Computers and Society

CSE 351 Spring 2024

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"We've trained the AI art generator so well that it now feels too insecure about its work to make any art."

Playlist: CSE 351 24Sp Lecture Tunes!

Announcements, Remnders

- HW24/25 due tonight by 11:59 PM
- Lab 5 due May 31st
  - Hard deadline, no use of late days!
- Final Exam Review: May 31st, next Friday; be there for special treat 🍪
- Gigi visits campus on June 3rd 1:30 – 3:30 PM Somewhere around Drumheller Fountain!
- **Final Exam:** Take-home June 3rd through 5th
  - Similar structure to Midterm
  - Same rules on collaboration apply: discuss at high level of abstraction, but no working together

Disclaimers

- This is a big and nuanced topic
  - Could fill whole courses with this type of content
    - *e.g.*, CSE480: Computer Ethics Seminar
  - Our hope is to expand your viewpoints about computers (and computing), but please think critically about the information and come to your own conclusions

- This lecture is a work-in-progress
  - There is a lot more I wish I could cram in here. Oh my god, so much.
  - It has a narrative that a group of people designed, therefore it is inevitably imbued with values and beliefs and experiences of those people

Pre-Quarter Survey Quotes

- Note that I will be interspersing some quotes from the pre-quarter survey, where one of your prompts was:

What is your current impression of computers?

  - These will be included without attribution for privacy
  - The point is not to call anyone out or to pass judgment, but to validate some of the points being made today as well as recognize that society shapes our views and values

Computers and Society

- **How We View Computers**
- Brief History of Computers
  - Augmentation and automation
  - Who are computers built for?
- The Cost of Computers
  - Costs of production
  - The technology cycle

How We View Computers

- Pre-Quarter Survey Top responses: useful, fascinating/cool, powerful, and complex
  - Based on personal usage, media, and coursework

- Personal views vary, but many trend towards utopian, essential, and mysterious
  - Easier to see the positives; that's how they're marketed, after all
  - Please remember that bias exists!

Pre-Quarter Survey Quotes (Idealistic)

- Personal views vary, but many trend towards **idealistic**, essential, and mysterious

> I think computers are pretty amazing! **Using them right can help us create a better quality of life**. I've seen my mom work on projects that merged computer science with ongoing world problems, and I aspire to work on projects like that too.

> The applications of computers are fascinating and **in my opinion make the world a better place**. My impressions are based on the impact they've had on society, the job opportunities, and the ever advancing research in AI.

> My current impression of computers is that **they are tools to help better the world** and tools that contain a lot of resources to better ourselves and our environment.

Pre-Quarter Survey Quotes (Essential)

- Personal views vary, but many trend towards idealistic, **essential**, and mysterious

> I think computers are an incredibly powerful tool that **are central to our society nowadays**.

> Computers run the world, even in our pockets **they are essential for human progression**.

> **They're everywhere and really important to society**, as we all use computers everyday.

> They are very **useful and powerful tools and I need mine** to go about my daily life.

Pre-Quarter Survey Quotes (Mysterious)

- Personal views vary, but many trend towards utopian, essential, and **mysterious**

> I think my current impression is that **it really is magic** and very interesting how it is something created with metal and code that we can interact with and do so much with.

> **Feels like a box of mysteries**; although a little less so with every CS course I take.

> **I think computers and how they work are mysterious** in a way and exceeding my current understanding of things.

> It's **kind of a black box that just does stuff when I ask it too** (sic) [I] guess. [T]hey are pretty cool though.

Computers as Tools

- **"We shape our buildings and afterwards our buildings shape us."** – Winston Churchill in a 1943 speech

Extremely powerful tools limited predominantly by our own capabilities with wielding them. I've used computers pretty extensively for most of my life, and I feel I've still only scratched the surface of what they can do. Fundamentally they're just literal computers—calculators, but the functionality that rises out of that is incredible.

A **powerful computing tool** (e.g. running simulation for scientific computation and training a neural network), a platform for many emerging technologies (AI), an entertainment device (e.g. playing computer games and watching videos), and an everyday necessity (I don't think I can live without my laptop).

Amazing tools and amusement [source] for lazy people like me. [I] Just think computers make life easier but **[I] have little impression about what life was like without computers**.

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The First Computers

- **Computer**: a person who computes
  - Doing calculations by hand quickly for aeronautics, warfare, science, etc.

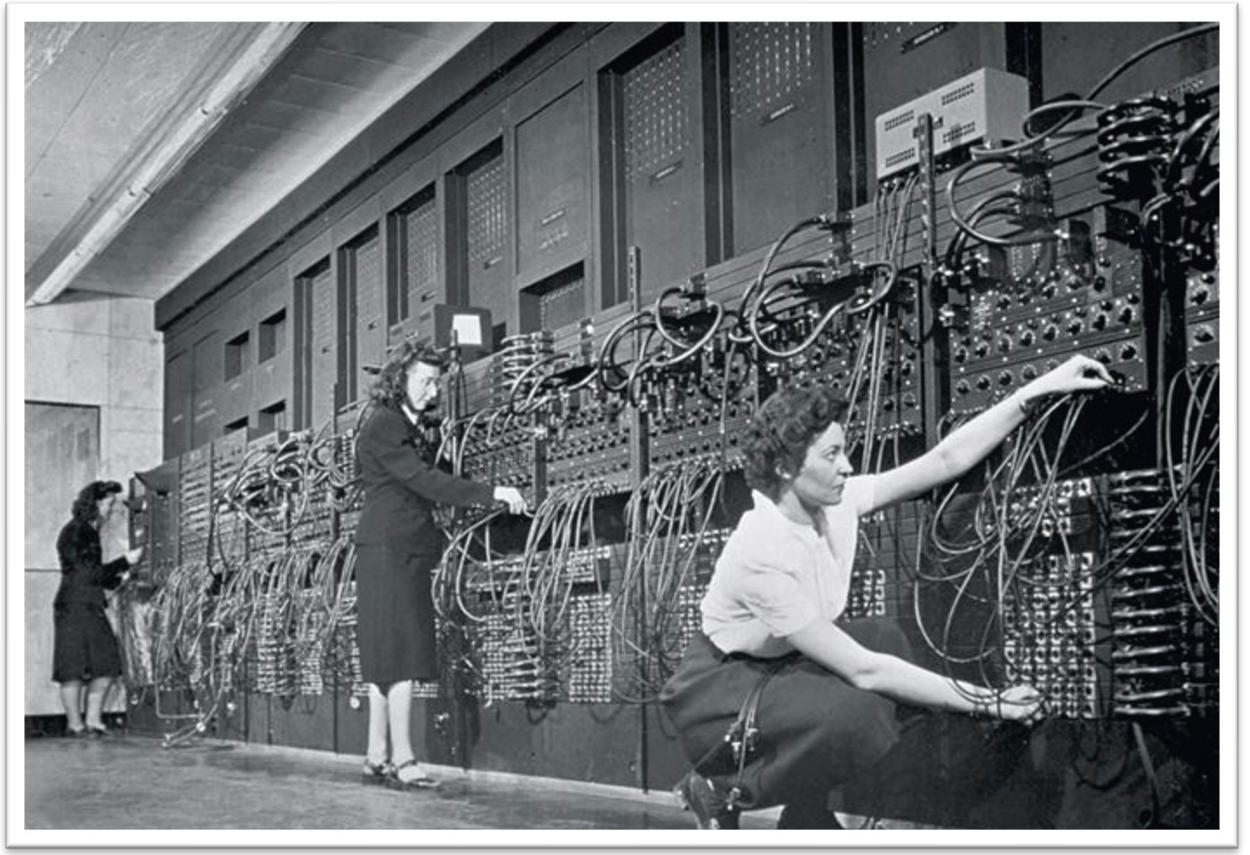
The women of Bletchley Park, Credit: BBC

Human Computers at NACA, Credit: NASA

Human Computers at JPL, Credit: JPL

Historical Programming (1940's)

- Manual plugboard wiring to connect arithmetic machines:

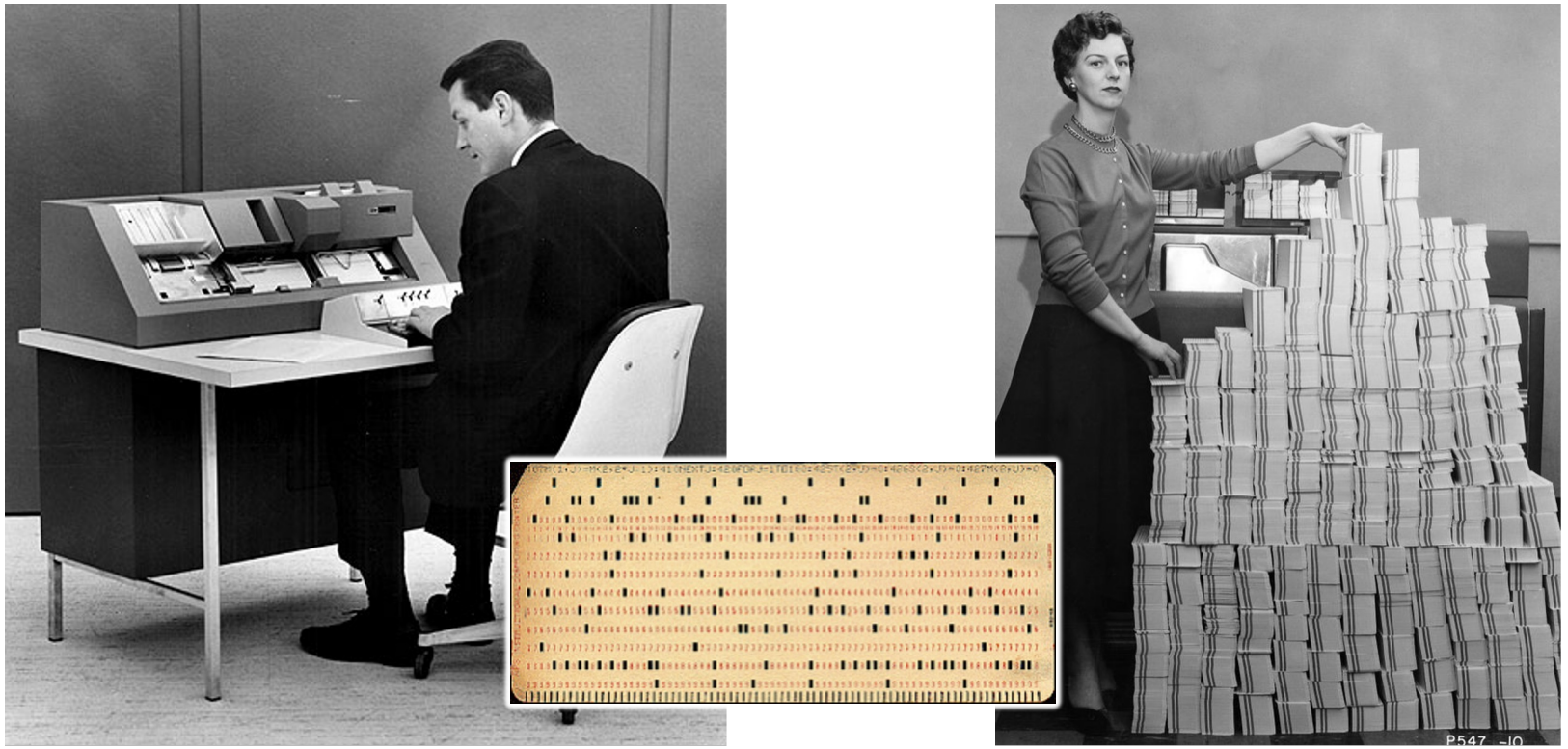


Jean Jennings (left), Marlyn Wescoff (center), and Ruth Lichterman program ENIAC at the University of Pennsylvania, circa 1946.

Photo: Corbis http://fortune.com/2014/09/18/walter-isaacson-the-women-of-eniac/

Historical Programming (1940's-1970's)

- Programming via punch cards
  - Idea taken from automated looms and data processing



Historical Programming (1940's-1970's)

- Human computer operators manage program queue
  - Precursor to operating systems!

Historical Programming (1970's)

- Magnetic tape replaced punch cards, operating systems could run more than one program
  - Programming by typing into a machine now:

Historical Legacy of Computers

- Computers **augment** the abilities of humans
  - Makes the labor of boring, repetitive work more widely available
  - Highly valued, but generally exclusively available
- Computers **automate** the boring, repetitive work
  - Culturally, we are conditioned to believe that such work should be automated
  - Has consistently led to job elimination
    - *e.g.*, ENIAC's calculation speed could displace 2,400 human computers
- Both narratives are simultaneously true, even today!
  - Underlying goal is **efficiency of labor** (usually for profit)
  - Take CSE480: Computer Ethics Seminar & CSE478: Autonomous Robotics for more

Historical Legacy of Computers

- And so AI is here…
  - Effects to the economy & job market:
    - Elimination of customer service jobs, especially in developing nations
    - Not just affecting "blue collar" jobs, but high-paying ones too
    - Creative jobs too? Depends on whom you ask

Quick Discussion

- What jobs have you heard about that might be in imminent danger of automation? Who tends to hold these jobs?

- What are some of the consequences if there are no more "low skill" (*i.e.*, boring, repetitive) jobs for humans?

Who Are Computers Built For?

- New computers tend to come with *de facto* requirements:
  - $$$ – generally quite expensive
  - A regularly-available power supply
  - Access to the Internet
  - A trained user (arguably)

- Most useful to those with access!
  - Have the means to afford new technology
  - Have access to learning opportunities and education

Computer Marketing

- First digital computers took up whole rooms
  - Housed at prestigious/exclusive universities, accessible to math and engineering students

Computer Marketing

- First digital computers took up whole rooms
- With advent of personal computing, marketed to those with leisure time and money

How to talk your parents into parting with $1300.

There's a new Apple® Personal Computer called the IIc that's so complete and so affordable that getting your parents to buy one should be easier than learning Logo.

If, that is, you know what to say.

For example, don't tell your parents that the IIc has the first true 128K VLSI motherboard, dual built-in RS-232 ports and a built-in half high disk drive. Or that it has a switchable 80/40 character display and built-in mousetronics so it can use an AppleMouse.

You know that's incredible in an 8 pound* computer, but all those specs may make your parents uncomfortable.

Just tell them that the Apple IIc can run more than 10,000 programs written for the Apple IIe, the most popular computer in education at all levels. And it works just the same as the Apple computers you learn on in school.

You might also mention that it's a bargain. It comes with everything you need to start computing in one box—including an RF modulator that lets you hook it up to your TV the moment you get it home. There's even a free 4-diskette course on computer basics they can use when you're too busy to show them how.

All for under $1,300.**

Of course, they probably won't want to hear that it runs more games than any other computer in the world except the Apple IIe.

But they might like to know that it also runs advanced business software. Including specialized programs for every profession from doctoring to farming to astronauting. Not to mention personal productivity software to manage their personal finances and taxes.

Speaking of which, they can deduct part of an Apple IIc's price from their taxes if they use it for business.

Even if they always keep it at home.

Don't confuse them right now with the wide array of Apple IIc accessories and peripherals. Like Apple's 1200/300 modems. Or the IIc's low cost full-color graphics/text printer, Scribe.

But assure them that your IIc can grow just as fast as you do.

Now, if all of these carefully reasoned arguments fall on deaf parental ears, don't despair.

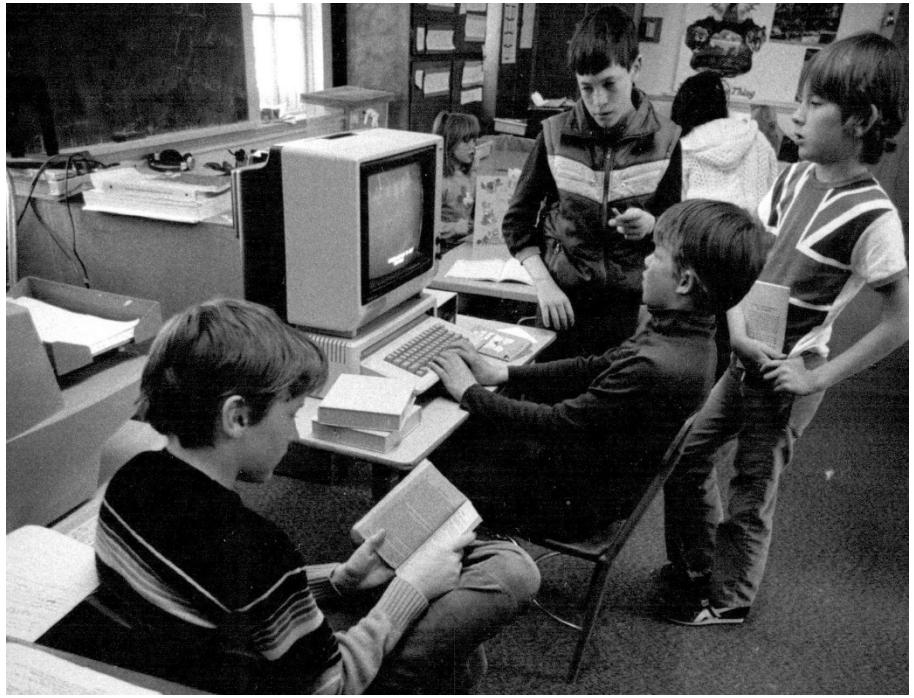
There is still one thing more you can do.

Get a paper route.

*The IIc alone weighs just 7.5 pounds. Power packs, monitors, printers, modems and mice can make it as heavy as you'd like. **Suggested retail price. © 1984 Apple Computer Inc. Apple and the apple logo are trademarks of Apple Computer Inc. For an authorized Apple dealer nearest you, call (800) 538-9696. In Canada, call (800) 268-7796 or (800) 268-7637.

Computer Marketing

- First digital computers took up whole rooms
- With advent of personal computing, marketed to those with leisure time and money
- Eventually trickled down to general population via K-12 schools
  - Only those that could afford them or close enough to tech to be donated
  - Also needed staff who could use/teach them



Computer Marketing

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- With advent of personal computing, marketed to those with leisure time and money
- Eventually trickled down to general population via K-12 schools
- Smartphones now advertised as productivity tool and social status symbol

YANN BASTARD

TECH

Why Apple's iMessage Is Winning: Teens Dread the Green Text Bubble

The iPhone maker cultivated iMessage as a must-have texting tool for teens. Android users trigger a just-a-little-less-cool green bubble: 'Ew, that's gross.'

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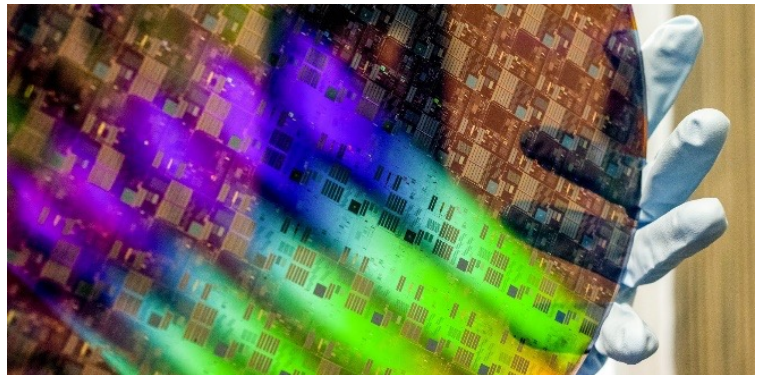
  - **Costs of production**
  - **The technology cycle**

Costs of Production

- Material resources:
  - Silicon (non-renewable)
    - Silicon dioxide purified from quartz or silica sand
    - In 2021, shortage of silicon metal caused 300% price spike – China cut production to reduce power consumption
    - Other industries that require silicon, including auto and solar, in trouble because supply being gobbled up by chip manufacturers
  - Lithium (non-renewable)
    - Lithium-ion batteries have a limited lifespan
    - Classified as non-hazardous waste and often end up in landfills or incinerators
    - Could be recycled, but the cost of collecting, sorting, and shipping used batteries to a recycler exceeds the scrap value
  - Plastics

Costs of Production



- Semiconductor Chip Manufacturing:
  - Needed for computers, cell phones, "smart" appliances, automobiles, airplanes, health-care equipment, etc.
  - Semiconductor Factories
    - Expensive machinery & chemicals to process and protect wafers (people just maintain the machines)
    - High water usage & waste water generation
    - A silicon wafer takes ~3 months and ~700 steps to process
    - Use of fossil fuels and chemicals can be harmful to the health of those living in proximity to manufacturing facilities; plus its own workers
  - Geopolitical & Environmental Consequences
    - Rare earth elements found in select locations: Congo, Myanmar, & elsewhere

Costs of Production

- Use & Disposal:
  - Strain on electrical grid during use (+ wasted energy while idling) contribute to greenhouse gases and pollution
    - Bitcoin mining is particularly power-intensive: The amount of electricity used to mine bitcoin "has historically been more than [electricity used by] entire countries, like Ireland"
  - Millions of tons of electronic waste are discarded into (overseas) landfills each year
    - Heavy metals can pollute the soil and contaminate groundwater

Learn how to dispose of waste at UW: https://facilities.uw.edu/services/recycling/disposal-guide

Quick Discussion

- In reconciling a utopian view of a fully computerized future with the costs of production, what parts of our homes, workplaces, and lives could/should most likely do without computerization?

The Technology Cycle

- Computers and technology eventually break down and stop working, but the industry really relies on consumers buying before that happens
  - The entire chip industry depends on a brand new laptop/smartphone meaning something!
    - Consumers want speedups, engineers should deliver
    - Self-fulfilling, industry taught consumers to believe "faster is better"
  - **Obsolescence**: when an object, service, or practice is no longer maintained, required, or degraded even though it may still be in good working order.
    - Newer version or new tech released = "technical obsolescence"
    - Old one is too slow = "functional obsolescence"
    - Old one no longer supported = "planned obsolescence"

The Technology Cycle

- Technology and longevity:
  - Longevity is nearly impossible to design for
    - Nothing is future-proof!
    - We've seen lots of weird historical artifacts in this class
  - Tension around technological change
    - Companies and developers hate supporting the same tool over a long period of time
    - Consumers tend to be resistant to change and hate being "forced" to upgrade
    - Backwards-compatibility can be a decent compromise
  - "Exciting" areas see lots of change, "boring" areas neglected
    - *e.g.*, unemployment systems and ATMs still run on COBOL (1959)

The Technology Cycle

- Who benefits? Who loses?
  - The consumers?
  - The developers?
  - The Earth?

- "The Consumer Technology Association notes that the average smartphone lifespan is 4.7 years. This obsolescence cycle fuels the purchase of more devices, drives up profits, and increases incentives for the use of unsustainable extraction practices."
  – https://anatomyof.ai

Where Do We Go From Here?

- In this class, we have examined some of how computers got to where they are today – but we get a say in where we go from here!
- You have unprecedented power and access as technologists – be the change that you want to see!
  - What would you like to accomplish?
  - Who/what will you support (explicitly or tacitly)?
- Remember, computers shape society and society shapes computers
  - Be wary of what you build and how you design it!
  - Make sure you take the messy social context into account