

IN4MATX 241: Ubiquitous Computing

Class 1:
History of Ubiquitous Computing

Daniel Epstein

Today's class

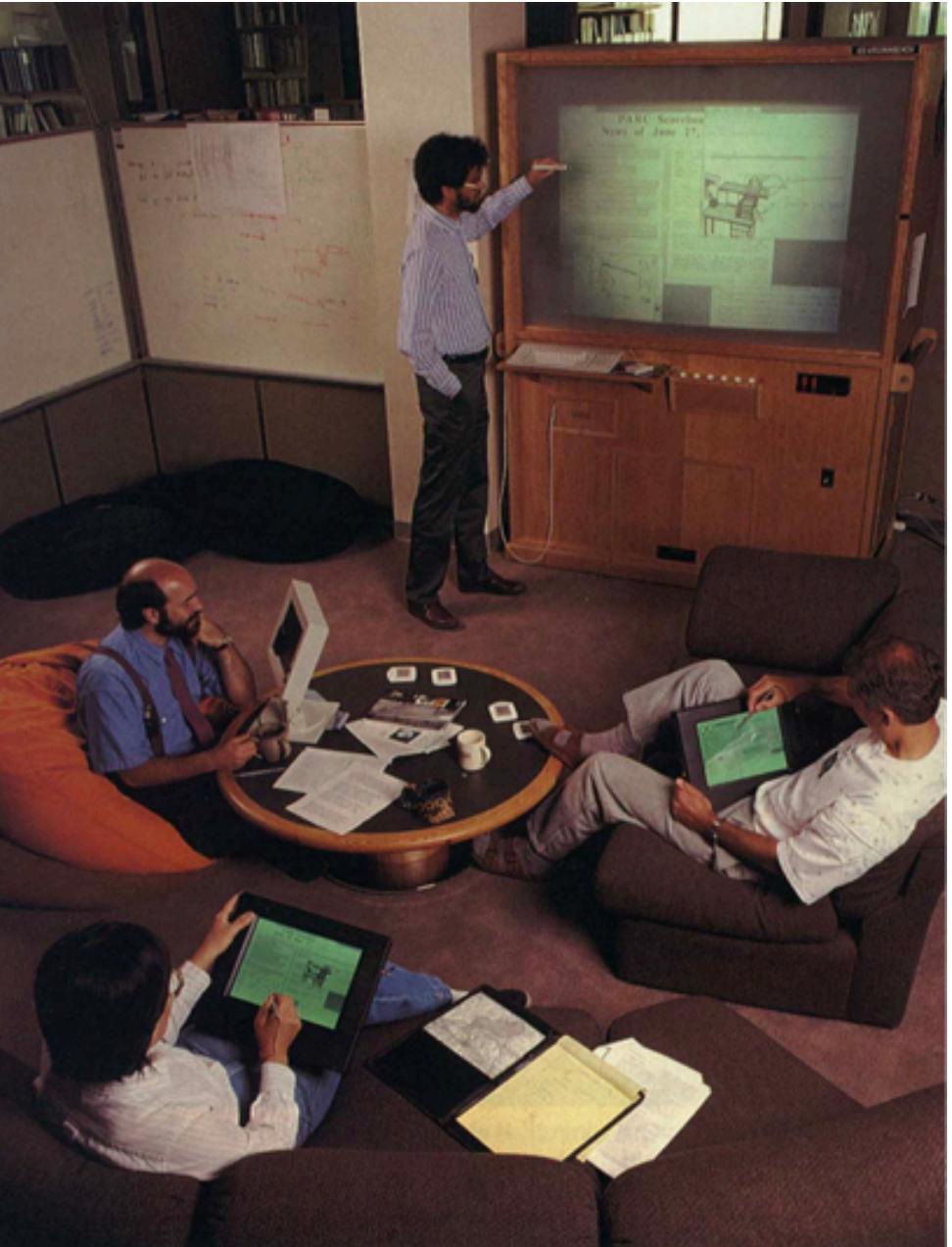
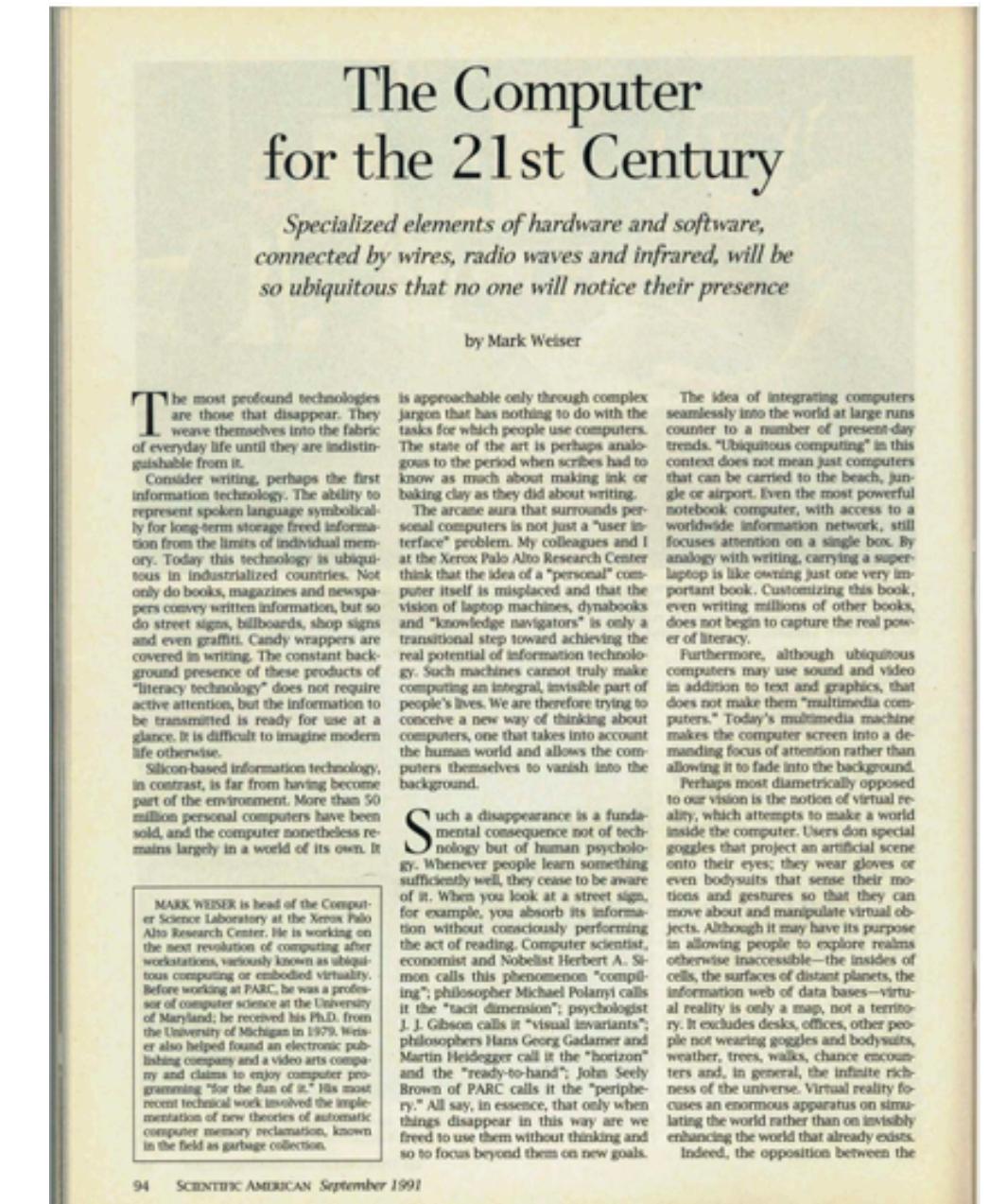
- Defining ubiquitous computing
- Course overview

Discussion time!

What is Ubiquitous Computing?

The Computer for the 21st Century

- Published in Scientific American, 1991
- Coined “Ubiquitous Computing”
 - Reflective and speculative
- I hope you liked the early-90's ads



Three waves of computing



Mainframe
computing



Personal
computing



Ubiquitous
computing

Three waves of computing



Mainframe
computing



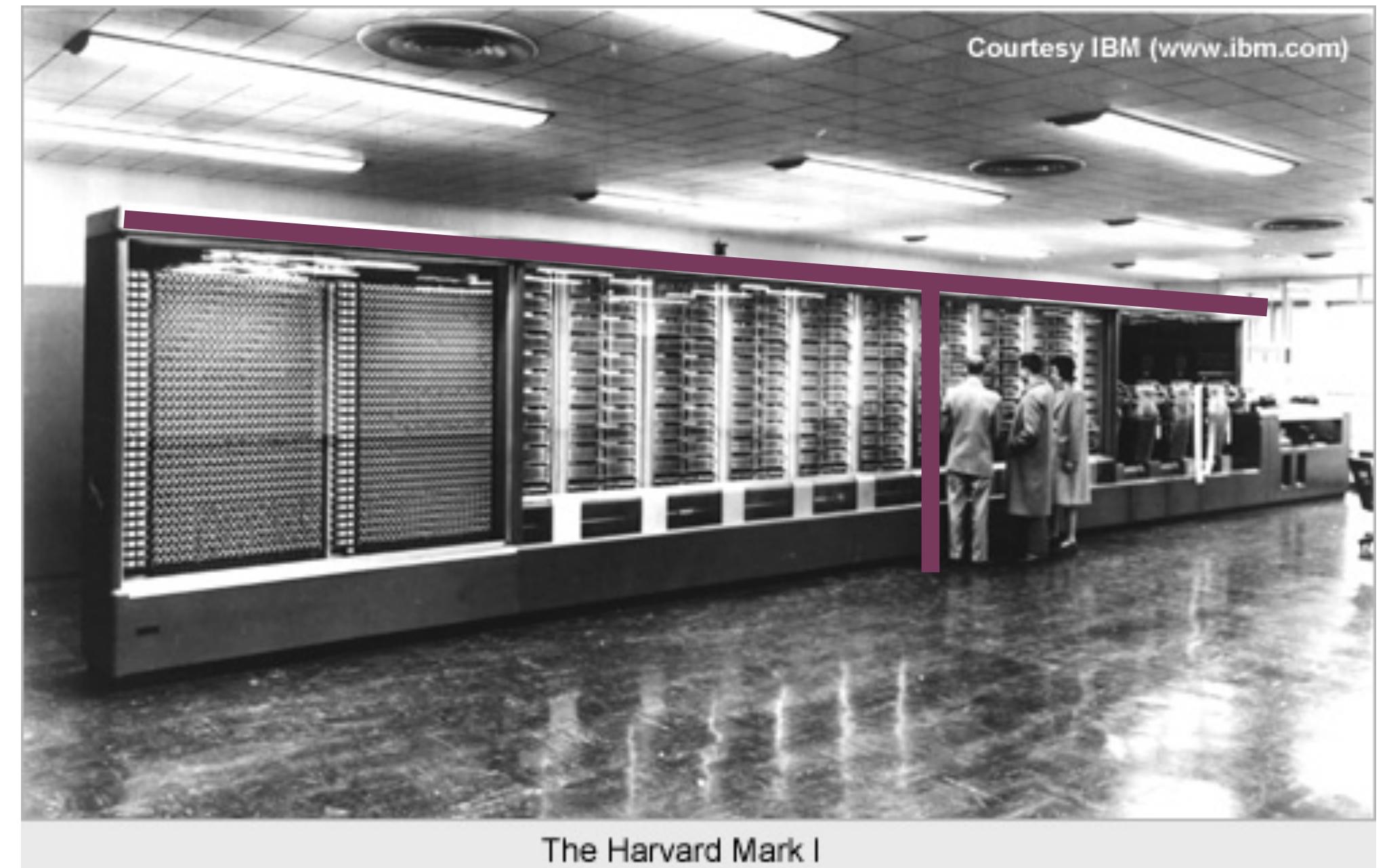
Personal
computing



Ubiquitous
computing

First wave: mainframe computing

- Harvard Mark I
- Large (55 feet wide, 8 feet high, 5 tons)
- Expensive (enclosure alone was \$50,000 in 1945!)
- Used to calculate implosion during the Manhattan Project

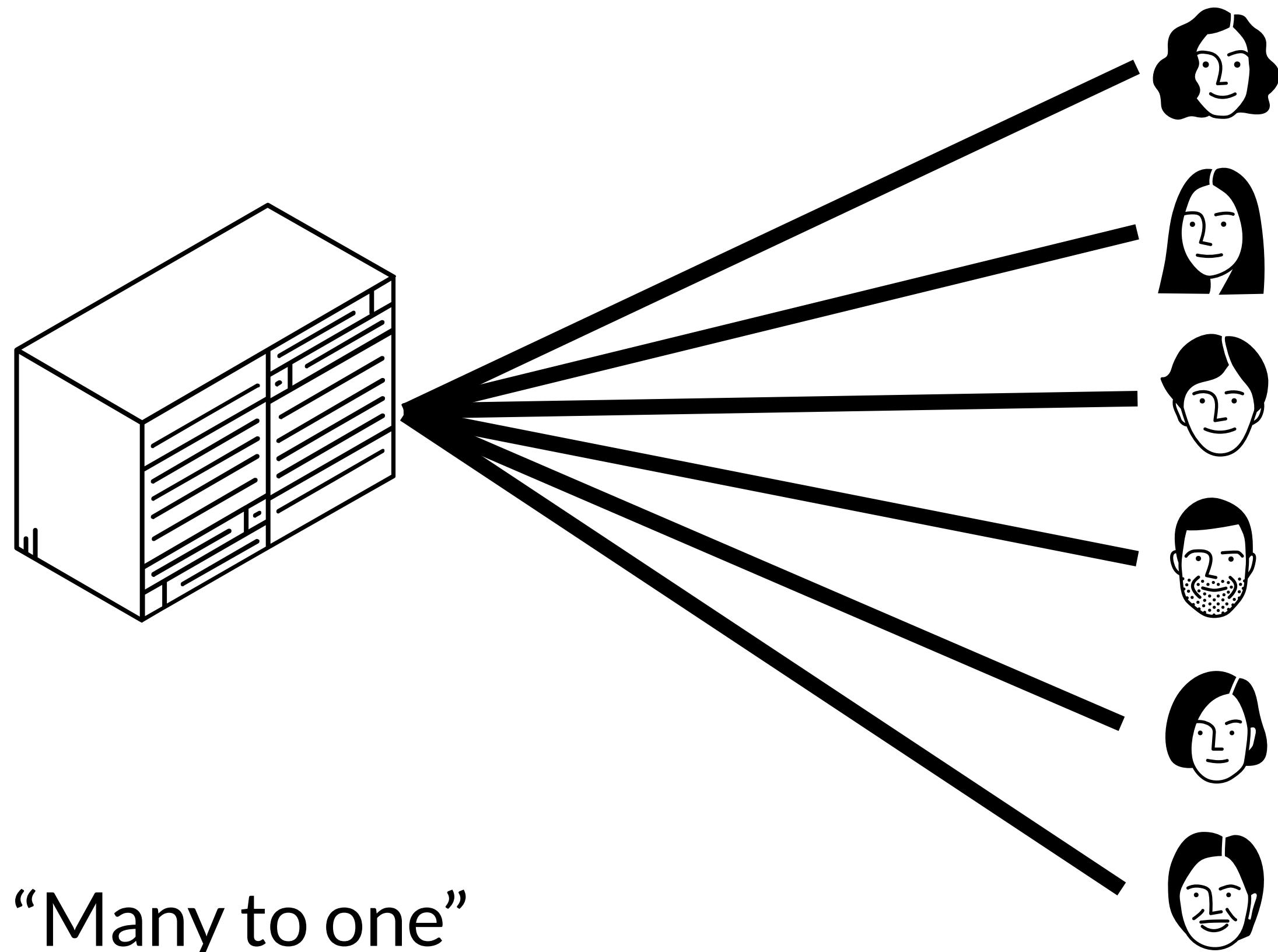


First wave: mainframe computing

- Batch processing
 - Write your program on punch cards
 - Wait your turn for the computer
 - Run program, hope it works
 - If it doesn't, you'll have to fix it and wait for your next turn
 - Efficient use of resources, but poor interactivity

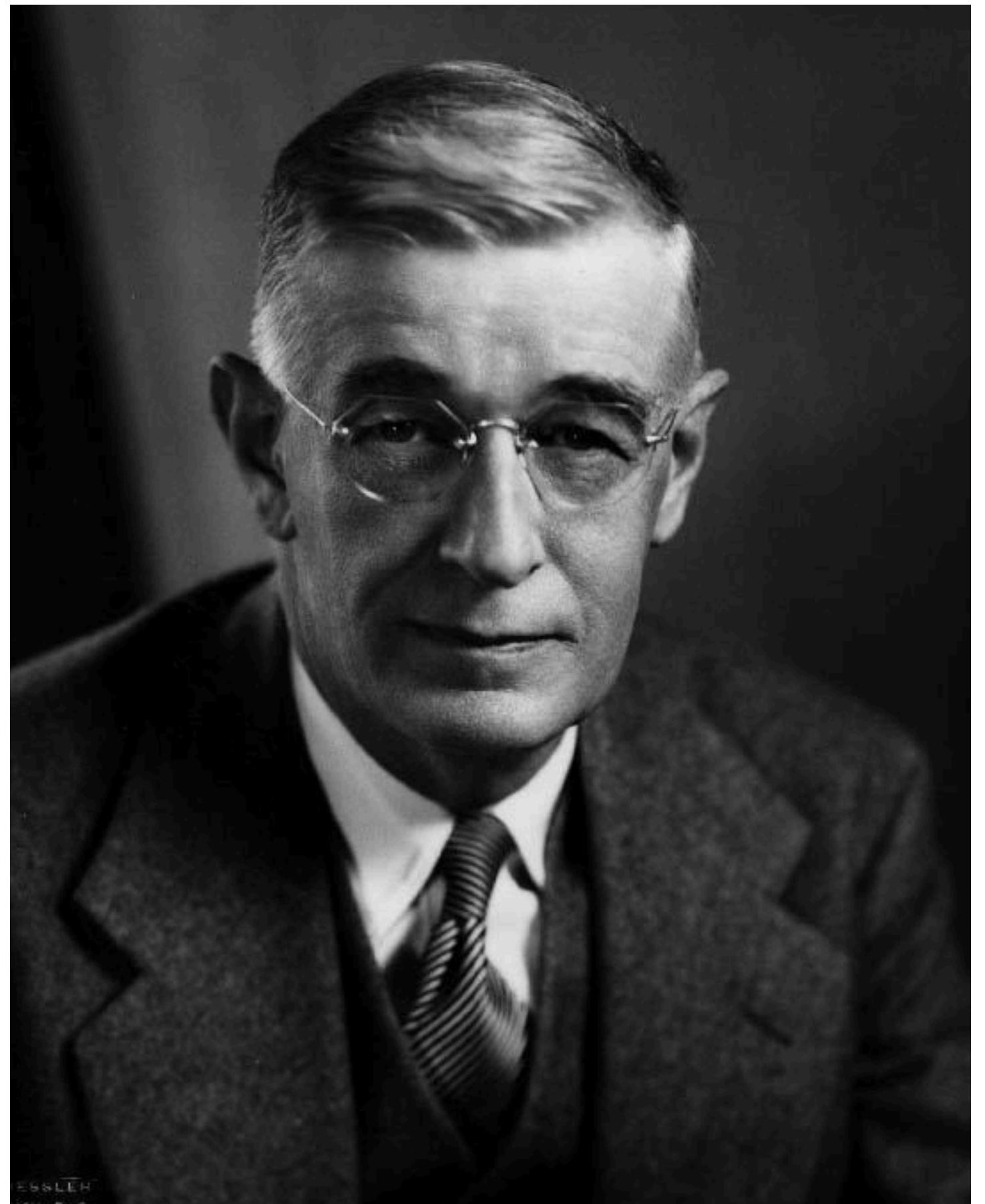


First wave: mainframe computing



Vanneaver Bush

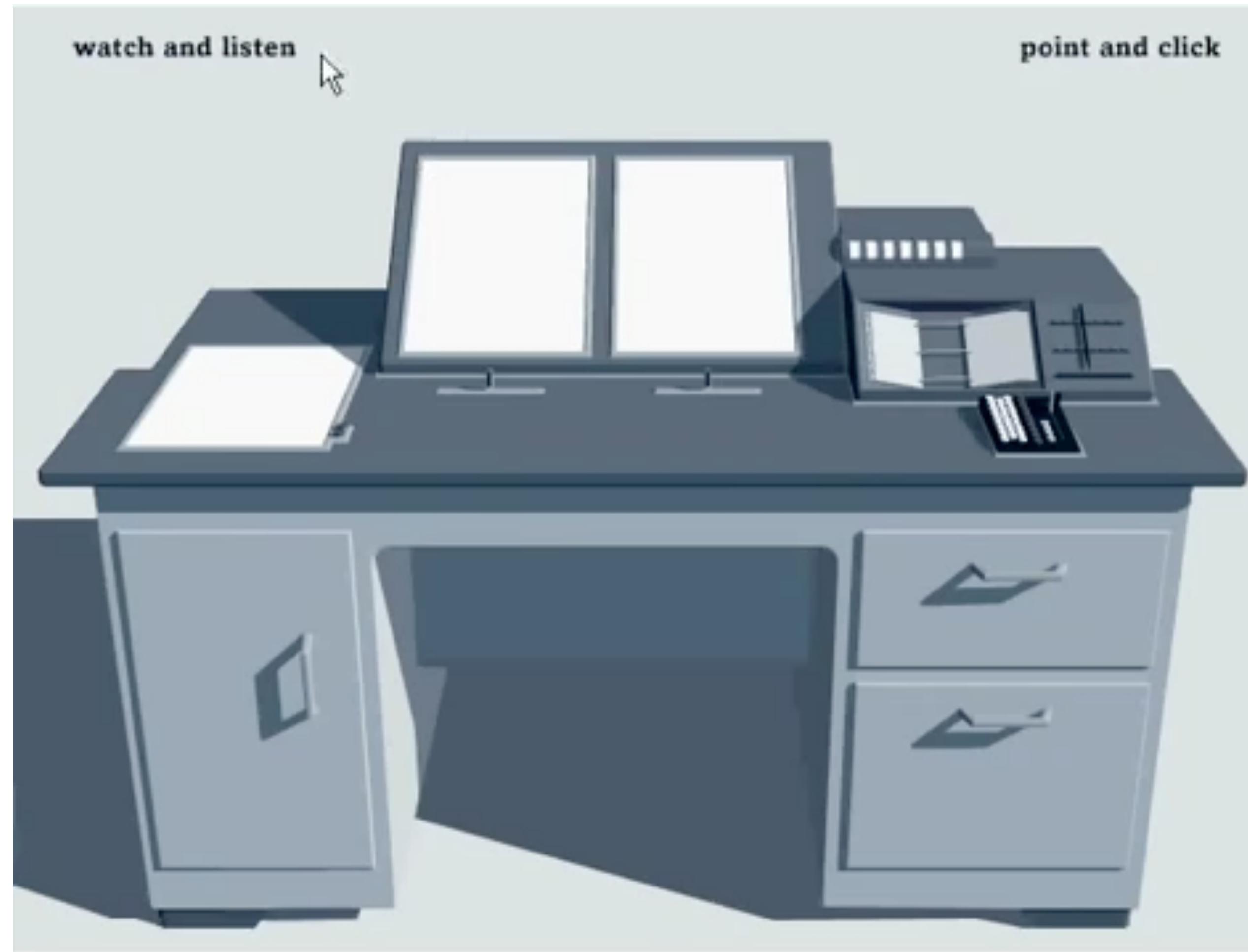
- Faculty at MIT
- Oversaw National Defense Research Committee, which led the Manhattan Project
- Post-war, helped define mission of the National Science Foundation
 - Federal government funds universities
 - Universities do basic scientific research
 - Research helps economy and defense



As We May Think

- Published in Atlantic Monthly, 1945
- [http://www.theatlantic.com/magazine/print/1945/07/as-we-may-think/
3881/](http://www.theatlantic.com/magazine/print/1945/07/as-we-may-think/3881/)
- In part, set out to define a post-war scientific research agenda
 - Speculative, not reflective

Memex (1945 speculative design)



<https://www.youtube.com/watch?v=c539cK58ees>

(video from 1995 animation presented at SIGIR, not from 1945)

Memex (1945 speculative design)

- Linking information across devices and sources
 - Hypertext, the foundation of the web
- Pen-based annotation of primary sources

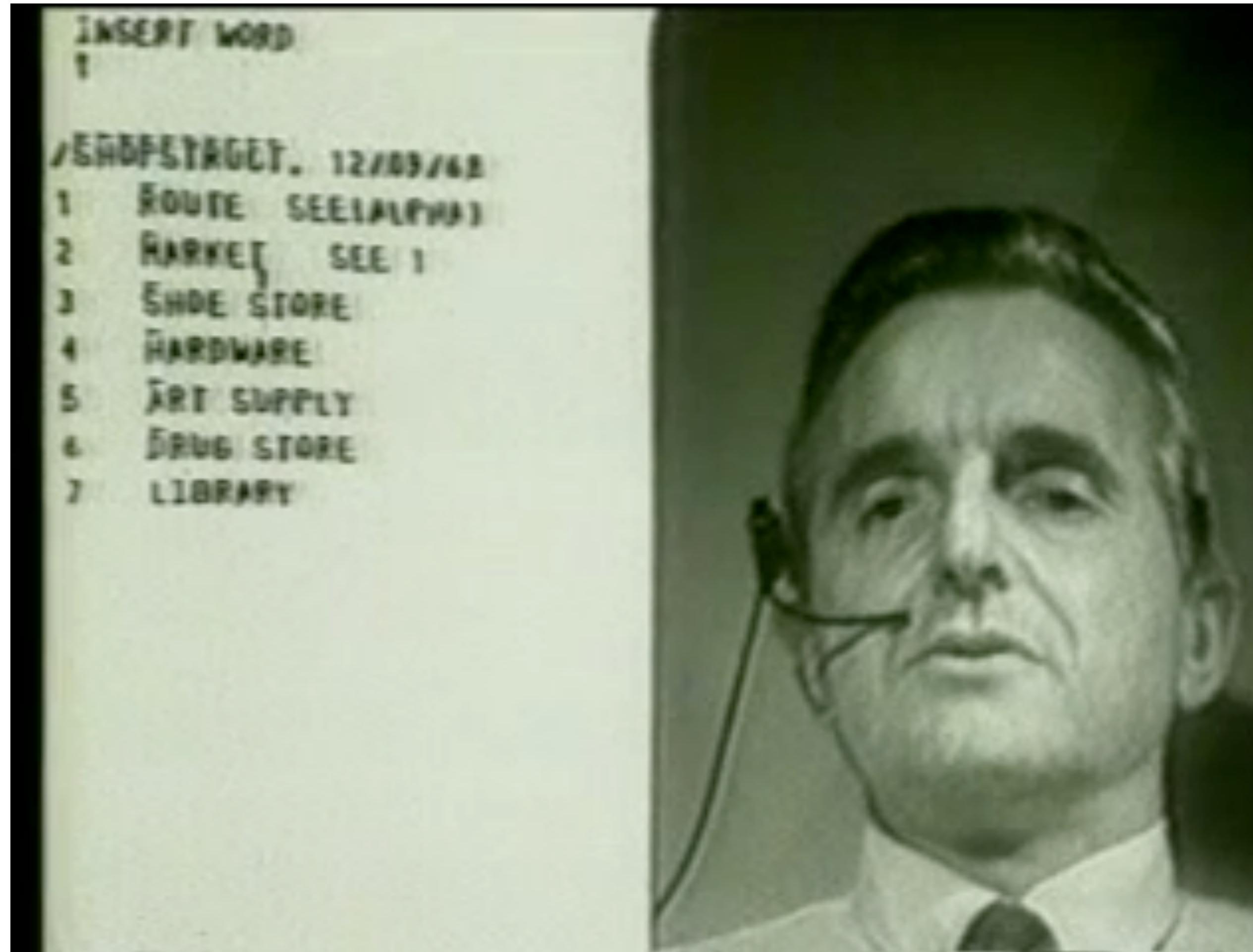


Command-Line interfaces (1960's)

- Originally used in a terminal connected to a mainframe
 - Was eventually integrated into personal computing (in Unix, etc.)
- A person could change execution based on output
- Enabled real-time debugging



Doug Engelbart's NLS (1968)



The image is a composite of two photographs. On the left, a screenshot of the NLS (Augment) interface is displayed. The screen shows a menu with the following options:

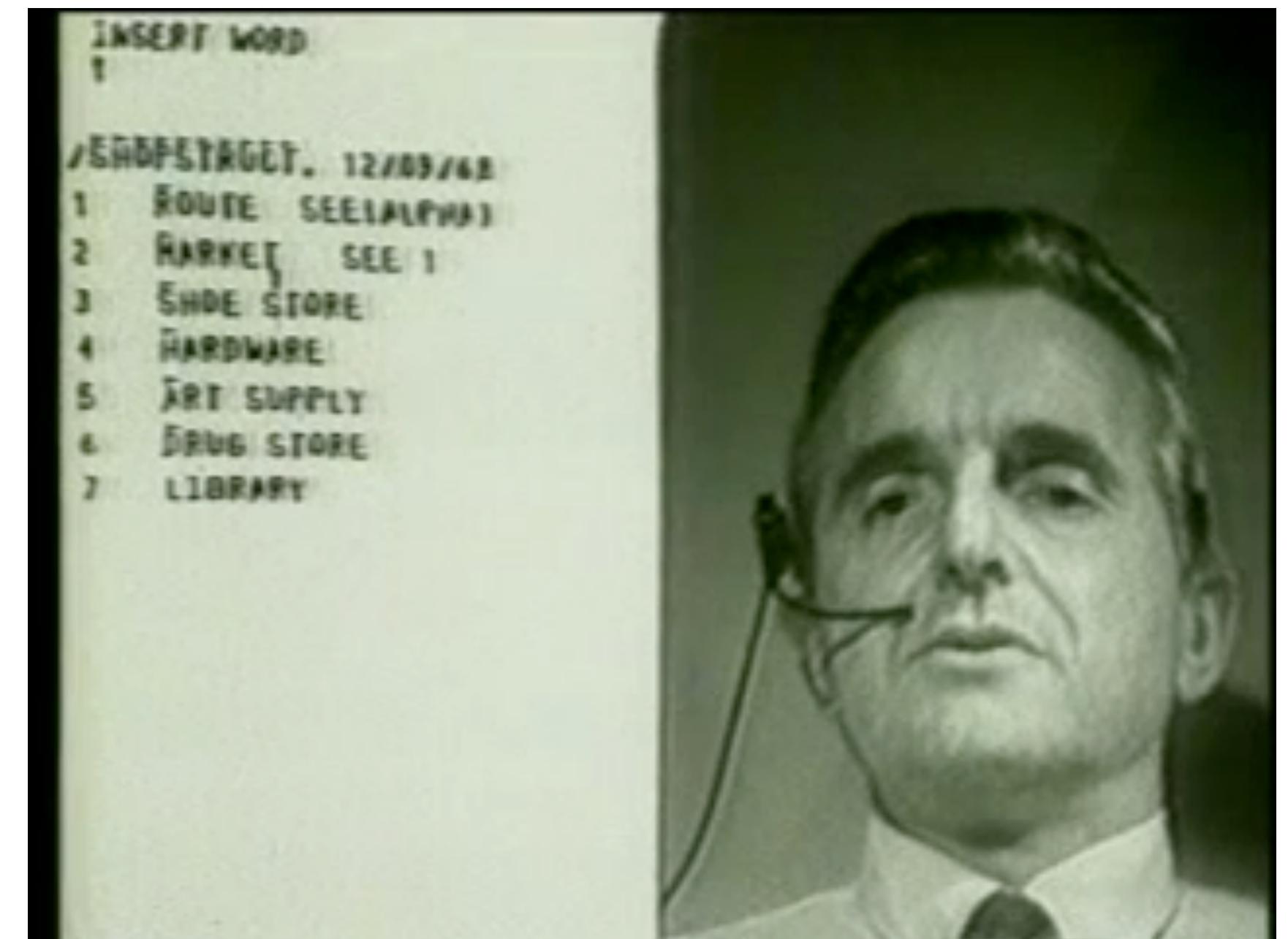
- 1 INSERT WORD
- 2
- 3 /SHOPSTREET. 12/09/68
- 4 ROUTE SEE ALPHABET
- 5 MARKER SEE 1
- 6 SHOE STORE
- 7 HARDWARE
- 8 ART SUPPLY
- 9 DRUG STORE
- 10 LIBRARY

On the right, a black and white portrait photograph of Doug Engelbart is shown from the chest up. He is wearing a light-colored shirt and a dark tie, and has a microphone attached to his shirt.

<http://www.douengelbart.org/firsts/1968-demo-interactive.html>

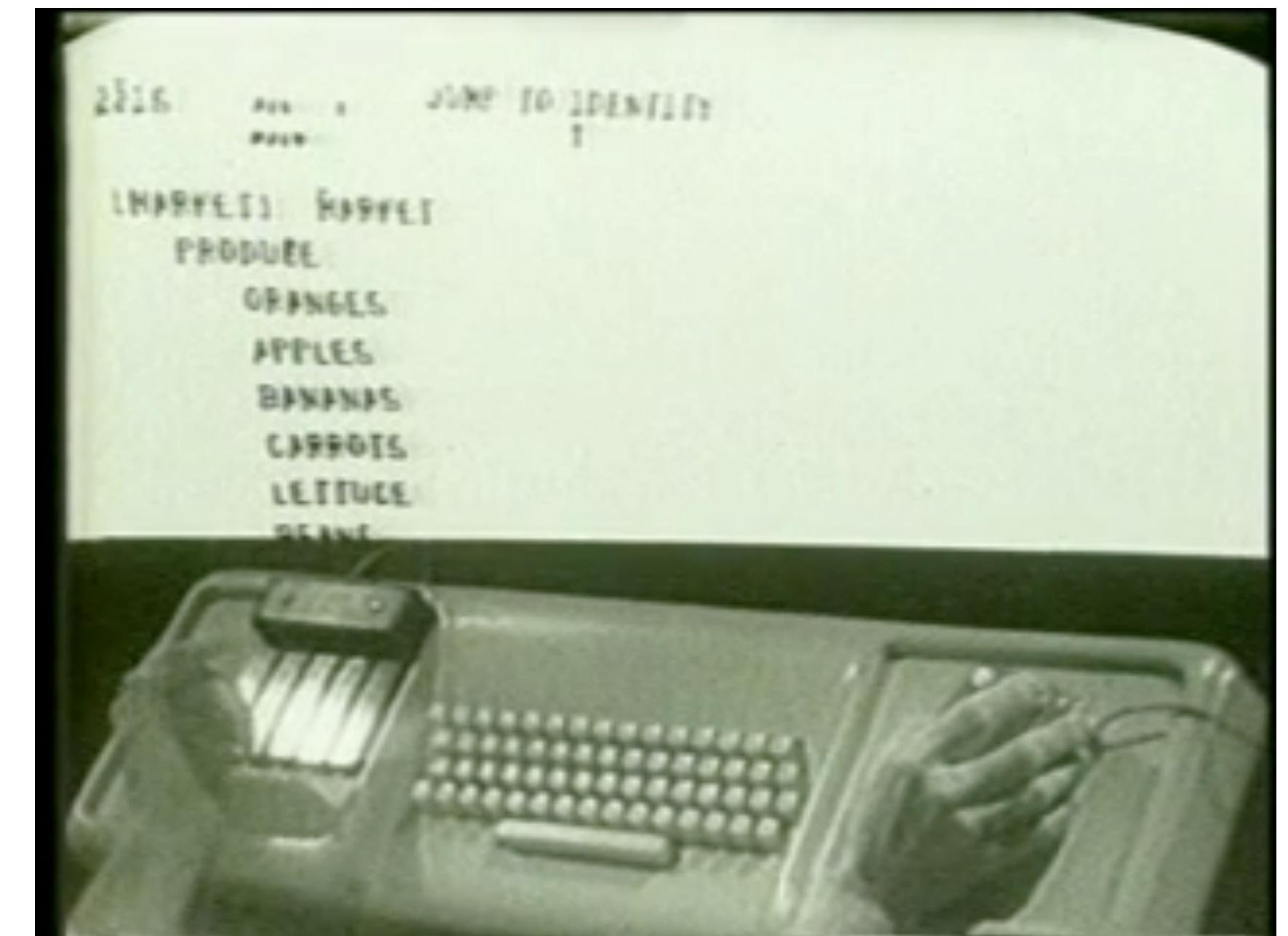
Doug Engelbart's NLS (1968)

- First working hypertext system
- Invention of the mouse
- Simple graphics
(earlier systems had this,
but used in a full system here)



Doug Engelbart's NLS (1968)

- It introduced other ideas as well
 - A chording keyboard
 - Remote collaboration
- Some people thought he “faked it”
- Others thought it was irrelevant because “the terminal can do the same”
- Won Turing Award in 1997



Three waves of computing



Mainframe
computing



Personal
computing



Ubiquitous
computing

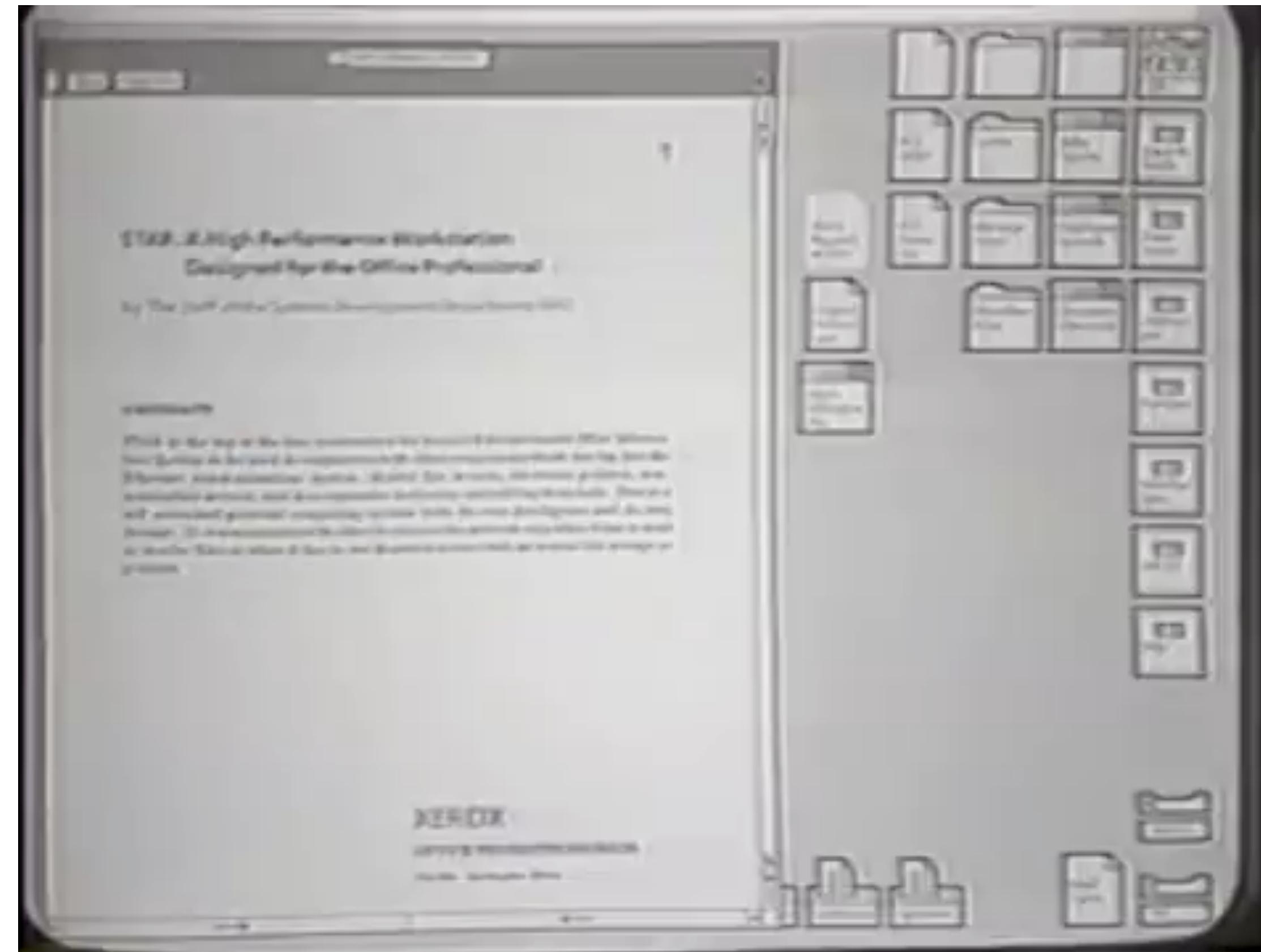
Second wave: personal computing

- First introduced by Xerox
- Xerox Alto, 1973
 - Mouse
 - Chording keyboard
- Xerox Star, 1981
- Xerox models were commercially unsuccessful
 - Still expensive, too few applications



Second wave: personal computing

Xerox Star (1981)

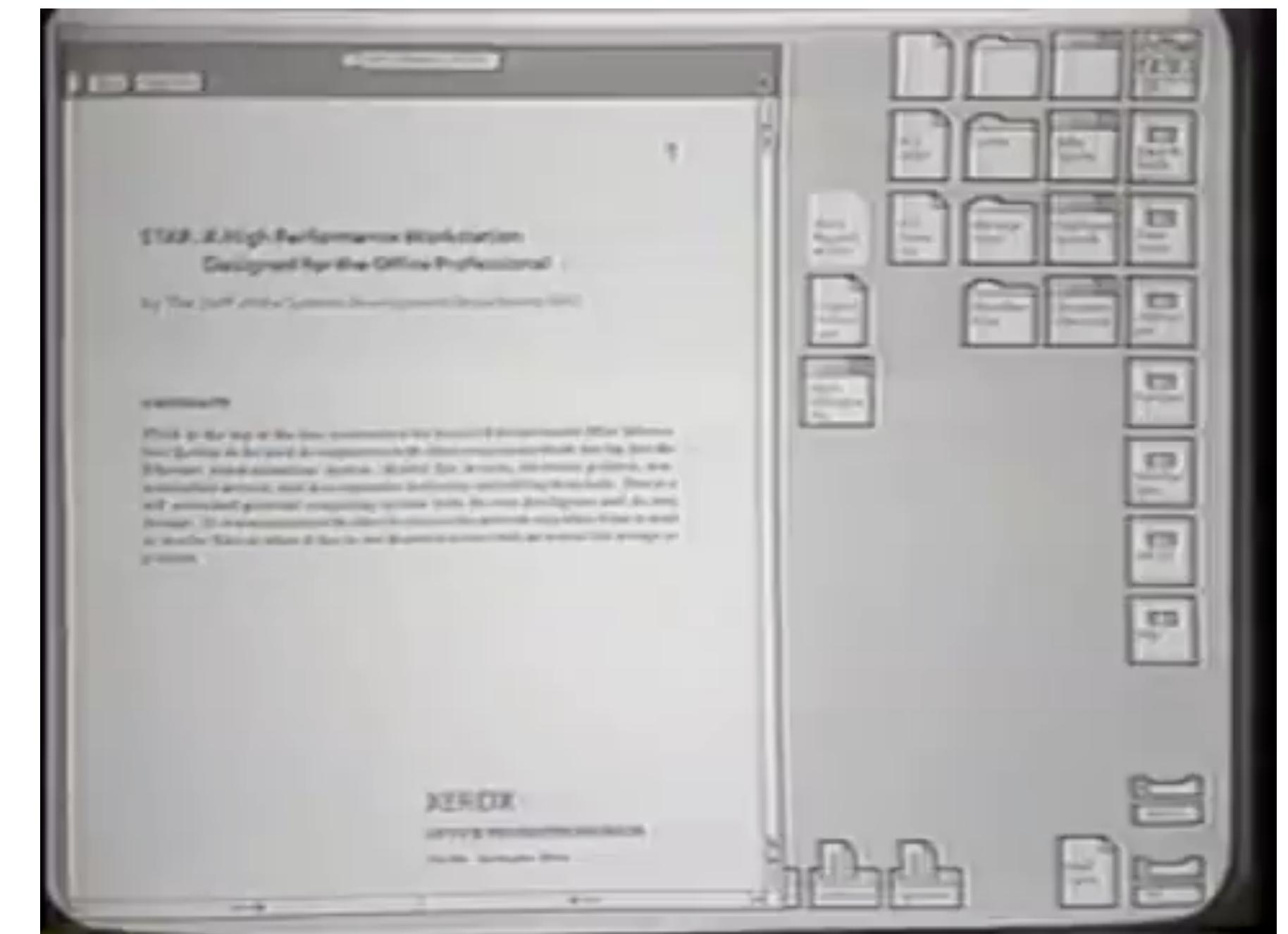


<https://www.youtube.com/watch?v=ODZBL80JPqw>

Second wave: personal computing

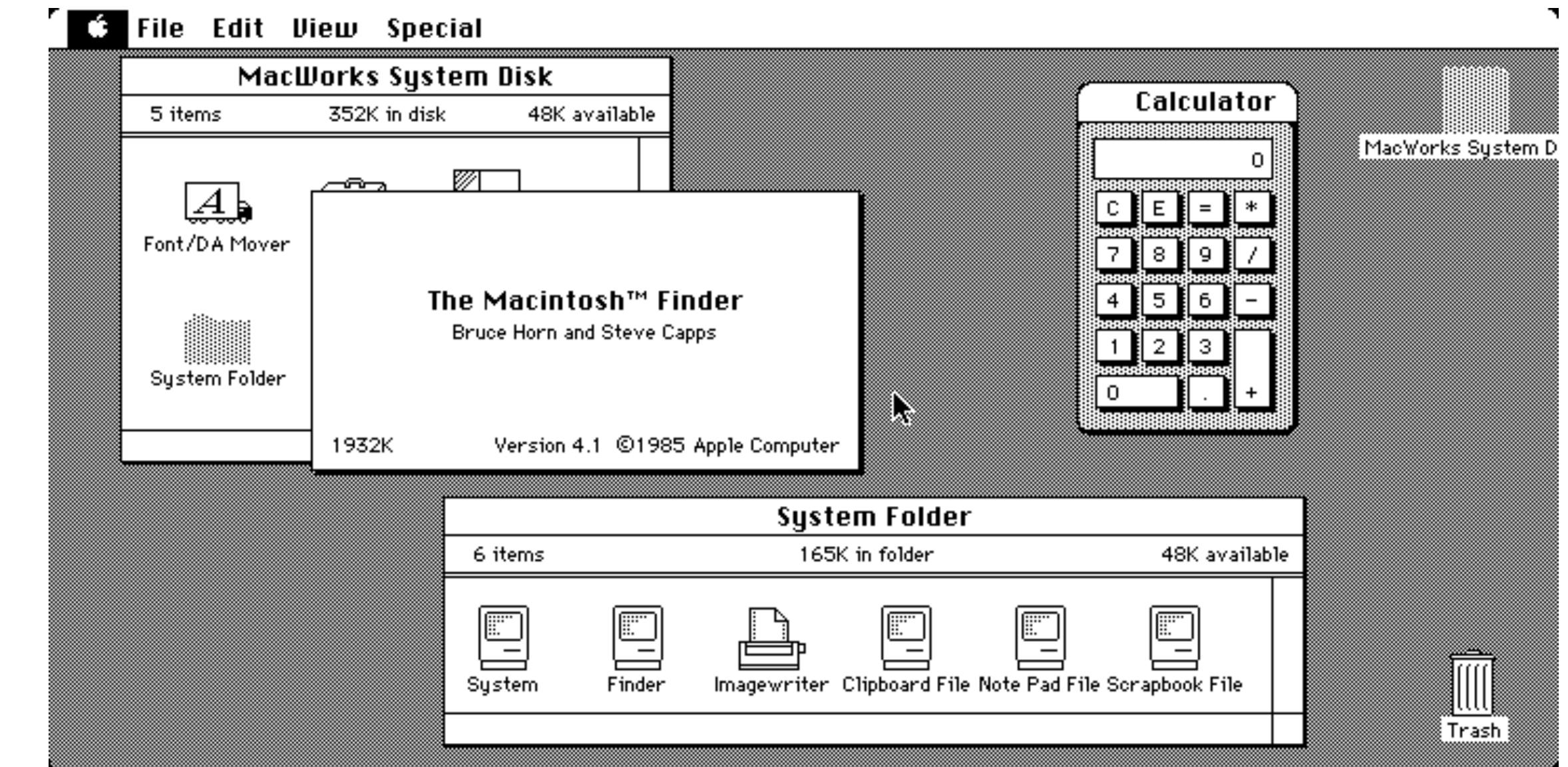
Xerox Star (1981)

- Software running in windows
- Desktop with icons for navigating between files and programs
- Super slow!



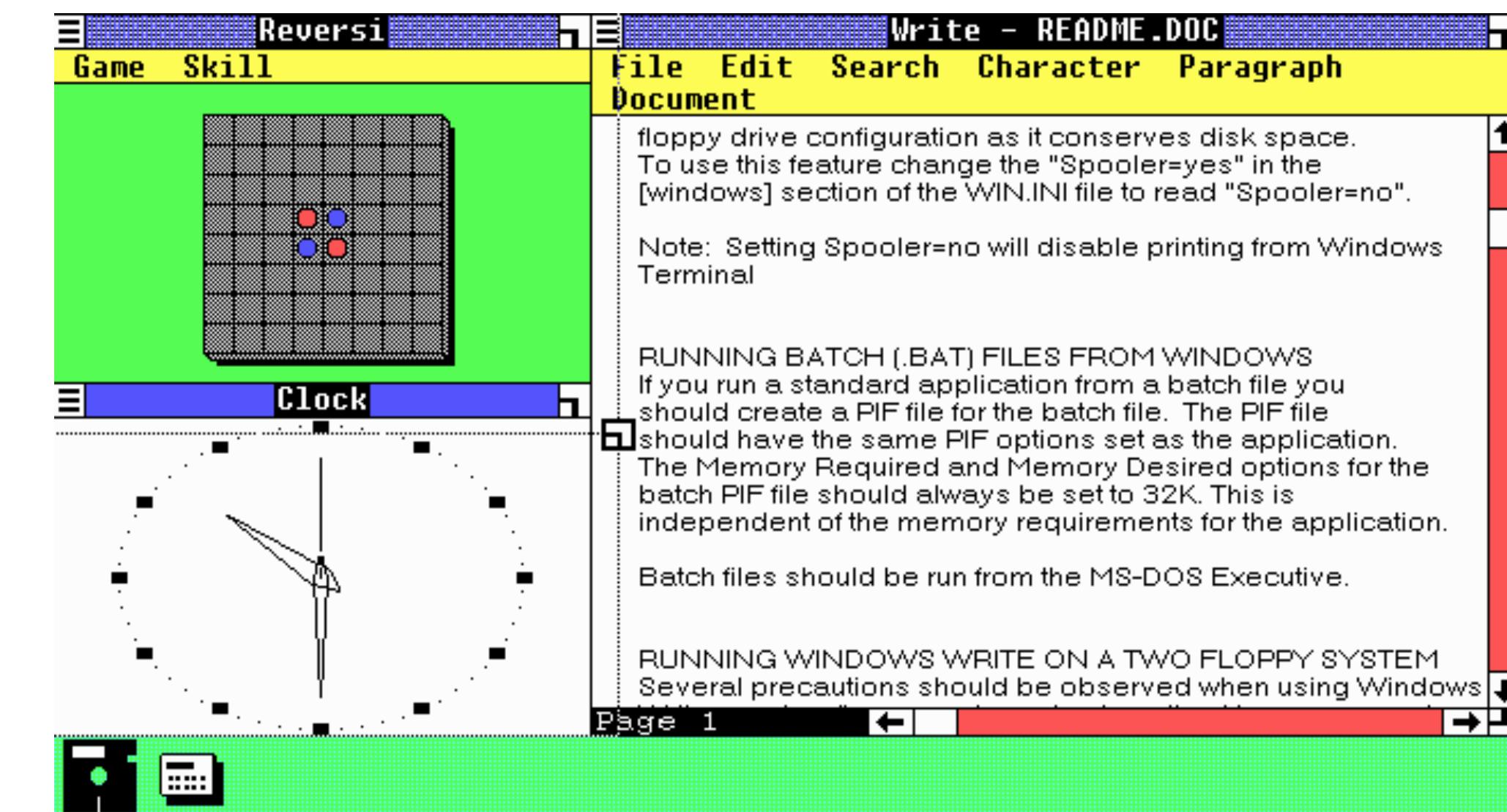
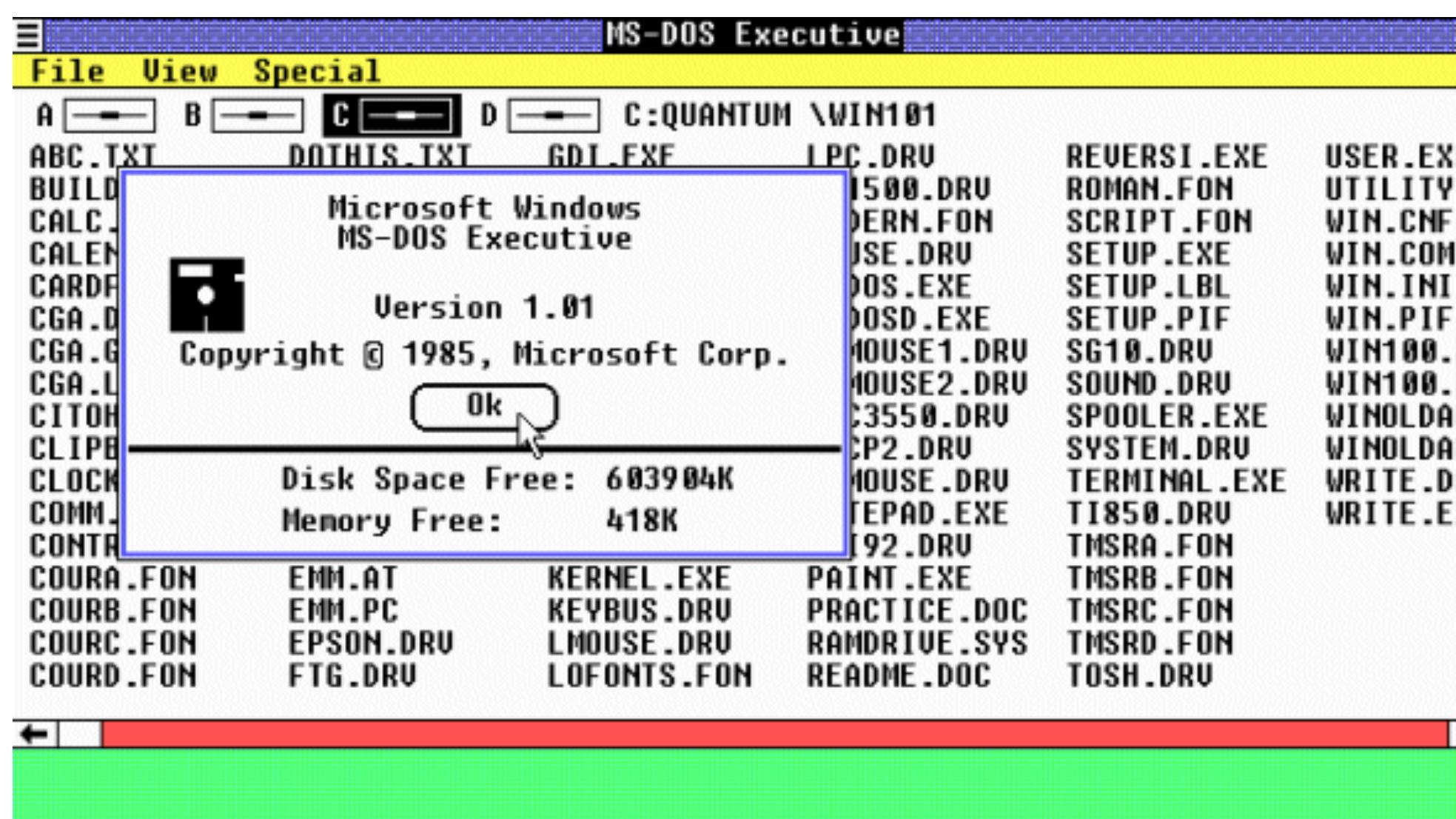
Second wave: personal computing

Macintosh (1984)



Second wave: personal computing

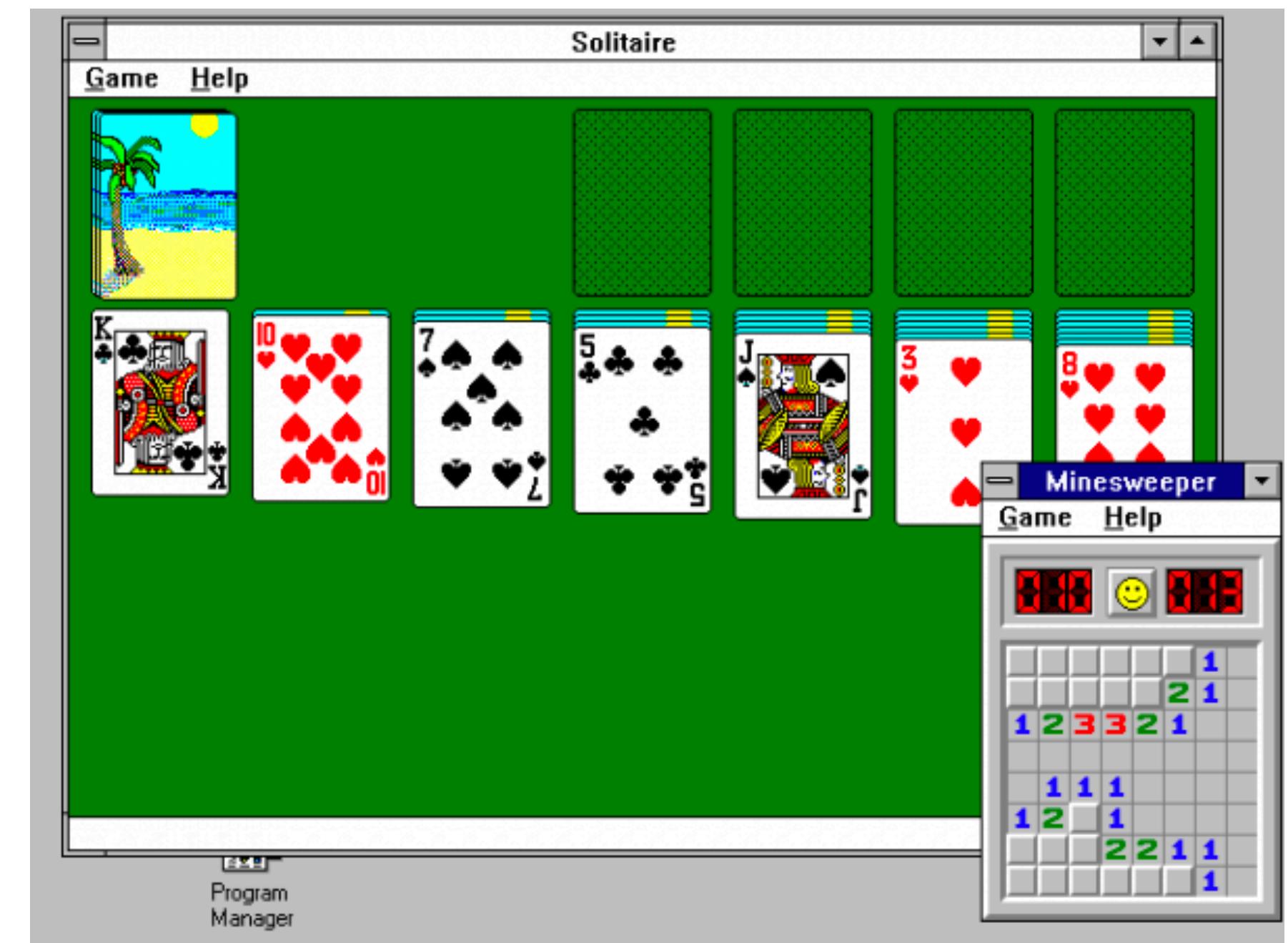
Windows 1.0 (1985)



Second wave: personal computing

Windows 3.0 & 3.1 (1990 & 1992)

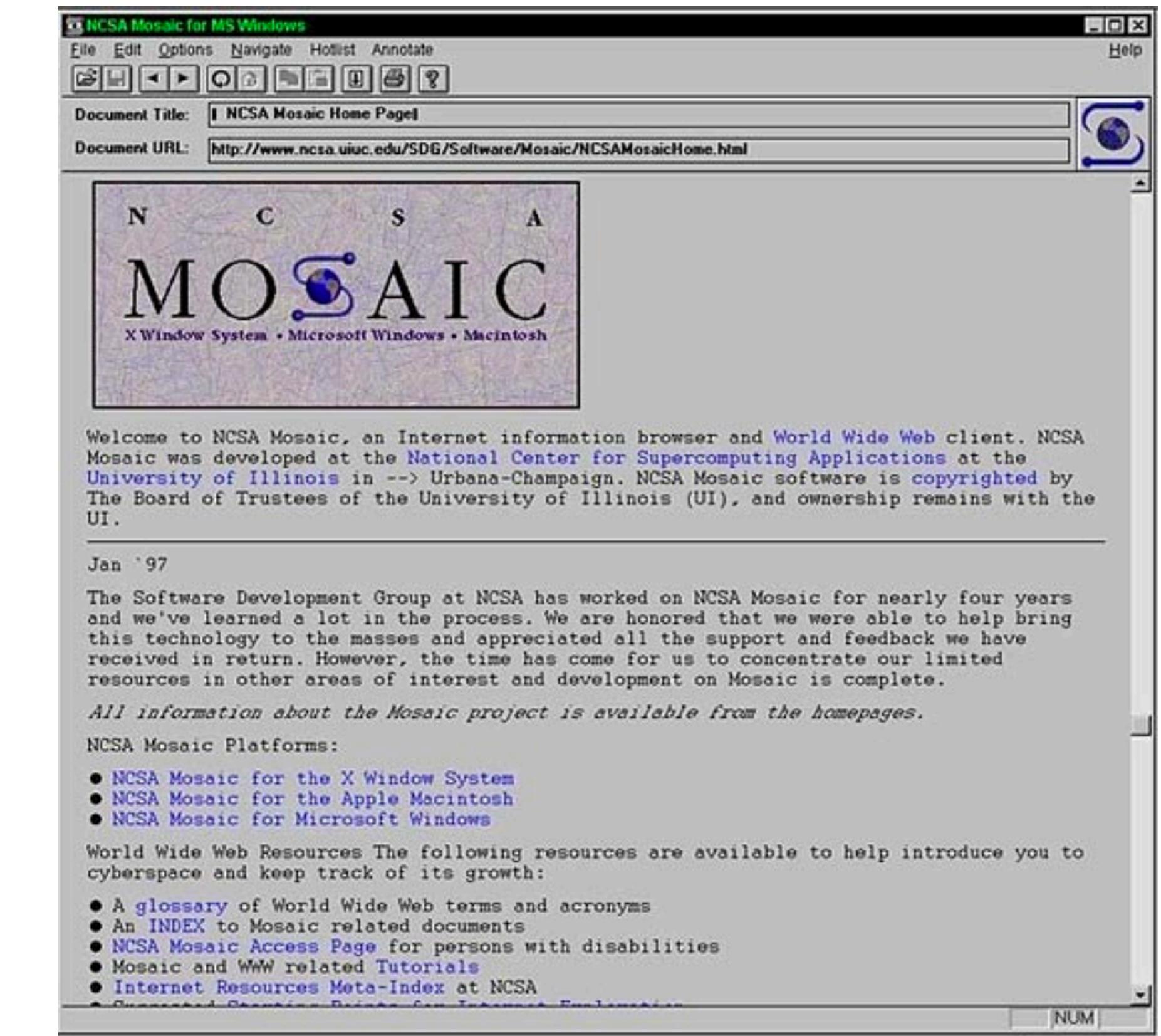
- Windowing became primary
- Added games: Solitaire, Minesweeper, and FreeCell!
 - These were a trick to teach mouse skills



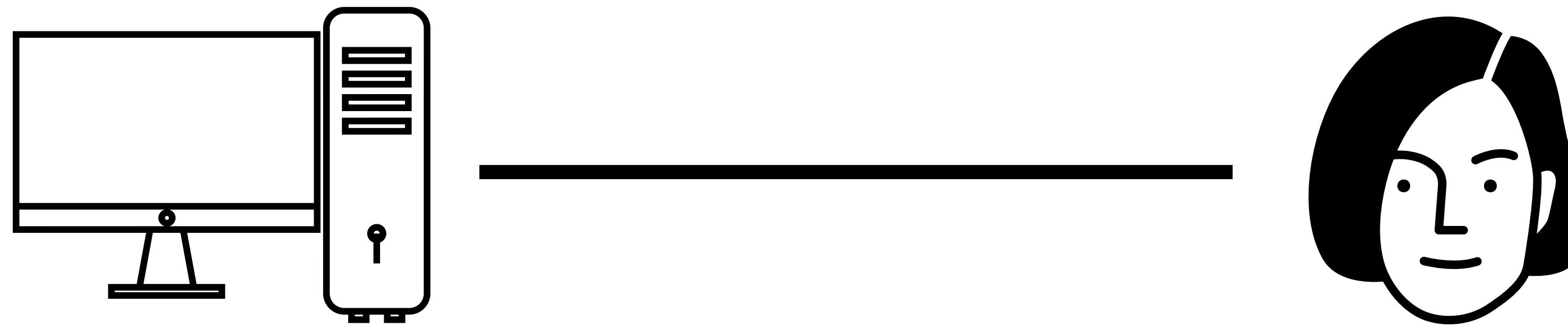
Second wave: personal computing

Mosaic Web Browser (1993)

- Originally for Unix systems, later ported to Mac and Windows
- “First” graphical web browser
- Microsoft IE came in 1995
- Apple didn’t make a browser until Safari in 2003



Second wave: personal computing



“One to one”

Three waves of computing



Mainframe
computing



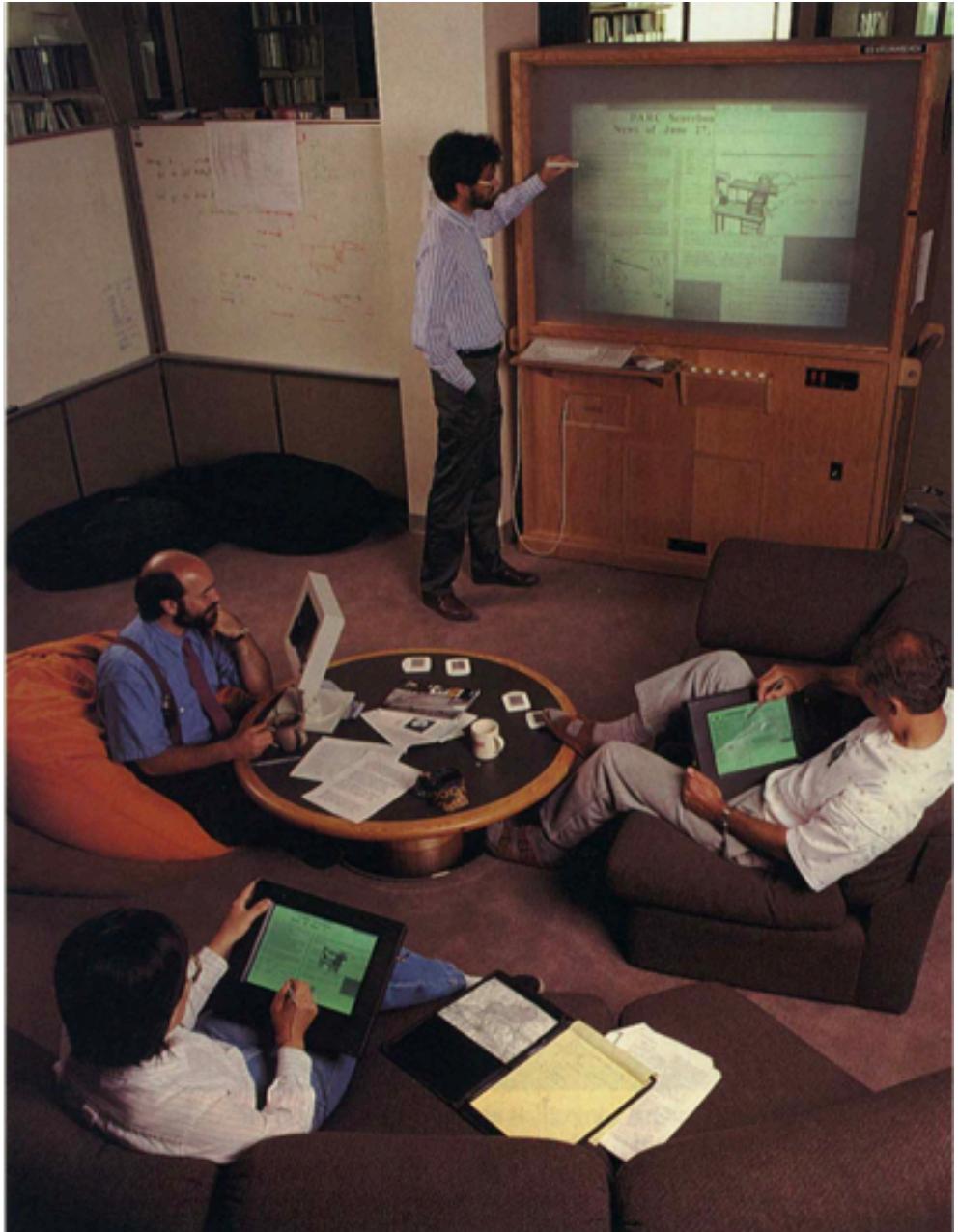
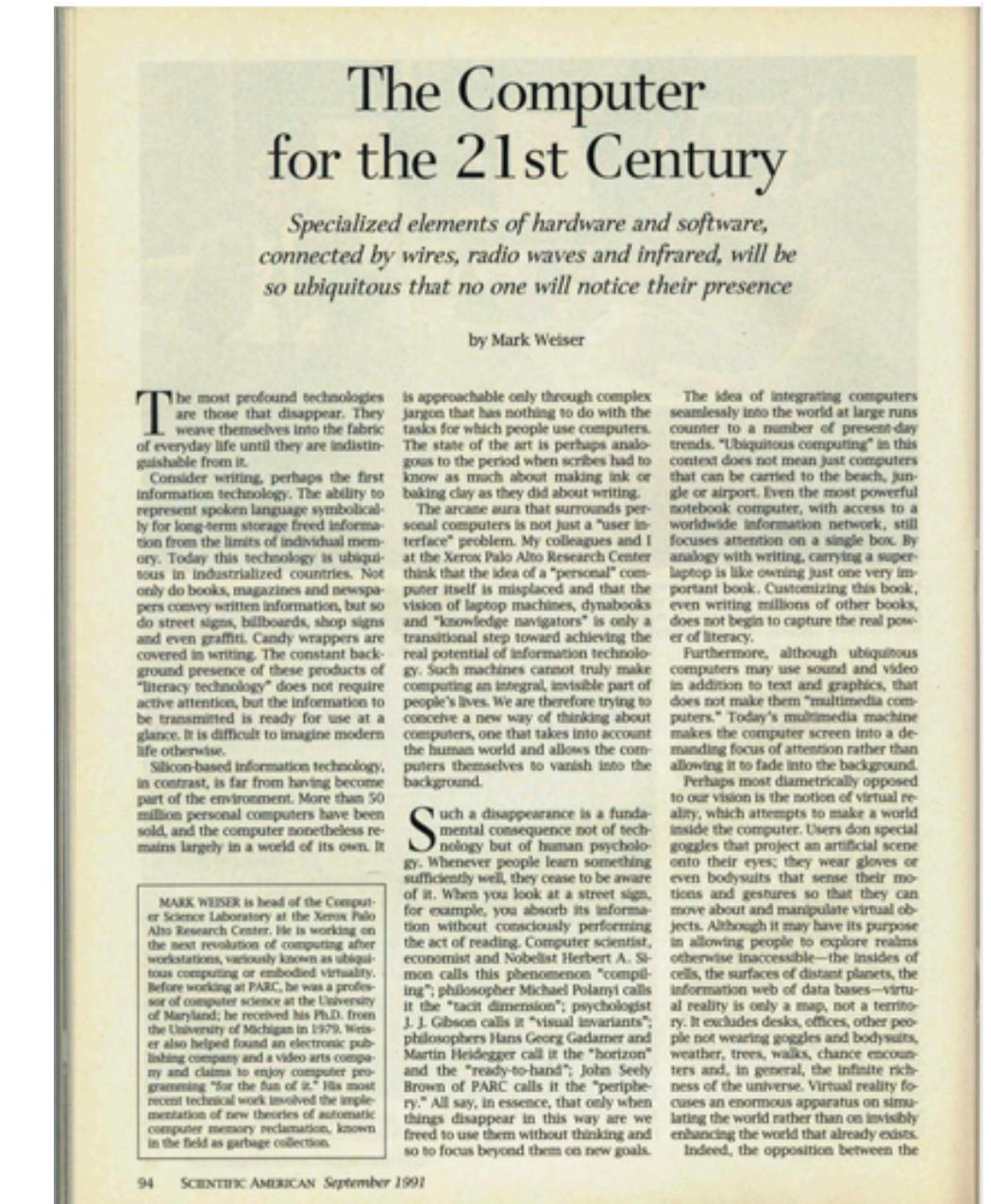
Personal
computing



Ubiquitous
computing

Third wave: ubiquitous computing

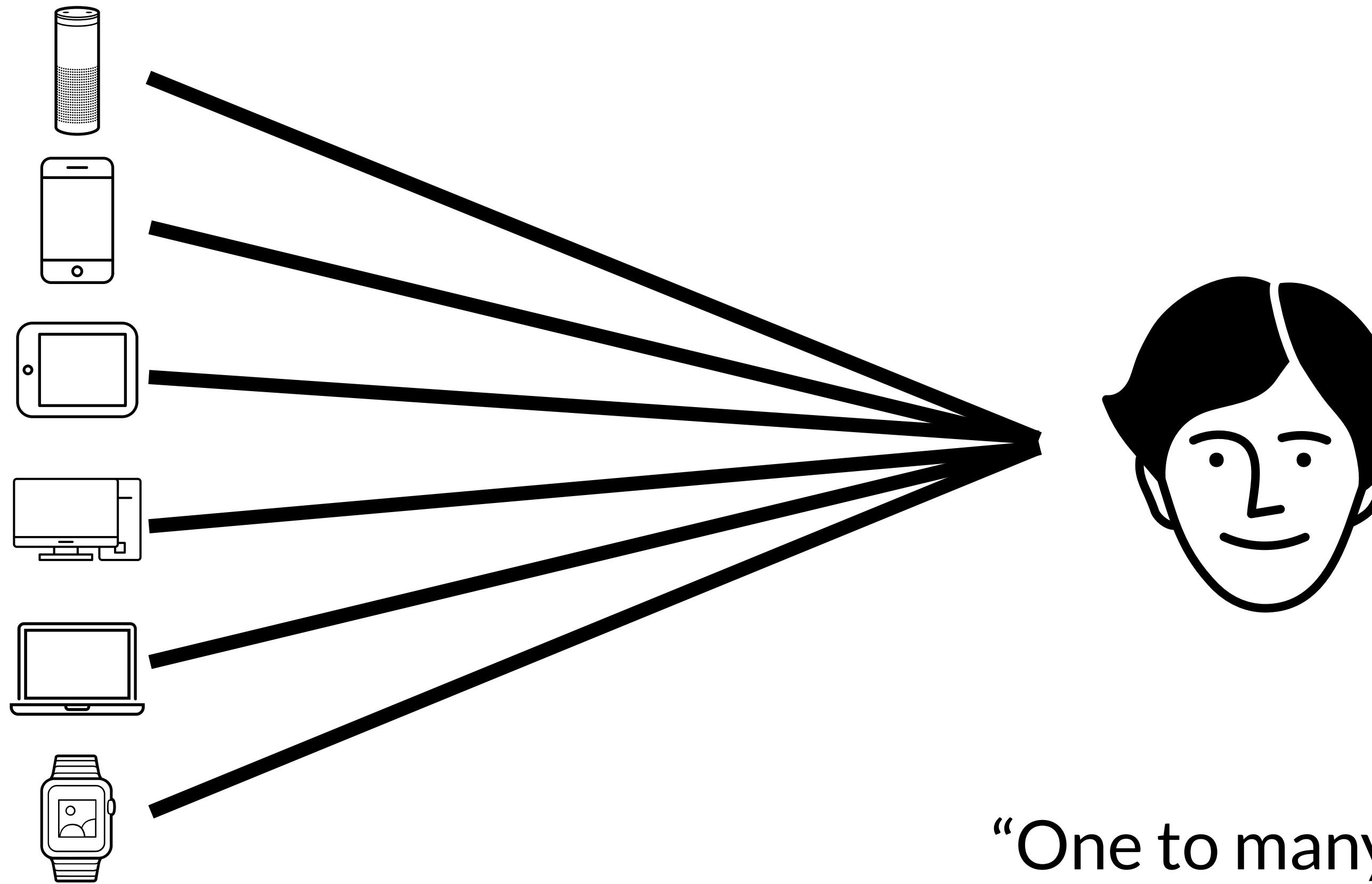
- Weiser speculated people would interact with three types of computers
 - Tabs: inch-scale devices, like post-its
 - Pads: foot-scale devices, like paper
 - Boards: yard-scale devices, like whiteboards
- Speculated devices would have shared ownership



Third wave: ubiquitous computing



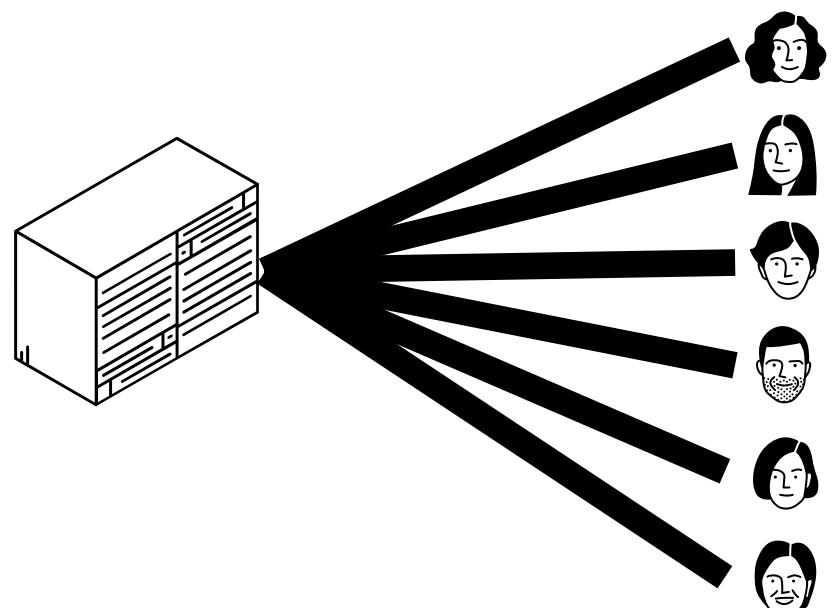
Third wave: ubiquitous computing



Three waves of computing



Mainframe
computing



“Many to one”



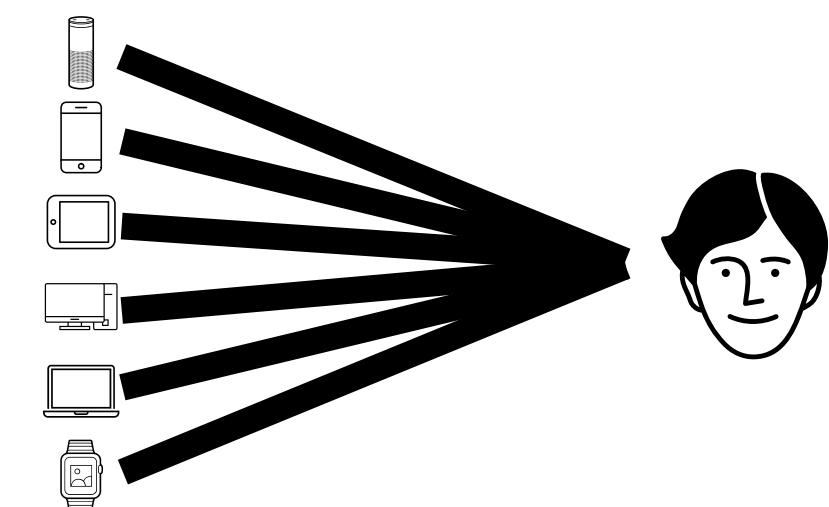
Personal
computing



“One to one”

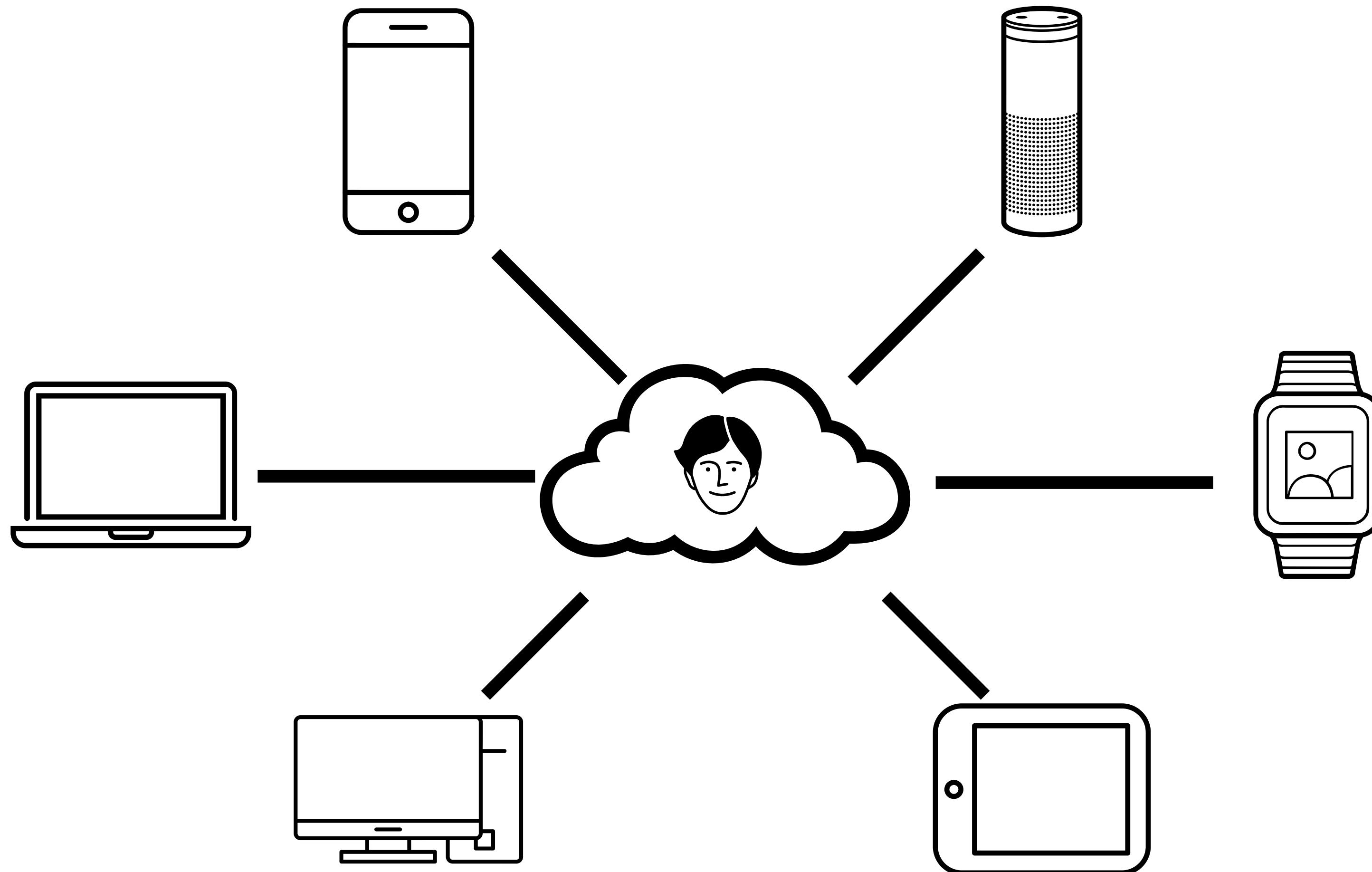


Ubiquitous
computing



“One to many”

One to many, synced over the cloud



Today's class

- Defining ubiquitous computing
- Course overview

Course Overview

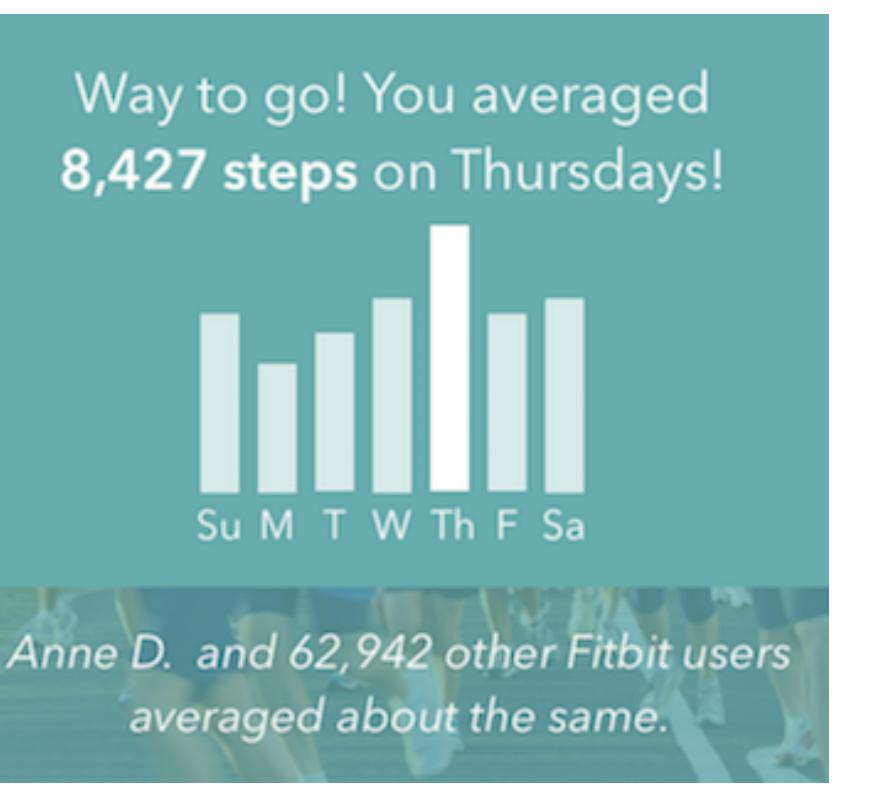
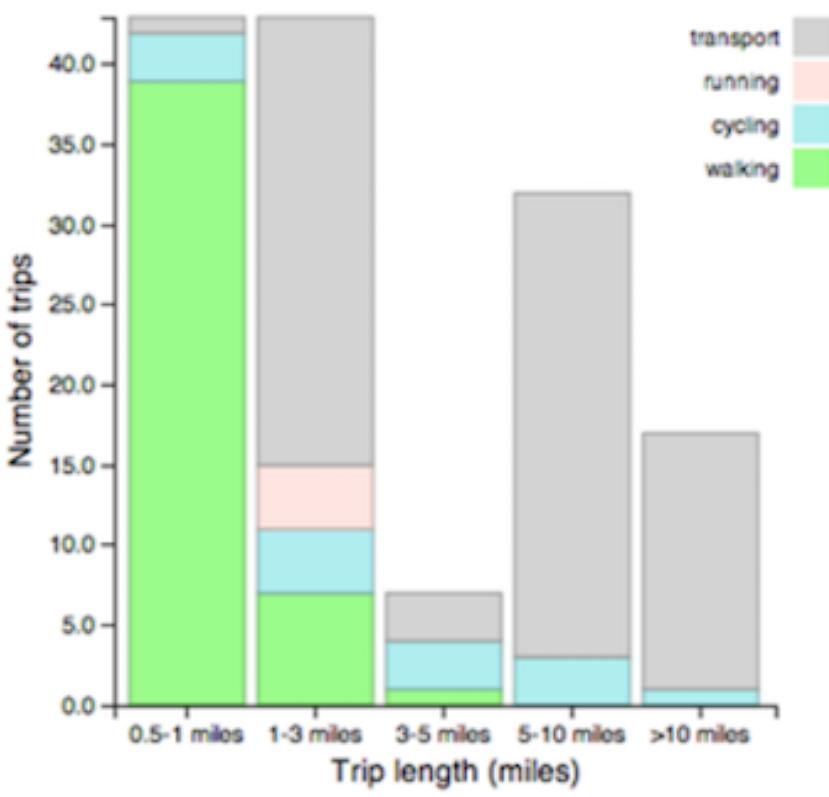
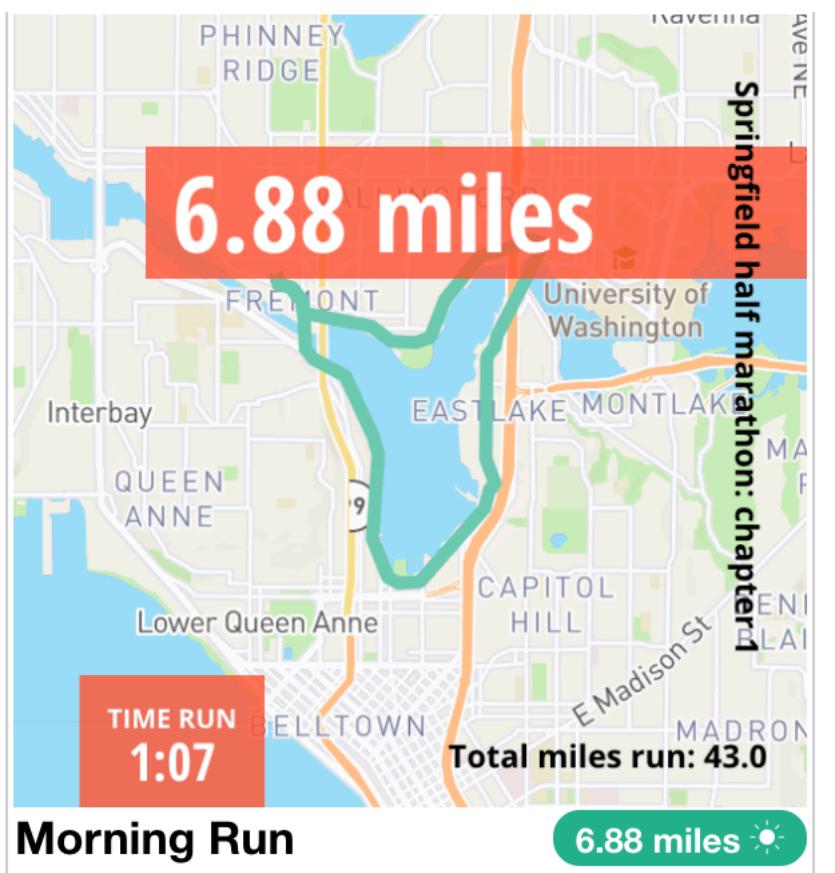
- Who I am
- Staying in touch
- Readings
- Assignments
- Project
- Grading
- Calendar overview

Who I am

- Ph.D. Computer Science & Engineering,
University of Washington 2018
- B.S. Computer Science,
University of Virginia 2012
- Joined UCI Informatics in 2018
Assistant Professor
- Internships at Microsoft & Adobe



Who I am



Who I am

- Broadly speaking, I work on Human Computer Interaction (HCI)
- Ubiquitous Computing is one of my sub-areas of focus
- I examine how ubiquitous technology can be best designed to help people achieve their goals



**Around the call!
Say your name, program & year,
and something fun about you**

Staying in touch

- Web: <http://inf241-wi21.depstein.net/>
- Email me: epstein@ics.uci.edu
- Slack: <https://uci-inf241-wi21.slack.com/>
 - Information will go out to Slack first, and may not go out over email
- Office hours: generally by appointment (send me an email)
 - This & next week are a good time to discuss project ideas

Readings

- Each week will cover a different topic connected to ubiquitous computing
- Readings will emphasize:
 - 1-2 *framing* papers which summarize and contextualize the topic
 - 1-2 *recent* papers of more specific contributions
- Doing the reading is a major component of the course
 - No exams

Readings

- Post “reading queries” to Slack the Sunday night before class
- Short (1-2 sentences)
- Discussion of what the reading(s) made you consider;
not a summary of the reading(s)
 - What did you find interesting or unusual?
 - What aspects of the work were particularly well done?
 - How might this research have informed other research or products you’ve seen?

Readings

- One of you will lead discussion for each class
- Your goal is to be “the expert” on each week’s readings
 - Present on the background of the reading authors
 - Offer context on research that informed or was informed by this work
 - Guide the discussion to cover key points made in the reading
 - Bring in points discussed in the reading reports
 - Ensure a range of voices/perspectives are given the opportunity to speak

Readings

- I have identified framing readings for each week
- Discussion leaders can choose the recent readings
 - I have provided some suggestions from the IMWUT venue, but you can also suggest another reading
- Let me know on Canvas what topics you are most (and least) interested in leading

Assignments

- 2 assignments, focused on giving firsthand experience designing or developing Ubiquitous Computing systems
 - Assignment 1: promoting physical activity
 - Assignment 2: TBD, probably supporting conversational journaling
- You can choose between design (e.g., UX) and development (e.g., programming)

Project

- Expected to be groups of 2
 - Singles and groups of 3 considered
 - Singles very highly discouraged
- Proposal, milestone, report

Project

- The project is intended to produce *novel research* in Ubiquitous Computing
 - Or implementation, study design, etc. in support of later novel research
- For example, you might:
 - Implement a new ubiquitous technology, such as a novel method for sensing
 - Develop and execute a study which contributes some understanding of how people use ubiquitous technology
 - Rigorously evaluate a piece of existing ubiquitous technology
 - Design a ubiquitous technology which critically examines people's practices

Project

- Some of you may have ongoing work that is relevant
 - It's fine, even encouraged, to "count" an ongoing research project for this class
 - So long as it connects to ubiquitous computing in some way
 - You may even be able to recruit classmates to help with your work!
- But I expect that a research project will be new to many of you
 - I'll create a Slack channel shortly with some project ideas
 - If you have an idea already, you can post it to that channel

Grading

- 45% group project
 - 5% project proposal, 10% milestone report, 30% final report
- 30% assignments
 - 15% assignment 1, 15% assignment 2
- 10% reading reports
- 5% leading discussion
- 10% participation

Course Overview

- Who I am
- Staying in touch
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- Assignments
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Course Overview

- If you expect lectures and assignments on processing signals, printing nanomaterials, etc., there's a little, but not much
 - In part because I do not have the background necessary to teach such skills
 - But I also find creating new knowledge much more fulfilling
- You may use these skills in your projects, but you will be expected to pick them up on your own

Course Overview

- Instead, you will leave this class with:
 - Context about where ubiquitous computing fits in the history of technology
 - A better understanding of how to make ubiquitous technologies useful for people
 - The ability to critique a new device or system and improve upon it
 - Ideally, a research contribution in ubiquitous computing through your project

IN4MATX 241: Ubiquitous Computing

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History of Ubiquitous Computing

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