulating Machine

The Herman Hollerith punched card tabulator compiled the 1890 census in 6 months -- 9.5 years faster than the 1880 census – and led to formation of International Business Machines (IBM).

Real Computers



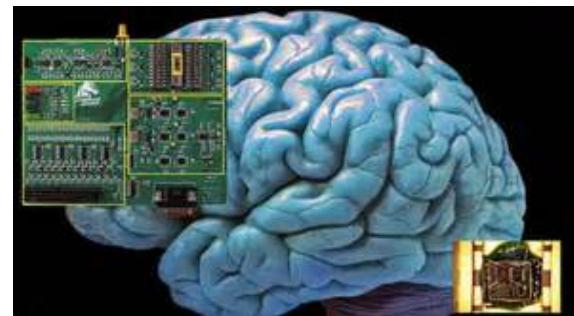
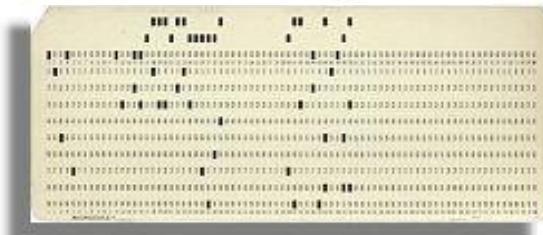
Early Electromechanical Computer



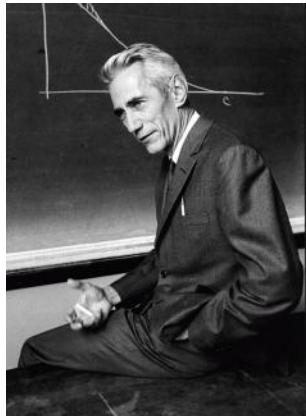
The Mark I was developed by IBM from a 1937 concept by Howard Aiken based on the Babbage Analytical Engine; it was delivered to Harvard in 1944 in time for use in WWII.

Modern Computing Stages

- Electromechanical
 - 1919-55 Desktop Tabulator
 - 1937-44 IBM/Harvard Mark I
- Vacuum Tubes
 - 1943-55 Colossus, ENIAC
 - 1955-60 IBM 704
- Transistor Semiconductors
 - 1959 IBM 7090
 - 1965 DEC PDP-8 Mini-Computer
- Integrated Circuits
 - 1968 DEC PDP-10 Mini-Computer
 - 1982-4 IBM - Apple PCs
 - 1993 Pentium™ Laptop
 - 2003 PowerMac™ G5
 - 2008 Intel Core™ 2 Duo
 - 2011 IBM z196, Intel Core i7 980x
 - 2014 IBM et al TrueNorth (5.4B)
 - 2020 - Continued extension



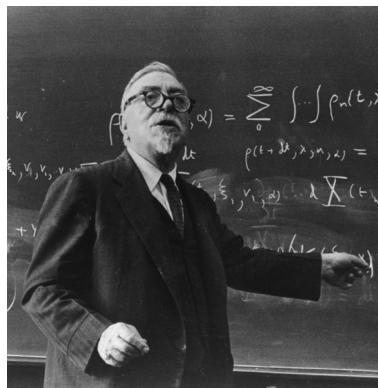
Pioneers of Information Theory



Claude Shannon, Bell Labs

“Claude Shannon defined the **quantity of information** produced by a source--for example, the quantity in a message--by a formula similar to the equation that defines thermodynamic entropy in physics. In 1948, at the very dawn of the information age, this digitizing of information of any sort was a revolutionary step. His 1948 paper may have been the **first to use the word "bit,"** short for binary digit.”

<https://www.scientificamerican.com/article/clause-e-shannon-founder/>



Norbert Wiener, MIT

“Norbert Wiener is considered the originator of **Cybernetics**, the science of communication as it relates to living things and machines, with implications for engineering, systems control, computer science, biology, neuroscience, philosophy, and the organization of society. Norbert Wiener is credited as being one of the first to theorize that all intelligent behavior was the result of feedback mechanisms, that could possibly be simulated by machines. **This was an important early step towards the development of modern artificial intelligence.**”

https://en.wikipedia.org/wiki/Norbert_Wiener

Shannon and Weiner provided the math and philosophy for the computer revolution

Early Configurations: The SAGE Computer

The SAGE network of computer systems was designed in the 1950's to detect and defend from incoming bombers. It became operational in the early 1960's and remained operational until the early 1980's.

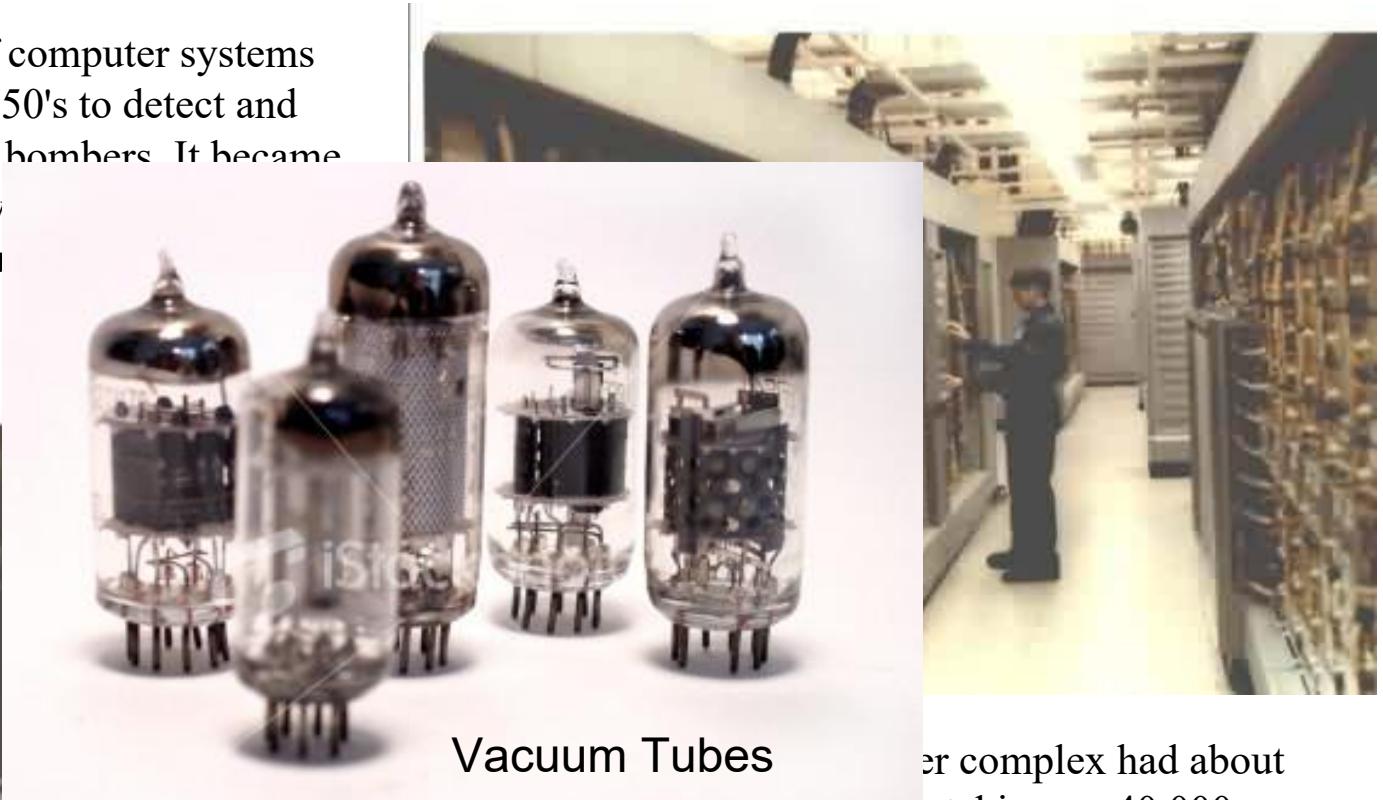


Each SAGE computer complex had about 50,000 vacuum tubes taking up 40,000 square feet and consuming *3 million watts of power*.

<http://www.thegalleryofoldiron.com/SAGE.HTM>

Early Configurations: The SAGE Computer

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Vacuum Tubes

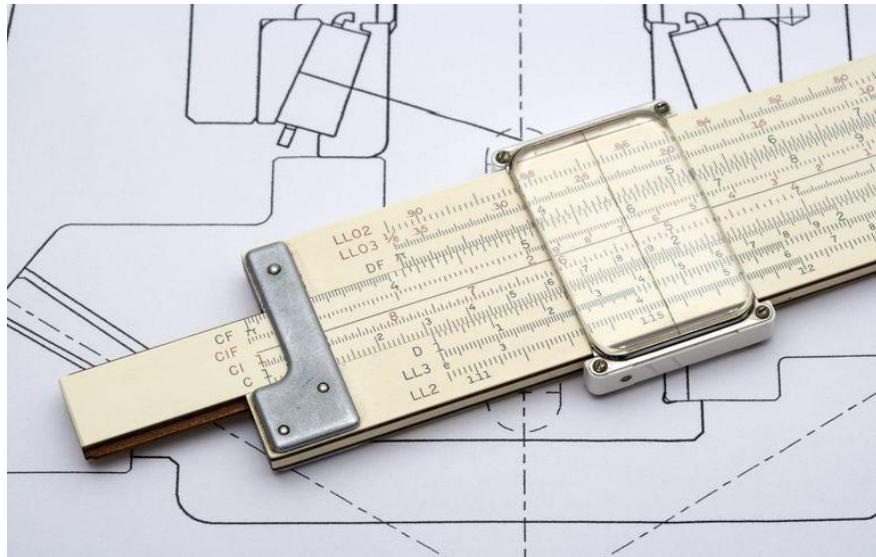
The SAGE computer complex had about 12,000 vacuum tubes taking up 40,000 square feet and consuming 3 million watts of power.

An Analog Throwback



Mechanical Differential Analyzer – Analog machine circa 1950s

20th Century Personal Assistants I

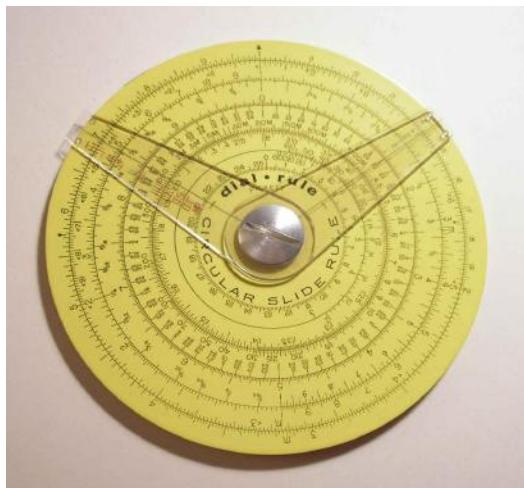


Ubiquitous Slide Rule

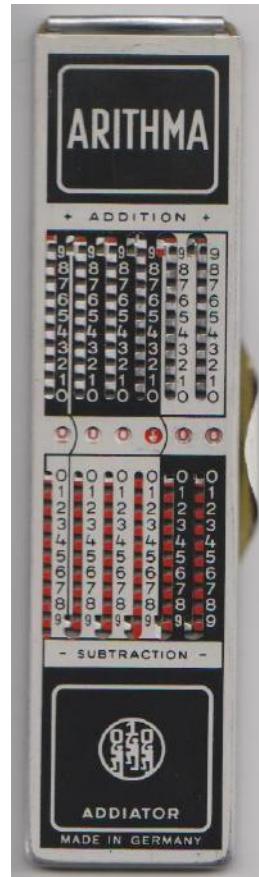


Stereotypical Engineer

20th Century Personnel Assistants II



Circular Slide Rule



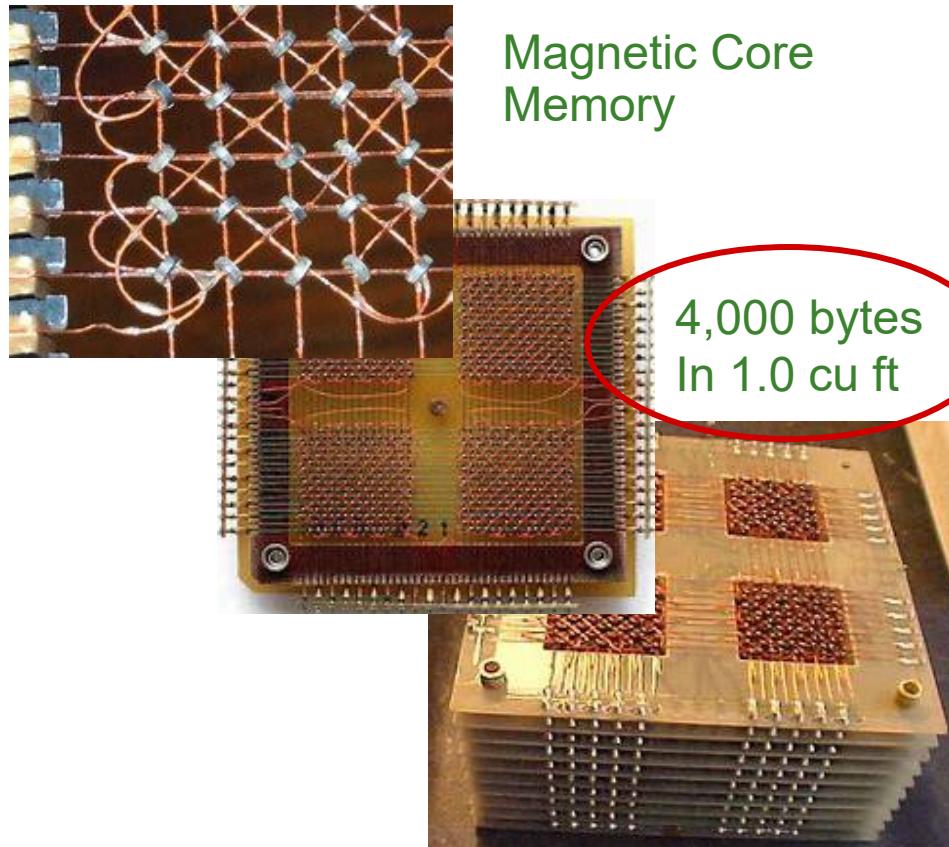
Pocket Calculator



Electronic Calculator

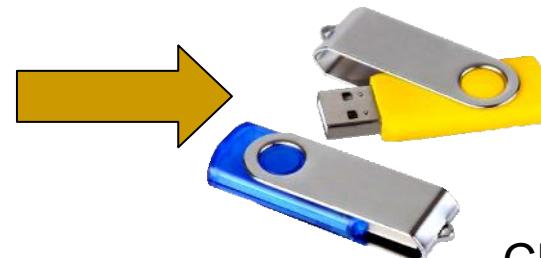
Digital Memory Evolution

In the 1950s



In the 2020s

256,000,000,000 bytes
In 0.0001 cu ft !!!



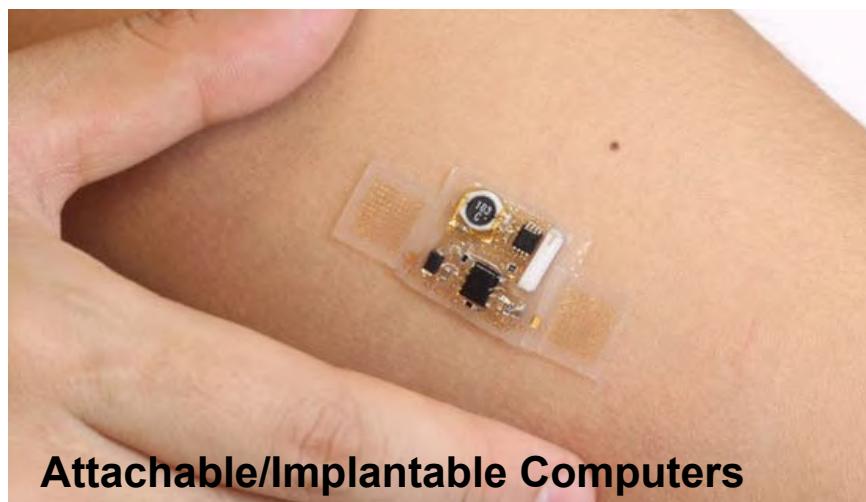
Today's Configurations



Mobile Computers



Embedded Computers



Attachable/Implantable Computers



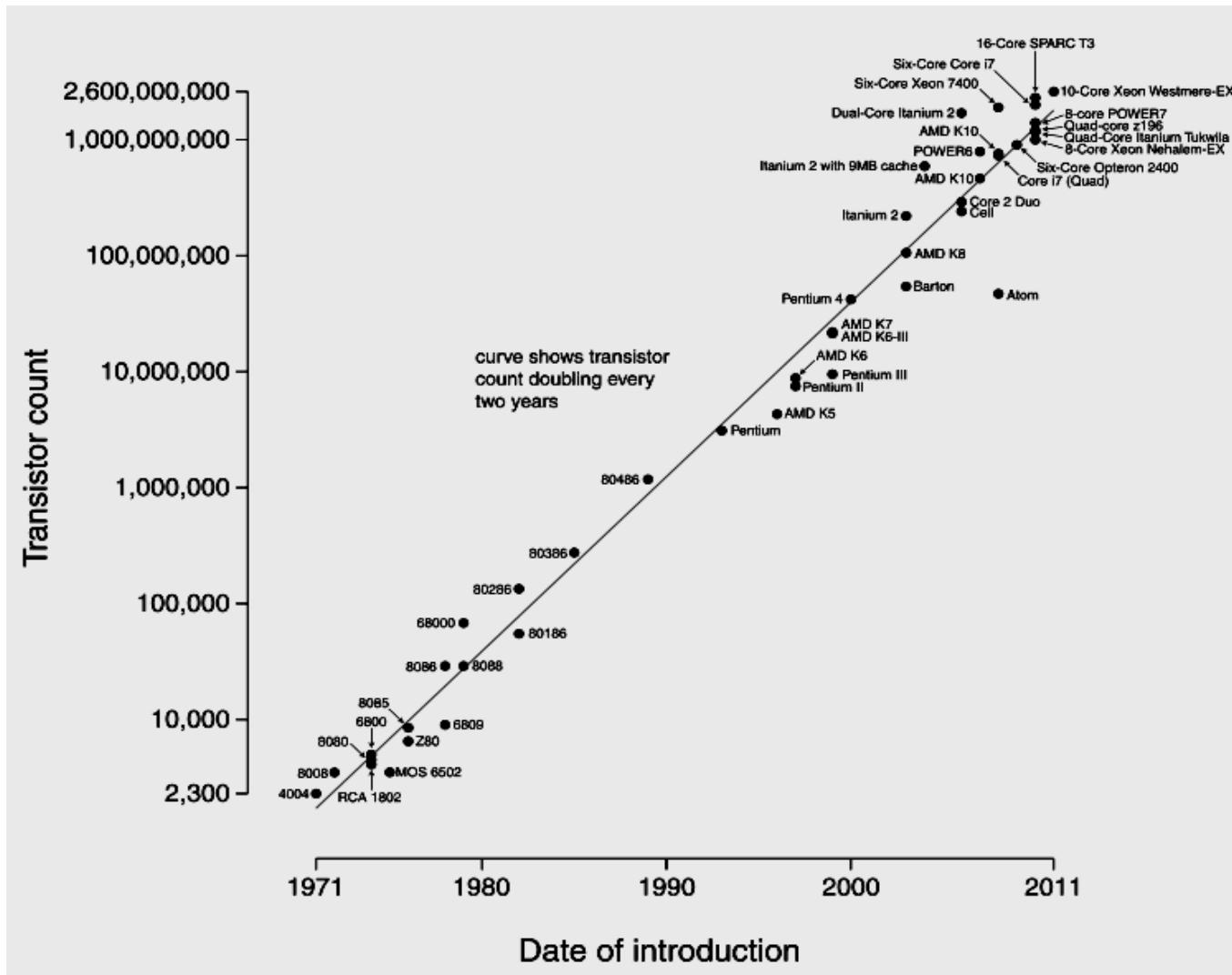
Wearable Computers

Laws of Computing Growth I

Moore's Law of Integrated Circuits

- Number of transistors on a chip doubles every 24 months
 - 1972 = 3,500
 - 1985 = 275,000
 - 1997 = 7,500,000
 - 2003 = 58,000,000
 - 2011 = 200,000,000,000
- Start: 1958
- Estimated end: ~2022

Moore's Law Illustrated



Laws of Computing Growth II

Moore's Law of Integrated Circuits

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 - 1972 = 3,500
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 - 1997 = 7,500,000
 - 2003 = 58,000,000
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- Estimated end: 2020

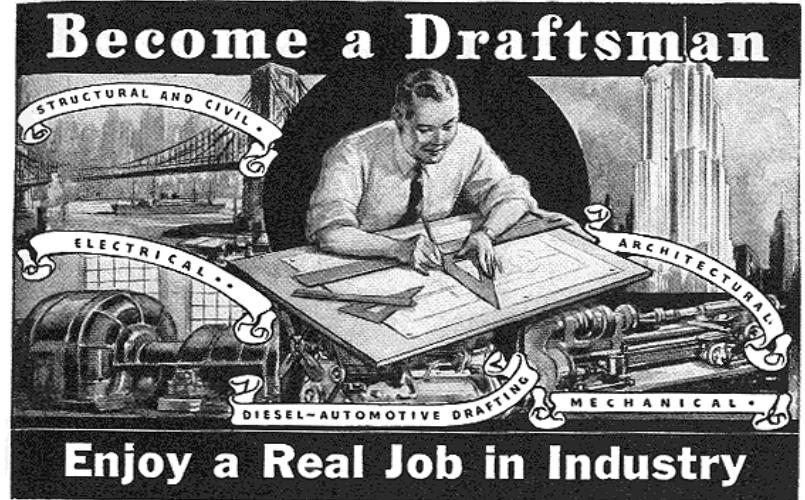
Kurzweil's Law of Accelerating Returns¹

- Computational technology is an evolutionary process and builds on its own progress.
- The time to accomplish a fixed technological objective gets exponentially shorter.
- There is no apparent limit to future increases in computational power.

¹From Ray Kurzweil "The Age of Spiritual Machines, Viking Penguin, 2000

Ethical Case 1: Simulation

- Scientific
 - Description and Prediction: Particle Physics, DNA, Weather, Economics, many other fields
- Industrial
 - CAD/CAM,
 - 3D Computer Graphics, Interactive Design
- Animation: Movies, Dynamics, etc.
- Training and Visualization
 - Augmented Computer Instruction
 - Virtual Simulation (e.g., SIMNET)
 - Demonstration and Exposition



Simulation: Oil Movement



Video provided by the National Center for Atmospheric Research (NCAR) during the Gulf of Mexico oil spill (with a warning that this was only a simulation)

Simulation: Flight Training

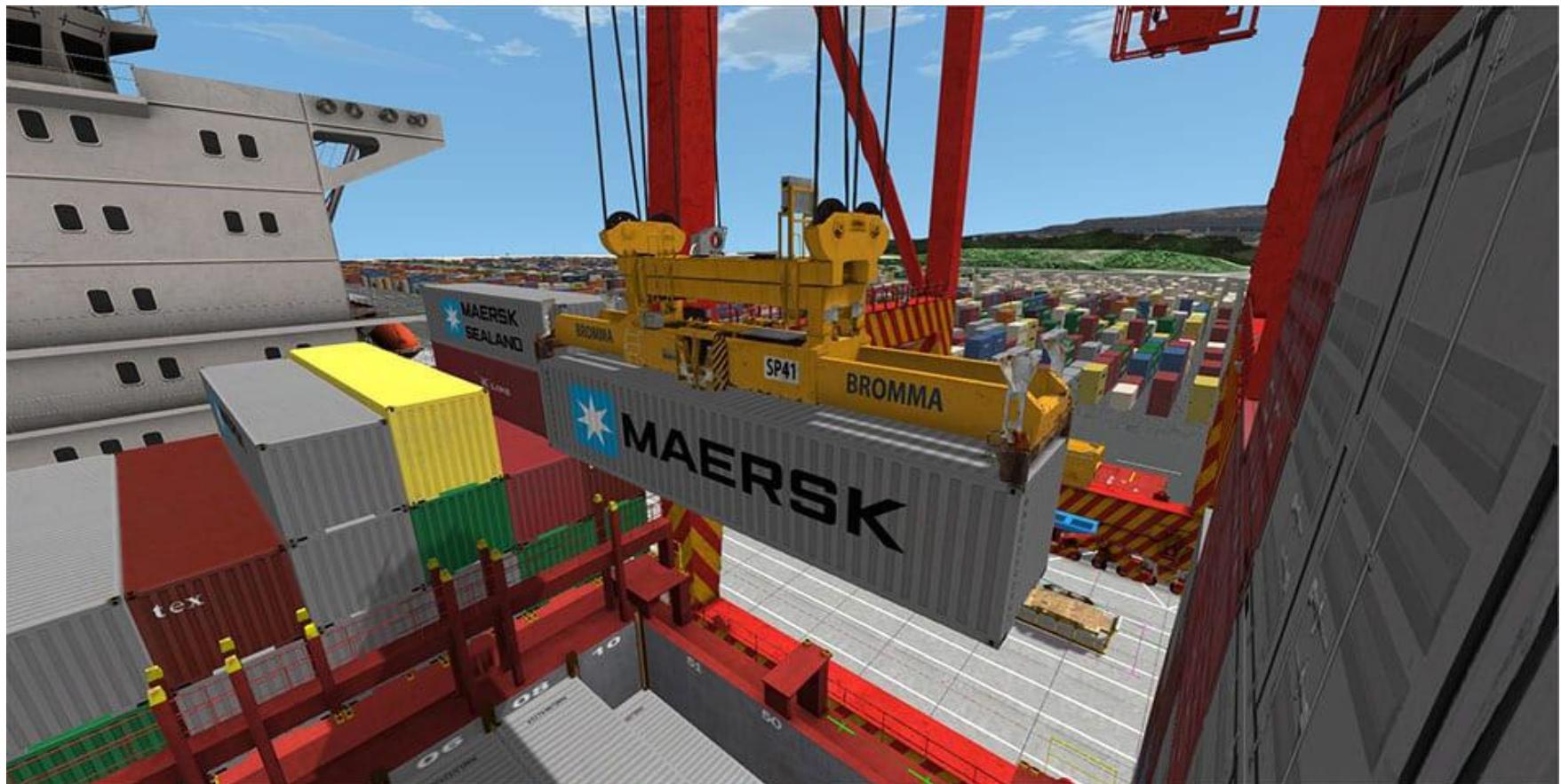


¹Evans and Sutherland, 2003

Simulation: Train Driving



Simulation: Crane Operation



Simulation: Surgery



Simulation: Digital Humans



DI-Guy™ is software for adding lifelike human characters to real-time simulations. DI-Guy lets the user add realistic human characters to real time simulations rapidly, reliably, and with minimum technical risk, while achieving high levels of visual realism and real-time performance.

DI-Guy™ images from Boston Dynamics, Inc., Cambridge, MA

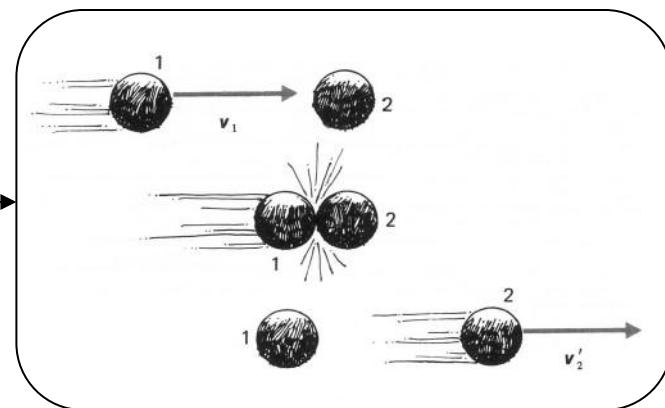
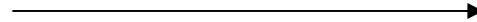
Simulation: The Virtual Battlefield



Close Combat Tactical Trainer (CCTT)

The Power of Visualization

$$m_1 V_1 = m_2 V_2$$



A Previous Observation...



Rene Magritte, 1929

...and Likewise



This is not a collision.

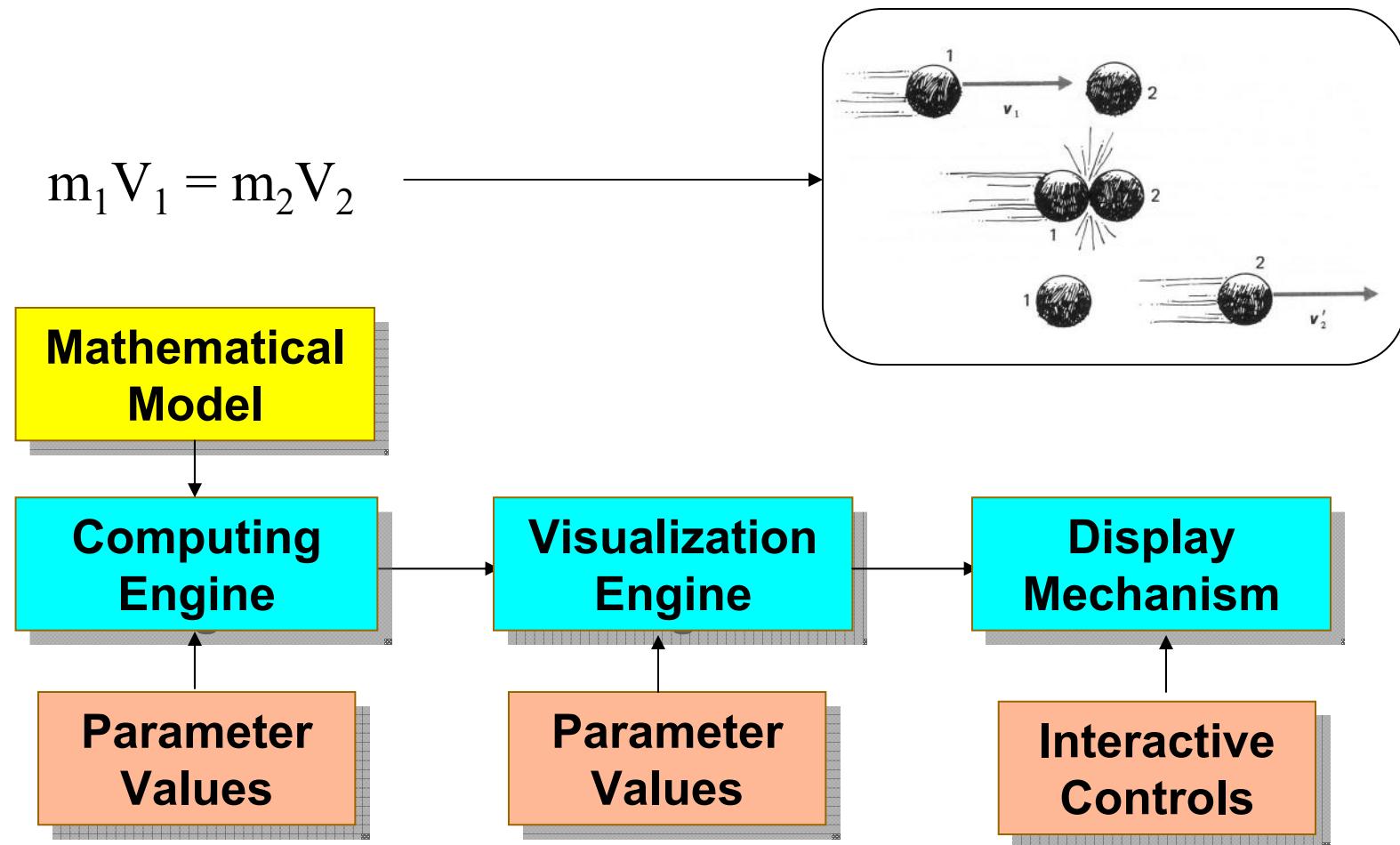
...and Likewise



Ethical Issues

- Major Issues of Modeling & Simulation
 - Believability
 - Transparency as well as Accuracy

Basis of Transparency: The System



Ethical Issues

- Major Issues of Modeling & Simulation
 - Believability
 - Transparency as well as Accuracy
 - Detection and Control of “Deep Fakes”

This is not Barack Obama



Computer scientists at the University of Washington analyzed millions of videos using a neural net to simulate how Obama's face moved as he talked .

<https://www.bing.com/videos/search?q=simulated+Obama&&view>

The Seriousness of Deep Fakes

Stanford Law School

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The Center for Internet and Society at Stanford Law School is a leader in the study of the law and policy around the Internet and other emerging technologies.

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DEEP FAKES: A LOOMING CHALLENGE FOR PRIVACY, DEMOCRACY, AND NATIONAL SECURITY

Author(s): Danielle Citron
Publication Type: Academic Writing
Publication Date: July 21, 2018

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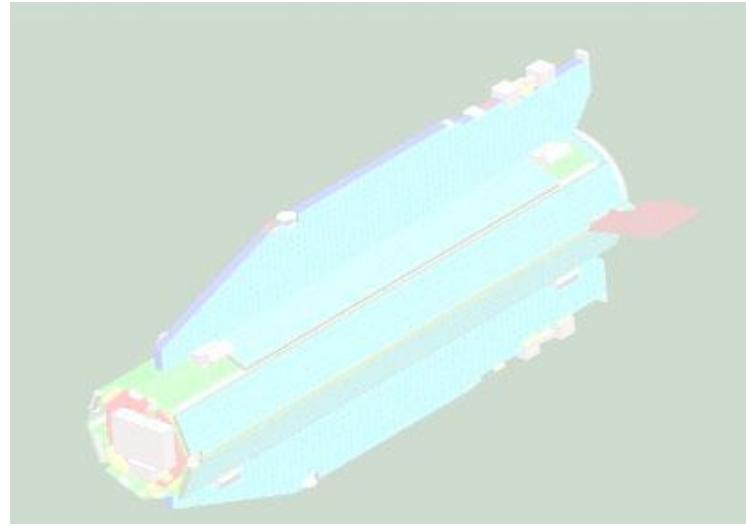
CALENDAR

Nov 16 Digital Switzerland's Berkley School of Information

Nov 16 Conference on Trade Secrets and Algorithmic Predictions

Ethical Case 2: Gaming

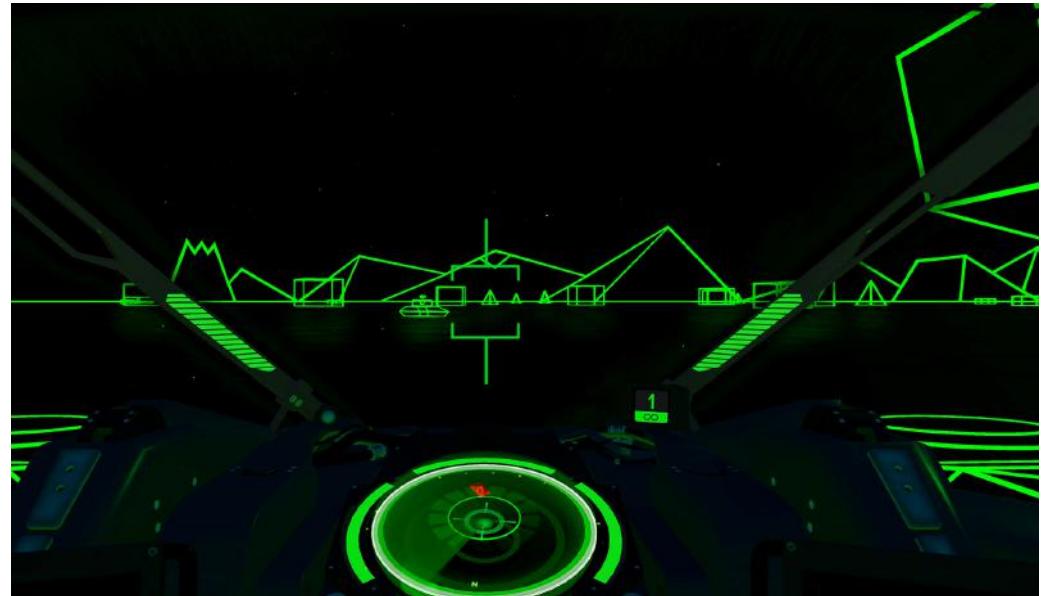
- Scientific
 - Description and Prediction: Particle Physics, DNA, Weather, Economics, many other fields
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- Animation: Movies, Dynamics, etc.
- Training and Visualization
 - Augmented Computer Instruction
 - Virtual Simulation (e.g., SIMNET)
 - Demonstration & Exposition
- Gaming & Entertainment
 - Single Player Shooter, Sports, etc.
 - MMOG to MMORPG
 - Virtual Communities



Gaming: Early Successes



'Pong' game console (1972)



'Battlezone' by Atari (1980)

Gaming: Exotic Environments



unrealtournament.com

Gaming: Virtual Worlds



Gaming: “Real-Life” Roles



Call of Duty WWII, Sledgehammer

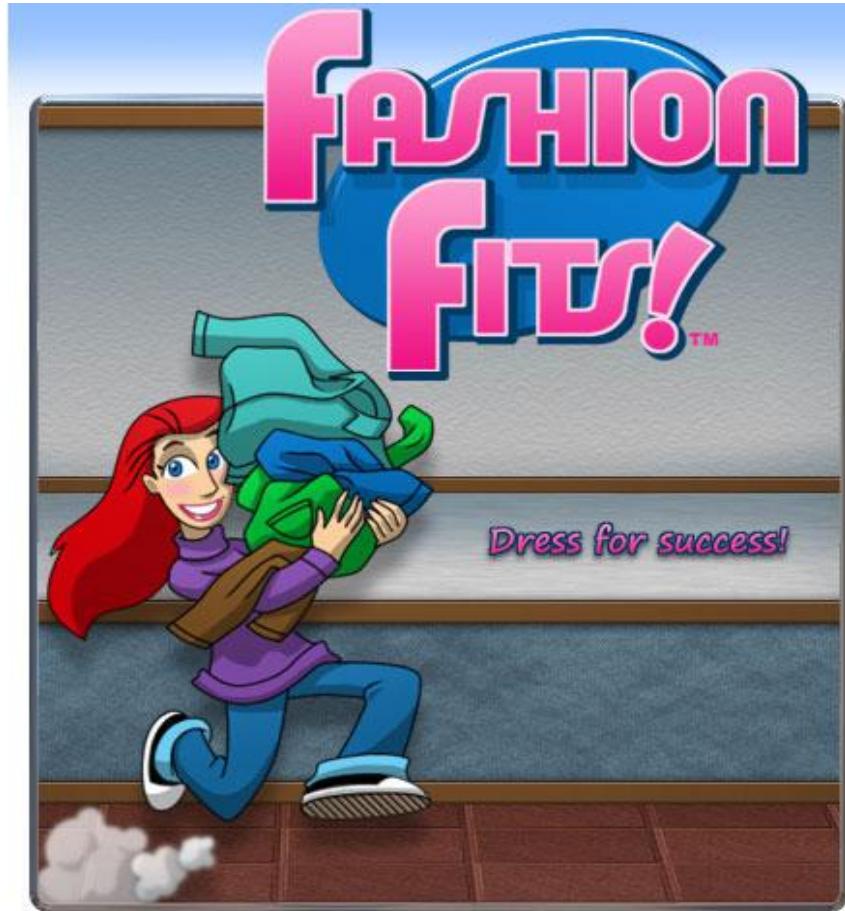


Grand Theft Auto, Rockstar Games

Gaming: “Real-Life” Roles



Fortnite Battle Royale, Epic Games



Fashion Fits!, Fugazo Games

Ethical Issues of Gaming

- Simulation
 - Believability of Simulation
 - Need for Accuracy and Transparency
 - Detection and Control of “Deep Fakes”
- Gaming and Role Playing
 - Promoting opposing life styles
 - Communal, cooperative and respectful
 - Antisocial, violent, misogynist and racist
 - Blurring societal distinctions
 - Legal and illegal actions
 - Ethical and unethical viewpoints
 - Normal and pathological behaviors
 - Learning *and practicing* real world behaviors
 - Positive and productive
 - Negative and destructive

If combat games are being used to train soldiers for war, can't violent role-playing games be training *at least some players* for anti-social action?

One Sample Case

YAHOO! NEWS

Norwegian killer used computer wargames to plan attack

 REUTERS By Walter Gibbs | Reuters - 5 hrs ago

OSLO (Reuters) - Norwegian anti-Islamic fanatic Anders Behring Breivik told a court on Thursday that he used computer games to prepare for his attacks, once spending an entire year isolated from society playing a game for hours on end.

Breivik, on trial for massacring 77 people last July, said he spent "lots of time" playing Modern Warfare, a first-person shooting game, and also took an entire year off to play World of Warcraft, a multi-player role-playing game with more than 10 million subscribers.

"I don't really like those games but it is good if you want to simulate for training purposes," Breivik said as he discussed Modern Warfare, smiling when asked about the aiming system.

Breivik killed eight people with a car bomb in Oslo on July 22 and then killed 69, mostly teenagers, at a Labour Party summer youth camp on Utoeya island, in a gun massacre.

Although he pleaded not guilty, he admitted the killings, saying his victims were traitors who supported immigration and multiculturalism, threatening Norwegian ethnic purity.

Breivik, who once played Modern Warfare 17-hours straight on New Year's Eve 2010/2011, said he used such games to simulate the police response and the best escape strategy.



Ethical Issues Become a Legal Issues

Court hears arguments on violent video games

AP Associated Press



Buzz up! 31 votes

Share 181

retweet 11

Email

Print

By JESSE J. HOLLAND, Associated Press – 59 mins ago



AP – In this image released by Rockstar Games, a scene is shown from 'Grand Theft Auto V: The Lost and Damned,' ...

WASHINGTON – The Supreme Court on Tuesday expressed sympathy for a California law that aims to keep children from buying ultra-violent video games in which players maim, kill or sexually assault images of people.

But justices seemed closely split on whether the restrictions are constitutional.

to animals earlier this year.

The high court has been reluctant to carve out exceptions to the First Amendment, striking down a ban on videos showing graphic violence

California officials argue that they should be allowed to limit minors' ability to pick up violent video games on their own at retailers because of the purported damage they cause to the mental development of children.

Some justices appeared to agree.

"We do not have a tradition in this country of telling children they should watch people actively hitting schoolgirls over the head with a shovel so they'll beg with mercy, being merciless and decapitating them, shooting people in the leg so they fall down," Chief Justice John Roberts said.

Roberts decried that one game lets a player "pour gasoline over them, set them on fire and urinate on them." "We protect children from that," he said. "We don't actively expose them to that."

Courts have usually acted against restraint of games, citing the 1st Amendment.

be able to buy the games for their children, but retailers who sell directly to minors would face fines of up to \$1,000 for each game sold.

The Gamer Community Defends Violence

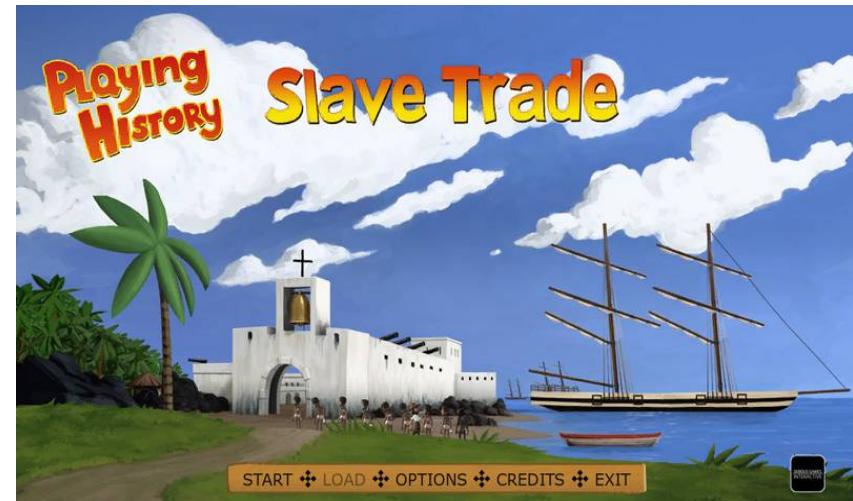


Gamers started Gamergate to defend their right to engage in violent games, even those that emphasize sexism and violence against women, but parts of the community fought back against this use of free speech principles.

Even Serious Games Can Have Problems

In the interest of making learning fun, the “Playing History 2 -Slave Trade” game by Danish company Serious Games rewarded players for:

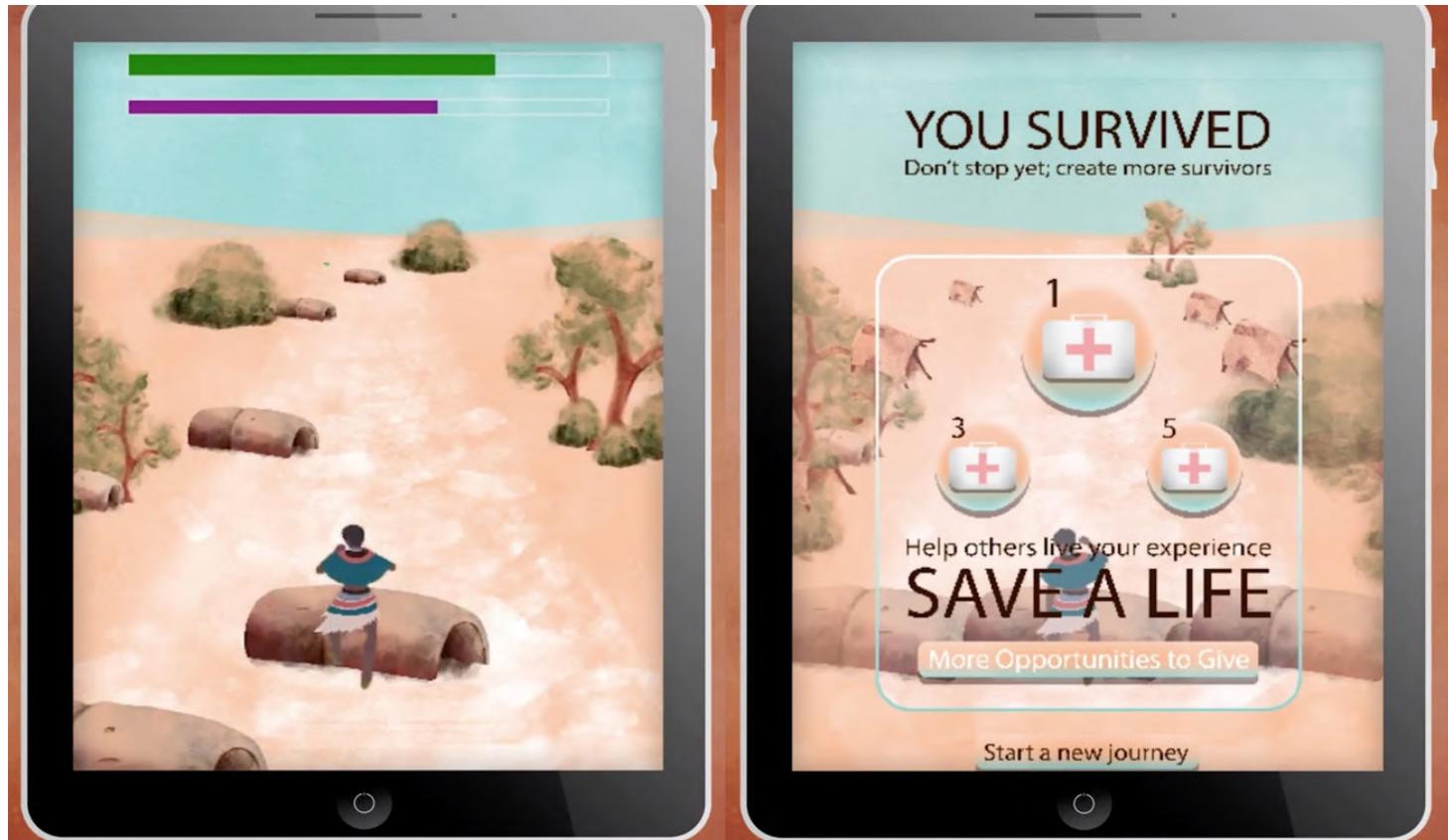
- Following “master’s” orders
- Negotiating for slaves
- Buying slaves at low cost
- Stacking slaves efficiently in ship
- Sailing quickly to ship’s destination
- Finding delicacies for the crew
- Selling slaves at a profit



Supplemental readings and a partial “happy ending escape” helped the case, but the player was still left with a skewed, “white centric” view of the slave trade. To its credit, the company responded to the criticism and redesigned the game.

Dexter Thomas, “It’s a lesson in how not to teach,” Los Angeles Times, September 7, 2015

A Serious Game Done Right



Salaam, a video game developed by Lual Mayen, a refugee from South Sudan, let players gather resources like food and medicine while running away from violence. A portion of the income went to aid actual refugees.

A Rating Process

The screenshot shows a web browser window displaying the ESRB website at <https://www.esrb.org/ratings-guide/>. The page title is "Rating Categories". The main content area features four large rating categories: "EVERYONE" (E), "EVERYONE 10+" (E 10+), "TEEN" (T), and "MATURE 17+" (M). Each category is represented by a black and white logo with the rating letter in a large font and "ESRB" below it. To the right of the logos is a "SHARE" button with icons for Facebook, Twitter, LinkedIn, and Email. At the bottom of the page are navigation arrows for "PREVIOUS" and "NEXT". The browser's address bar shows the URL, and the taskbar at the bottom includes icons for Start, File Explorer, Edge, Google Chrome, File Manager, Task View, and Internet Explorer.

<https://www.esrb.org/ratings-guide/>

A Request for More Detailed Ratings

OP-ED

The fallacy of ‘educational’ video games

BEFORE THE PANDEMIC, the average American child between 8 and 18 played video games for an hour and 20 minutes a day, and if my kids are representative, that figure skyrocketed this past year. Like many parents, I gave in to increased gaming time but gravely told my children they should choose educational games.

Unlike many parents, I knew my rule made no sense. I study learning for a living, and it’s usually impossible to know what, if anything, kids will learn from a video game based on a simple description of it. Gaming companies should tell us, and while that may sound like the fox guarding the henhouse, there is a model that could make it work.

The Entertainment Software Rating Board rates games for objectionable content like sex and violence. That’s helpful, but it should be as easy for parents to guide their kids toward enriching games as it is to shield them from unacceptable ones. A similar board should rate educational content.

Here’s why parents need help. Most educational games don’t simply teach academic content (like math or history) and test kids to be sure they’ve got it. Kids learn from such games, but they can be boring, like a worksheet with animated characters. They’re derided in the industry as “chocolate-covered broccoli.”

To make them fun, game creators either make the content less academic (and claim education will still benefit) or remove the tests (and claim kids will still learn). But the effect of either change on learning is unpredictable.

It’s nearly impossible to tell what a child will learn from playing a game, so establish a ratings system to address that

By Daniel T. Willingham

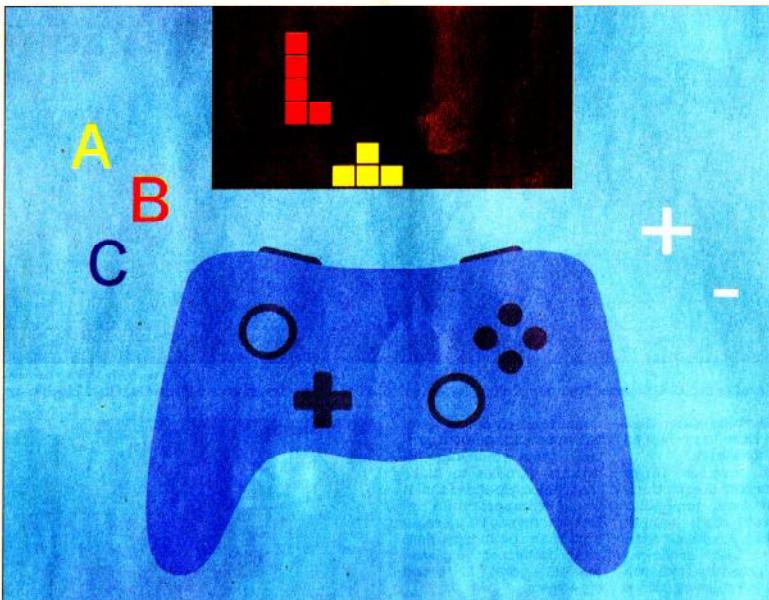


Illustration by NICOLE VAS Los Angeles Times

reviewers laud the educational value, but the laws of physics are so unintuitive, it’s more likely gamers play by trial and error. And predictably, some players actually relish crashes.

A game description is not enough to tell parents what, if anything, their child will learn. Someone who understands cognition needs to evaluate gameplay. The video gaming industry could arrange for that.

An obvious concern is that the industry will deem every game educational, even if learning is limited to “increased thumb dexterity.” But the Entertainment Software Rating Board, which has rated games for objectionable content since 1994, has avoided bias and earned praise from the Federal Trade Commission.

An industry lobbying group created and oversees the board, but it remains independent. Game makers submit a detailed description of a new game, which is then evaluated by three professional raters. The board offers an overall age recommendation and information about the presence of objectionable content in 30 specific categories, for example “alcohol reference” and “crude humor.”

Experts in learning could create ratings for educational content. The categories would tell parents the topics their child might learn about, including whether the learning is likely to transfer beyond the game. The rating would assess the likelihood that learning should actually happen, based on an analysis of gameplay.

This information could be added to parental controls that are already integrated into mainstream

The writer says that games should be rated for their educational value, but doesn’t suggest rating them for ethical value as well – not an unusual omission.

Los Angeles Times, May 11, 2021

Game Players' Ethics and Morality

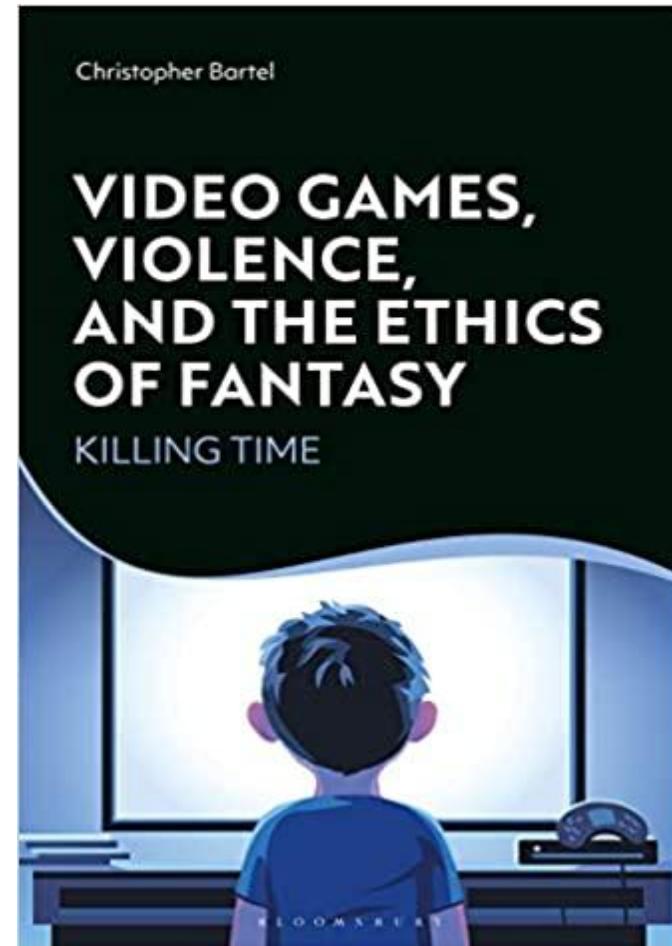
Christopher Bartel, Professor of Philosophy and Religion at Appalachian State University, asks:

"Should players worry about the morality of their virtual actions when playing video games that allow them to commit numerous violent and immoral acts like sexual assault, theft, and murder."

Issues include:

- Absence of actual harm
- Morality of violent fantasizing
- Motivations
- Repercussions

If there is moral harm in playing violent games, are developers the immoral "enablers?"



Game Developers' Ethical Code I



Guiding Principles

- Community
- Professionalism
- Expression
- Innovation
- Leadership
- Impact
- Fun

Game Developers' Ethical Code II



Guiding Principles

- Community
- Professionalism
- Expression
 - Games are like art, other media
- Innovation
- Leadership
- Impact
- Fun

Game Developers' Ethical Code



Guiding Principles

- Community
- Professionalism
- Expression
 - Games are like art, other media
- Innovation
- Leadership
- Impact
 - Learning, creativity, innovation
- Fun

Game Developers' Ethical Code III



Developers' Ethics

- Equal Access and Opportunity
- Give Respect and Credit
- Present Self Accurately
- Respect IP Rights
- Promote Fair Ownership Rights
- Honor Legal Agreements
- Use Computer Tech Properly
- Cooperate with Ratings Boards
- Share Knowledge
- Promote Public Knowledge
- Promote this Code of Ethics

No statement regarding *violence, misogyny, racism, ethics* in game contents!

Ethical Take-Away

- Simulation -based games are a big and rapidly growing \$220B industry today, almost 3x the size of the \$77B movie industry.
- Games can be valuable educational tools as well as compelling entertainment.
- They can also teach bad ethics as well as good ethics, sometimes inadvertently.
- *What's in a game reflects individual decisions and individual actions!*
- *Game designers and producers need to consider carefully what ethical positions they want to advance, and to ensure that their games actually do so.*

Our hope is that simulation-based games will enhance society, not devalue it!