

# Designing Interactive Systems I

## Lecture 5: History I

### From Abacus to Macintosh

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<http://hci.rwth-aachen.de/dis>

# Radically New Interface



Released in 1984

Image: Buxton Collection

<http://research.microsoft.com/en-us/um/people/bibuxton/buxtoncollection/>

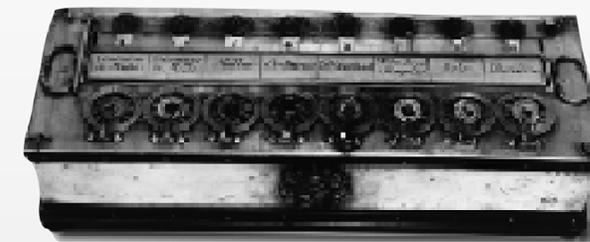
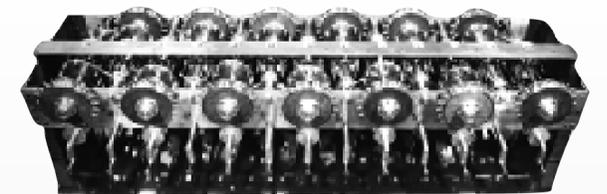
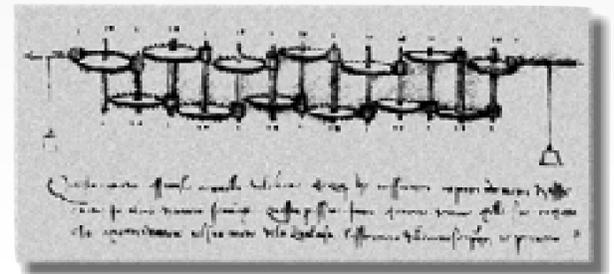
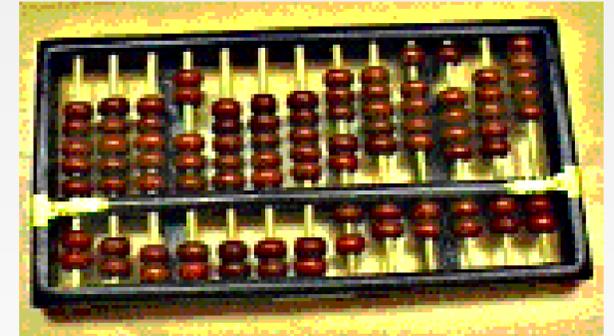
“Picasso knew everything about art history,  
because he had to know the rules  
before he could break them.”  
— Bill Buxton, CHI '11

# Lesson from HCI History

- **No Single Hero:** Even interfaces that seem “radically new” were built on lots of previous iterations (mouse, touch screens,...)

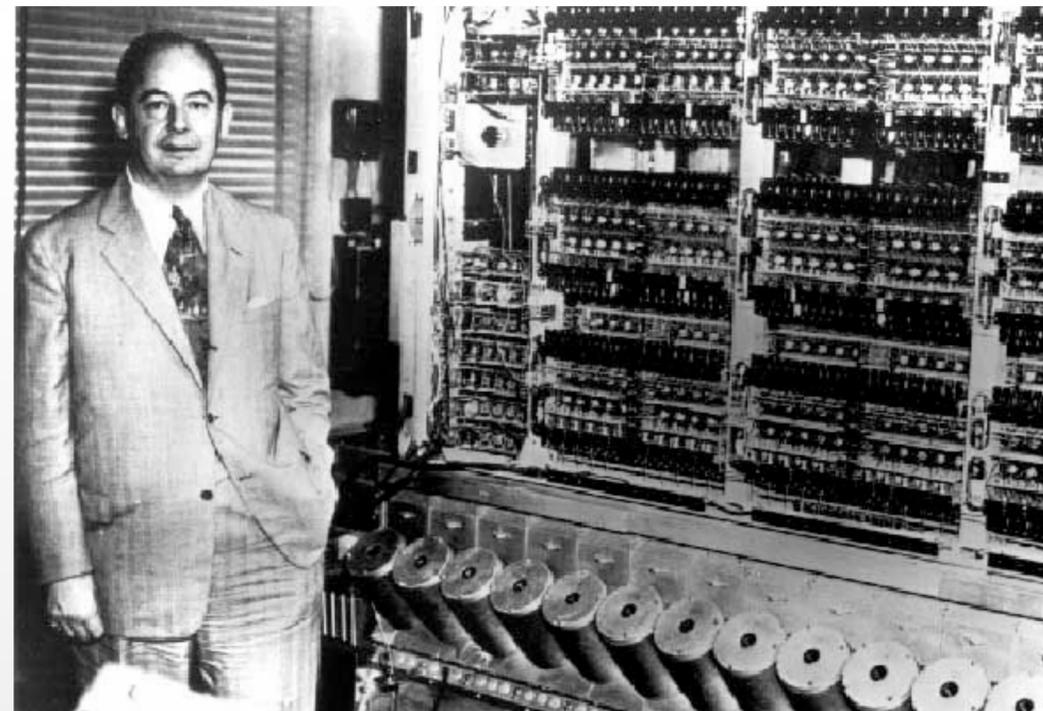
# Pre-Computing

- Abacus (Babylon, ~ 2000 BC): no UI
  - First known mechanical calculating aid
- Da Vinci's mechanical calculator (1500s)
  - First design of mechanical calculator
- Pascal's Arithmetic Machine (1642)
  - First working model, +/-
  - ~ Leibniz, Schickard
- Driving force
  - Early: direct representation of conceptual model
  - Later: increasing level of abstraction



# First Computers

- Plugboards (e.g., ENIAC 1946)
  - Just data, no program memory



Von Neumann in front of ENIAC, 1946

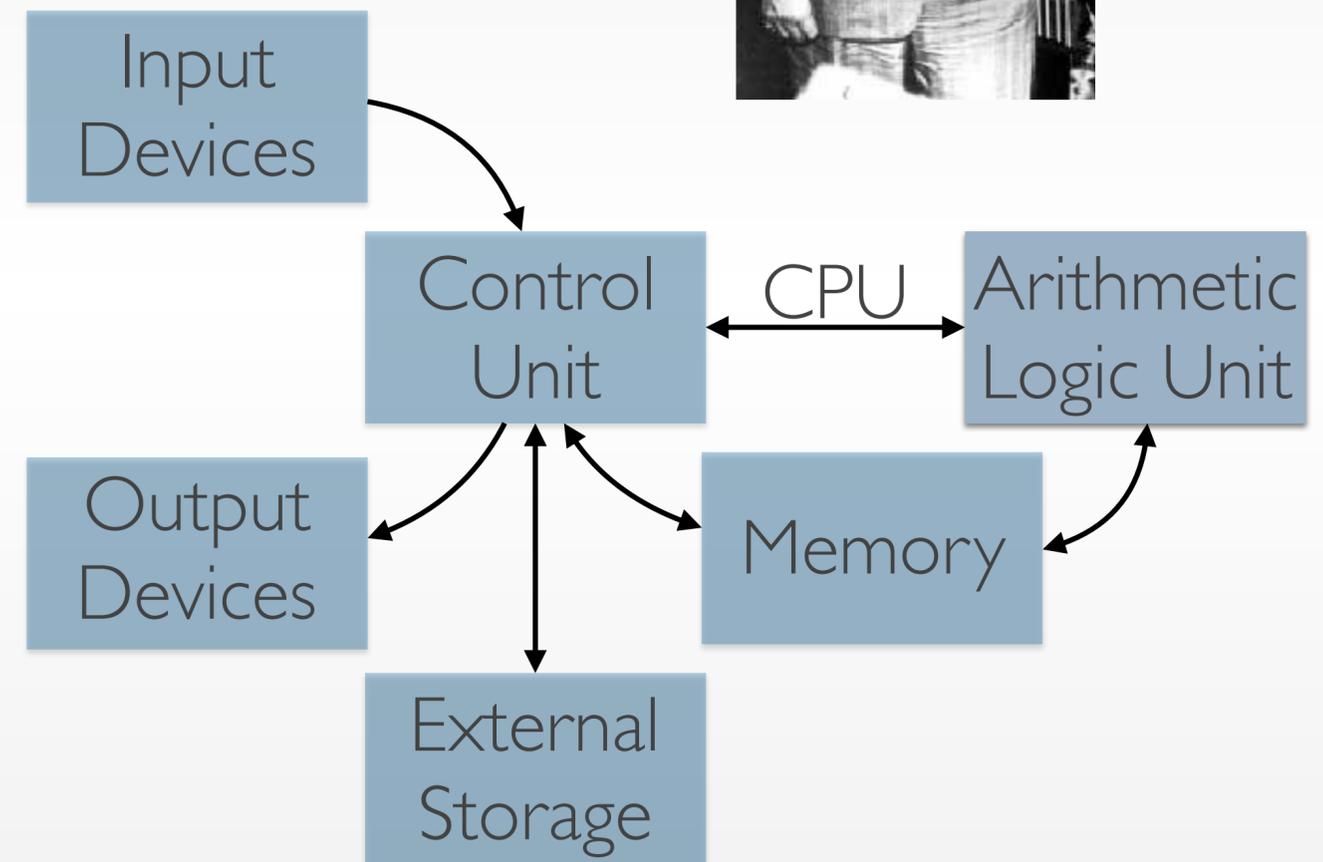


IBM 557 plugboard and resistor plugs, ca. 1965

# First Computers



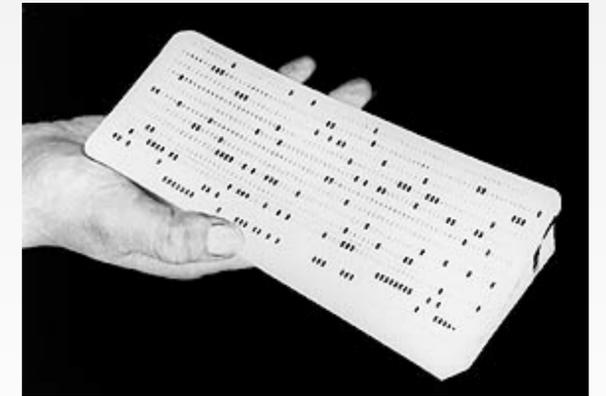
- Von Neumann architecture (1945)
- Key advances:
  - Defined basic components of today's computer
  - Storing instructions in memory
- ~ Zuse Z1–Z4 (1936–50)



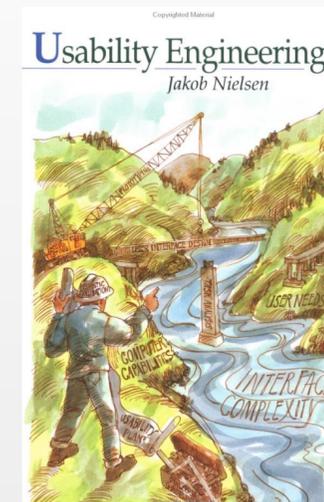
Von Neumann architecture

# Mainframes & Batch Processing

- Prepare data on punch cards—submit—wait for result as printout offline
- Mode of interaction on mainframes of 60's & 70's
- Efficient use of machine; no waiting for human input
- “0-D user interface” [Nielsen’93]
  - Single point in time for submission of the batch job as a single unit



Machine for punching cards





# Time Sharing

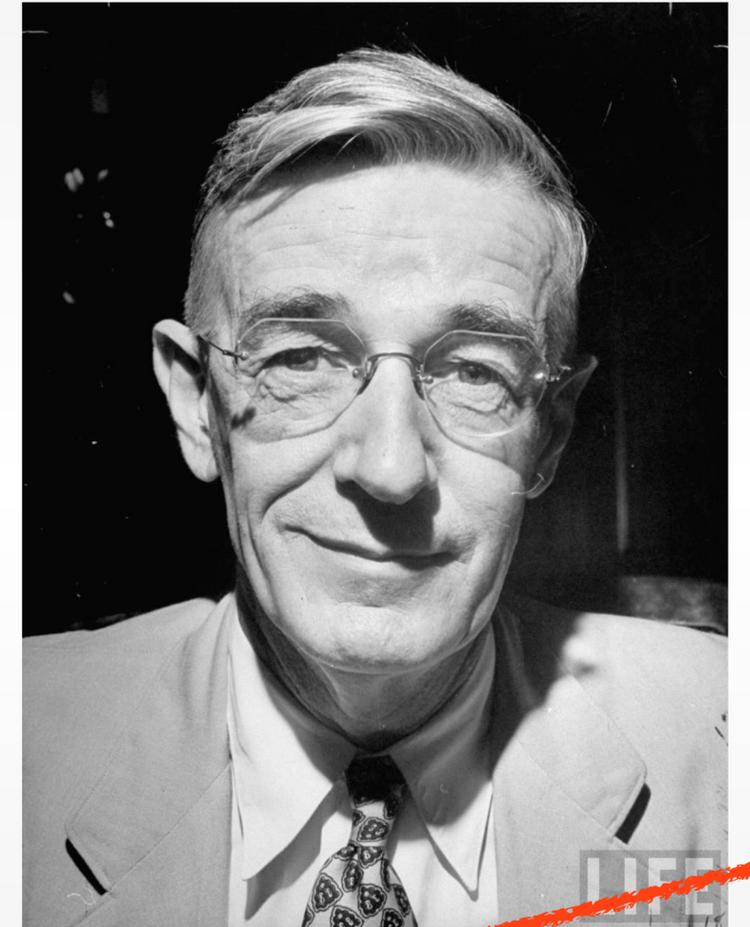
- Key advances: Provide general purpose interactive response efficiently to many users simultaneously with one computer
- MIT CTSS/ITS/Unix etc.
- First teletypes, then glass teletypes
- Addressable character Terminals
- Command-line interfaces
- “I-D interfaces” [Nielsen’93]
  - Enter and edit one command line, then hit SEND key



Teletype

# Memex: A Vision of Computing

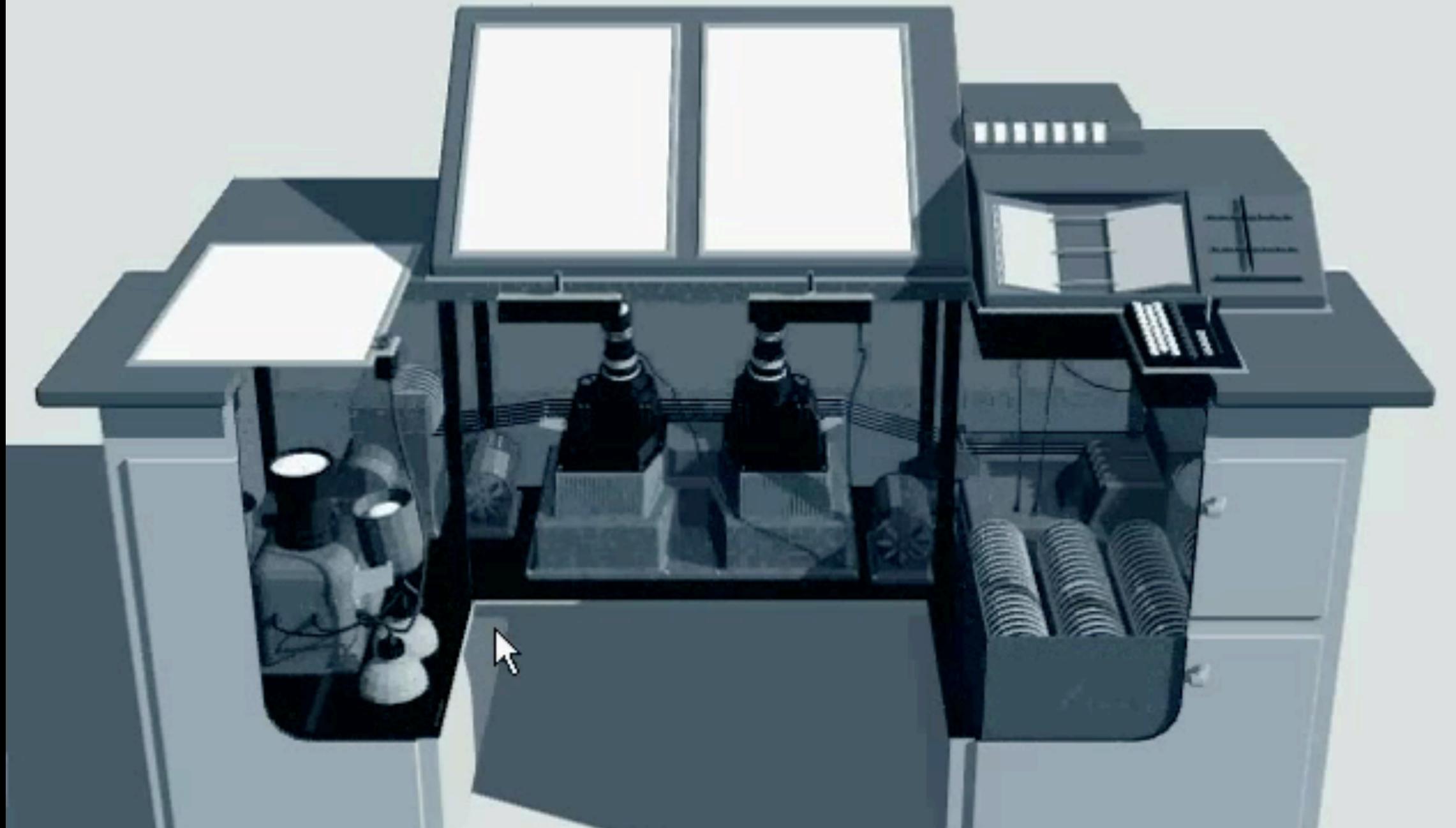
- Vannevar Bush: “As We May Think”, The Atlantic Monthly, July 1945
- The **Memex** is a device storing all of an individual’s books, records, and communications
- Information may be consulted with exceeding speed and flexibility
- Predicted: Hypertext, PC, internet, WWW, speech recognition, online encyclopaedias



**Reading Assignment**

Demo

Done



Memex Animation from SIGIR '95  
<http://www.youtube.com/watch?v=c539cK58ees>

# Radar Systems

- Example: SAGE Air Defense (MITRE, 1963)
- Key advances: Real-time response for complex (but specific) tasks, including graphics; First GUI (sort-of)



SAGE control center (1958)

# Sketchpad (Sutherland, 1963)

- First interactive computer graphics program
- Key advances: Techniques for direct manipulation of graphics on a screen, including constraint satisfaction



# Part 3: Historical Perspective: "Computer Sketchpad"

(not shown  
at CHI'83)

(Excerpt)

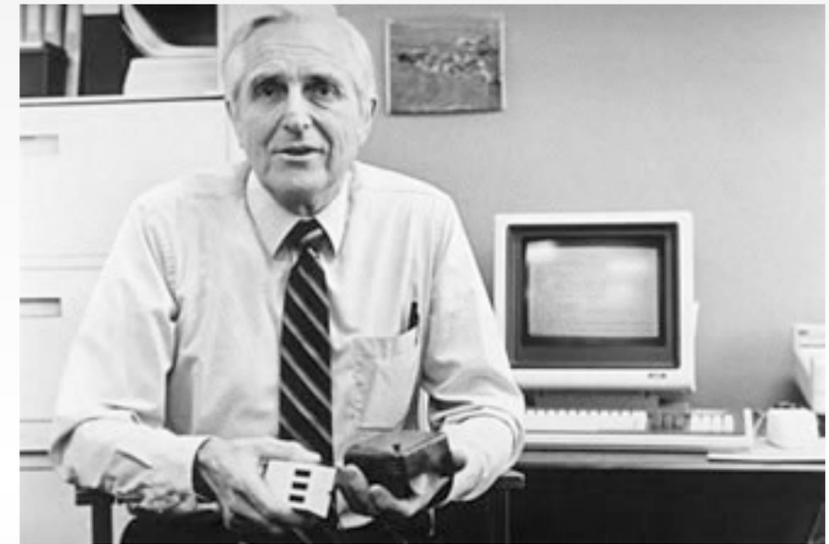
- \* a classic and beautiful system
- \* first CAD system
- \* introduced the concept of the graphical user interface
- \* introduced the concept of the graphical user interface

Part 1: [https://www.youtube.com/watch?v=USyoT\\_Ha\\_bA](https://www.youtube.com/watch?v=USyoT_Ha_bA)

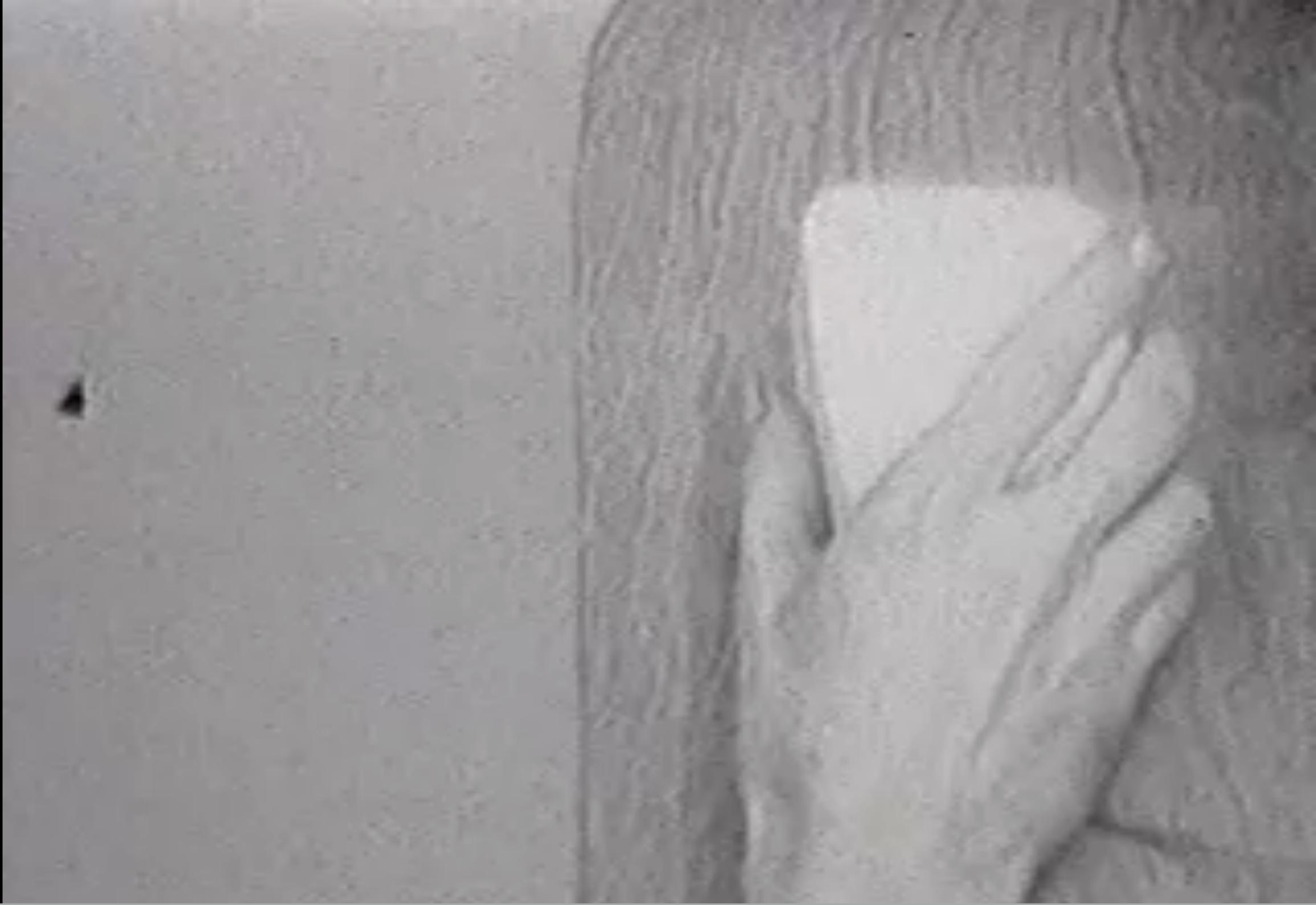
Part 2: <https://www.youtube.com/watch?v=BKM3CmRqK2o>

# NLS: oN-Line System (Engelbart, 1968)

- Word processing and linking
- Key advances: Mouse, windows, hyperlinking, video conferencing, revision control, word processing, and collaborative real-time editor
- Focused on enhancing expert performance, not on initial ease of use
  - Failed in user tests because of its complexity
  - Perfect for trained users with 4 hands :)
- But: “Mother Of All Demos” :)



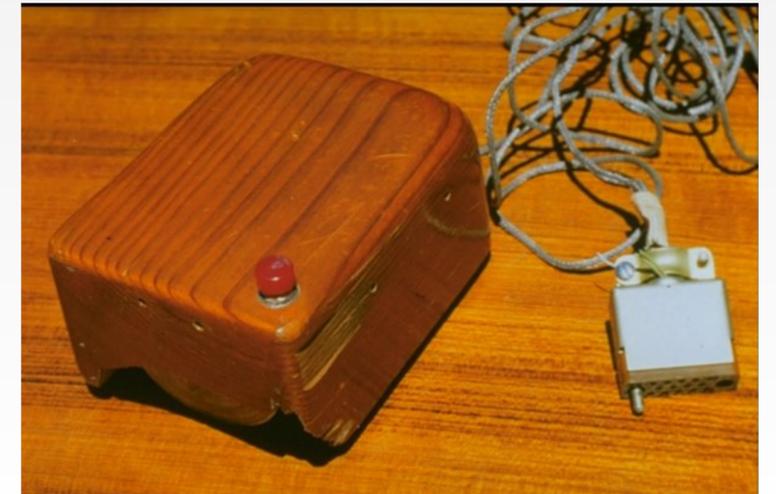
[www.dougenelbart.org](http://www.dougenelbart.org)



Mother of All Demos: <https://www.youtube.com/watch?v=yJDv-zdHzMY>

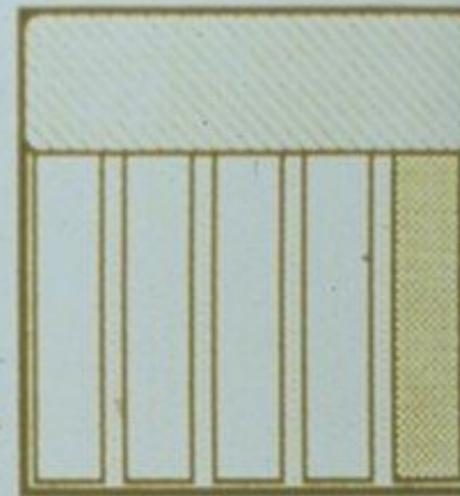
# Engelbart's First Mouse (1964)

- Two wheels, wire is on the back, one button
- Won the test when comparing with other pointing devices at the time:
  - Light pen, tracking balls, foot-pedal, knee-operated devices, head-operated devices



[www.dougenelbart.org](http://www.dougenelbart.org)

One-Handed,  
Chord Keyset:



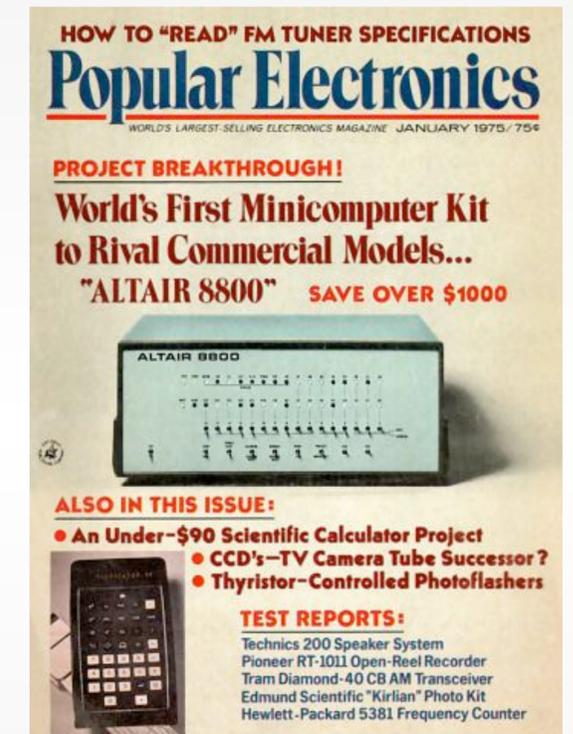
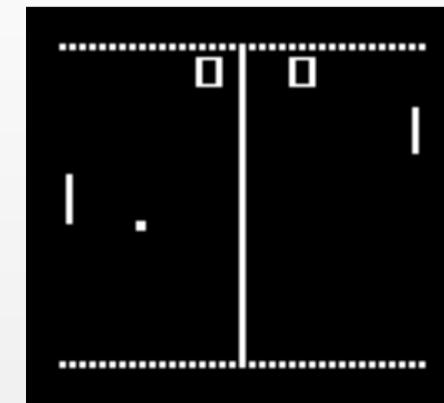
Code for "a" →

b	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
d	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
g	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
h	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
x	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
y	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Memex Complexity: Chording Keyboard  
[www.dougengelbart.org](http://www.dougengelbart.org)

# Early Hobbyist PCs & Games

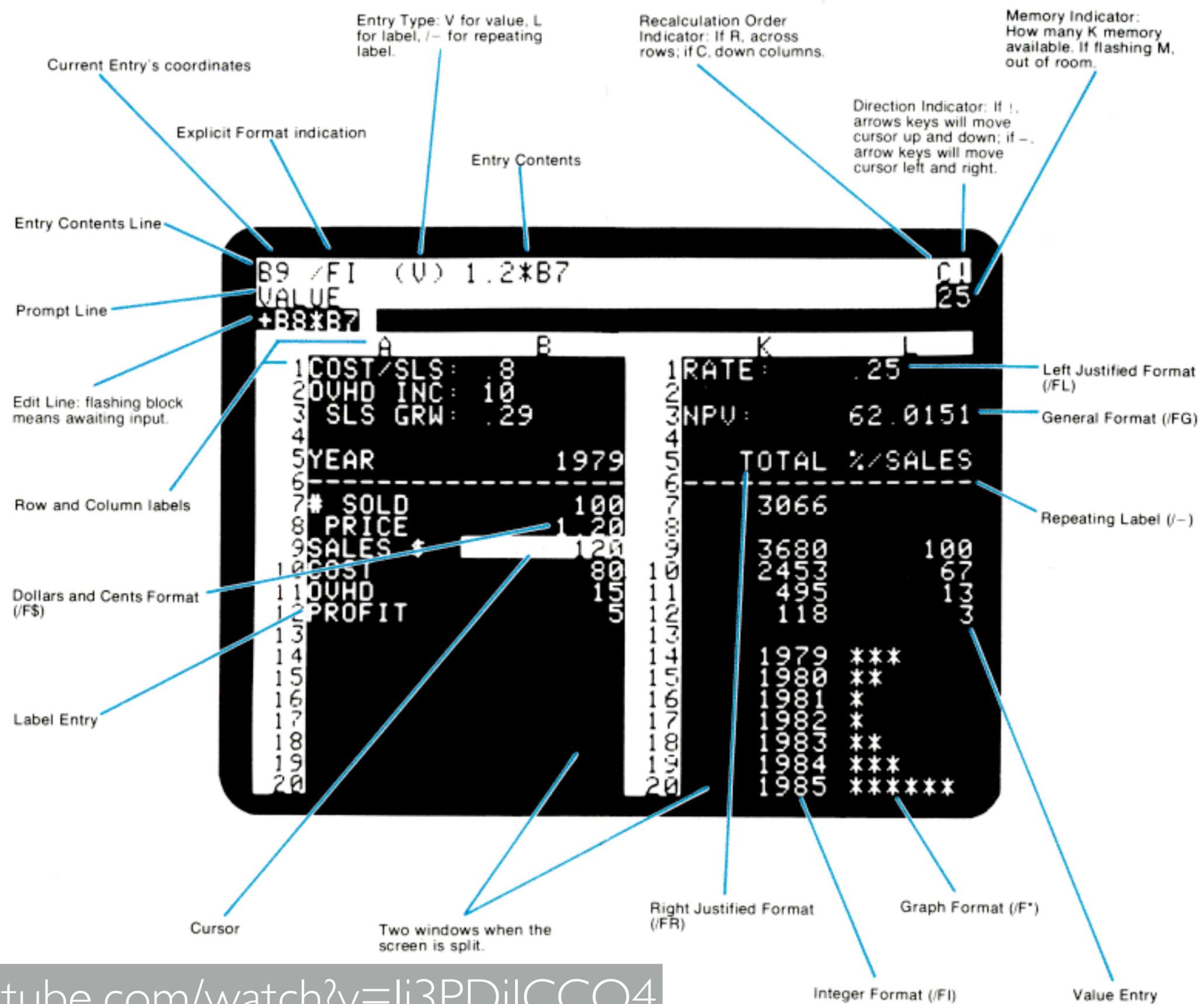
- Atari PONG (Bushnell, 1972)
- MITS Altair (1975)
- Key advances: Machines cheap enough to be used by someone other than government and big business or research labs



# Early Personal Computers

- Apple II, 1977
  - Key advances: First general purpose personal computer used widely in business (because of VisiCalc)
- IBM PC, 1981
  - Key advances: Making the PC respectable to business in general by putting the IBM label on it
- Features
  - Character terminal
  - Text UI standards (IBM CUA)
  - Graphics: non-standard





<https://www.youtube.com/watch?v=li3PDjjCCQ4>

# Bitmap Displays and GUIs

# Xerox Alto (PARC, 1973)

- 2.5MB removable HD (pre-floppy), 128-256K RAM, 600x800, mouse, Ethernet, not commercialized
- Smalltalk platform, Bravo WYSIWYG editor, email
- Key advances:
  - Bitmap Display and GUI
  - Menus, windows, pointing, dragging, etc., as we now know them



# Xerox Star (1981)

- Introduced window systems commercially, \$17K
- Key advances: Integrated networked document environment, WYSIWYG text editing, icons, property sheets, window management, ...
- Built to improve Alto
- Unique design process (8 years of prototyping)
- “2.5-D interfaces” [Nielsen’93]
  - Interacting with 2D display + overlapping windows



# XEROX

Part 1: <https://www.youtube.com/watch?v=Cn4vC80Pv6Q>

Part 2: <https://www.youtube.com/watch?v=ODZBL80JPqw>



Xerox Star keyboard and mouse  
[www.digibarn.com](http://www.digibarn.com)

# Star: Design Lessons

- ✓ Design first, then code
- ✓ Objects & Actions
- ✓ Detail
- ✓ Graphic designers
- ✓ DIA cycle



# But:

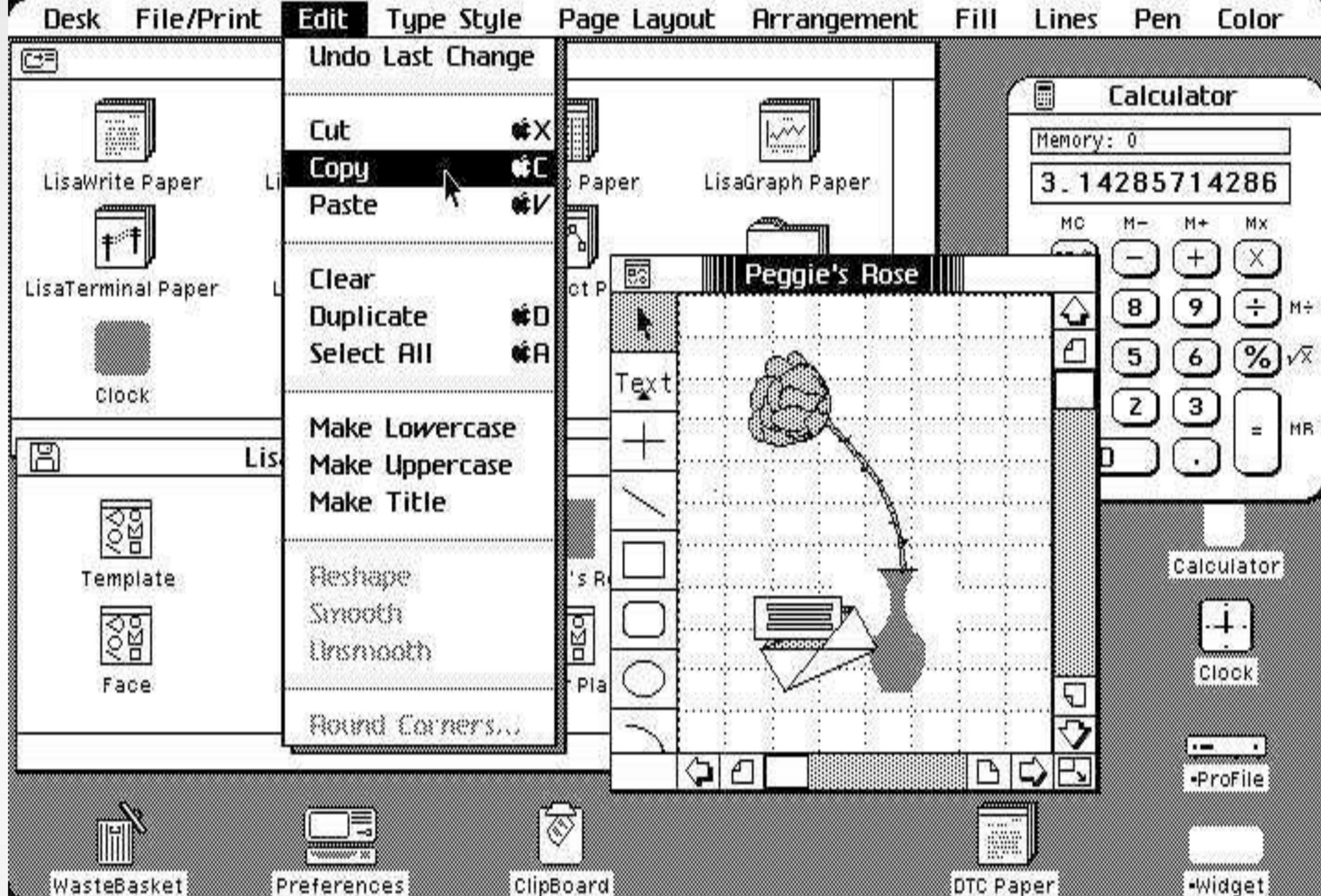
- ✗ Industry trends
- ✗ Customer focus
- ✗ Extensibility
- ✗ Responsiveness
- ✗ Metaphor limits
- ✗ Selling radical innovation



# Apple Lisa (1983)

- Apple's first bitmapped-GUI computer
- Inspired by Alto (not Star) — One-button mouse
- Key advances: Fixed menu bar (instead of pop-up menus: Fitts' Law)
- But: underpowered, bad marketing (\$10K)

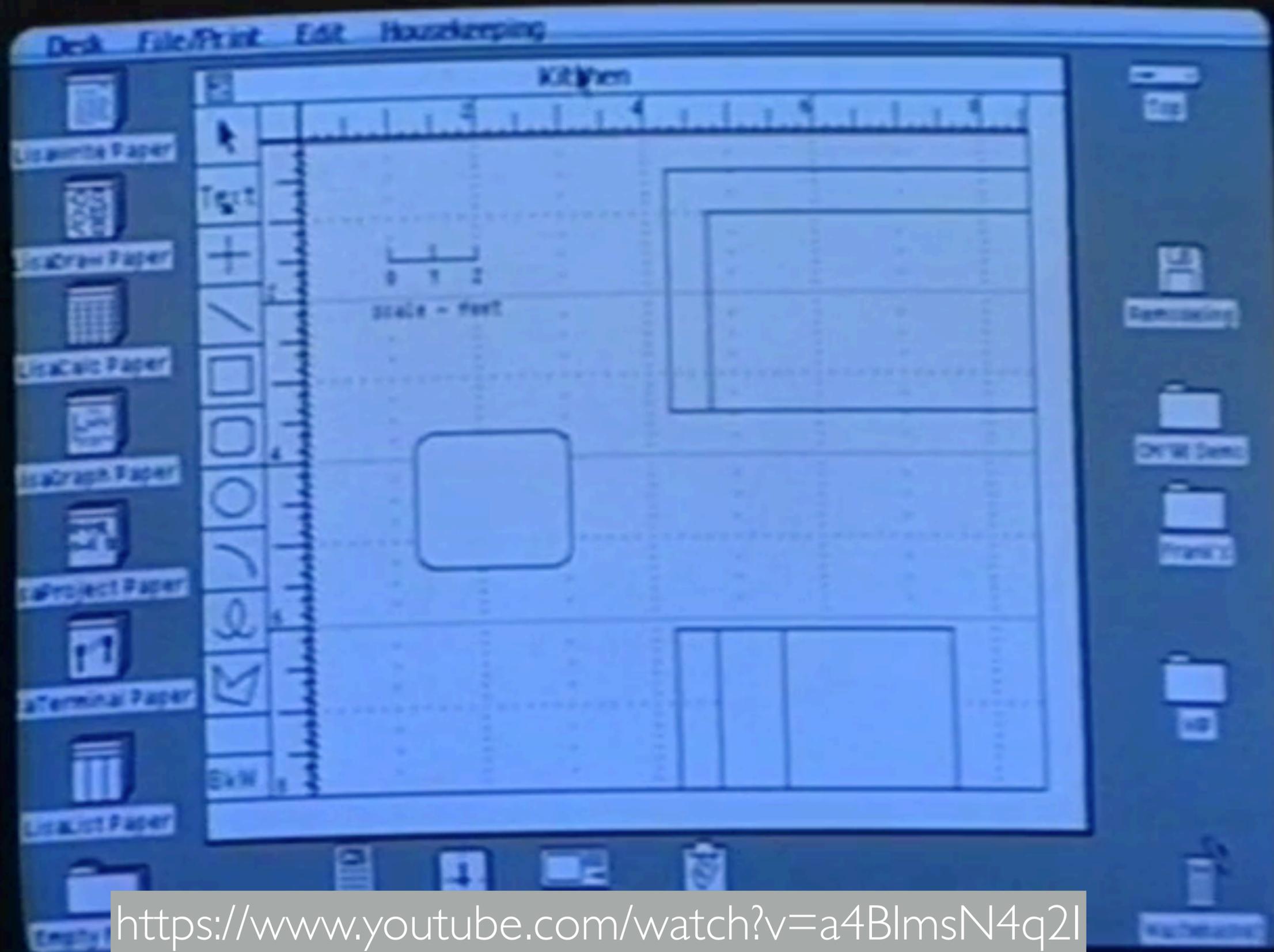




Lisa User Interface  
[Craig, 1993]



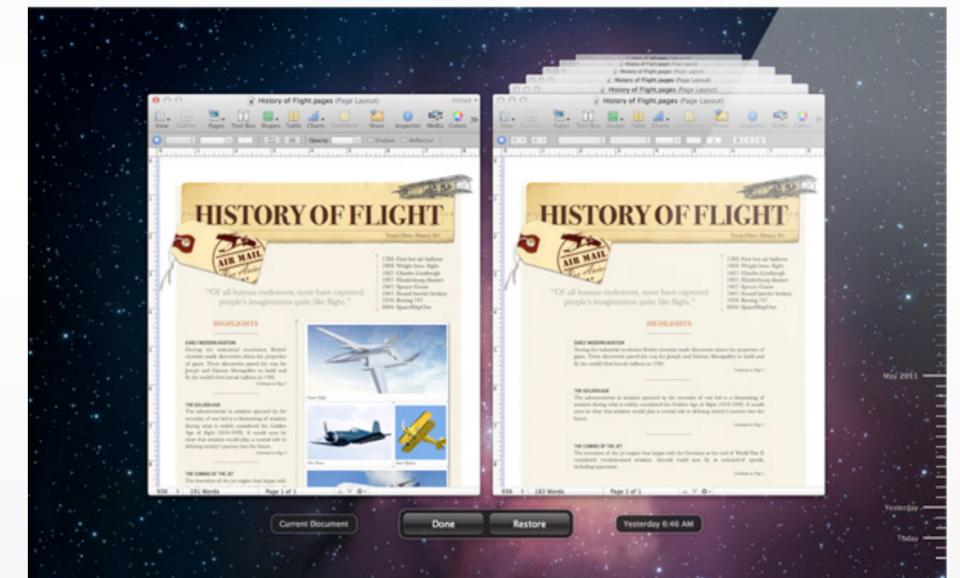
Auto Save in Lion (2011)  
<http://www.apple.com/macosx/>



<https://www.youtube.com/watch?v=a4BlmsN4q2I>

# No Need To Save: Why History Matters

- Apple, 2011: “New feature: Documents are saved automatically and continuously—only need to save explicitly for checkpoints!”
- Relaunching an application brings back all open documents in their last state
- Guess what? Lisa had these features in 1983!
  - Got lost with Mac due to hardware/software performance limitations at the time
- History tends to repeat itself — although 2011 adds better versioning UI



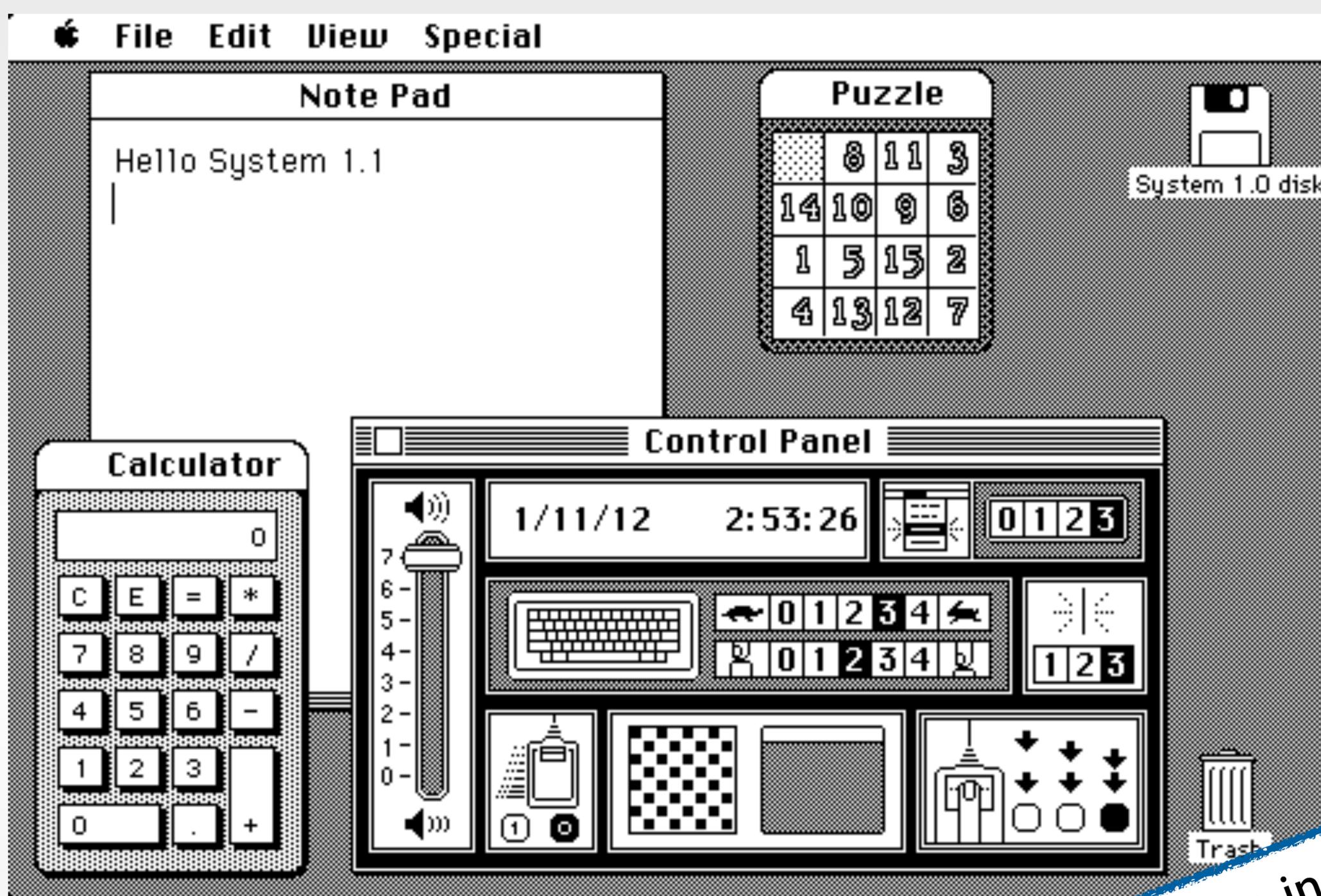


<https://www.youtube.com/watch?v=2zfqw8nhUwA>

# Apple Macintosh (1984)

- Lisa follow-up
- Key advances:
  - First commercially successful WIMP system, \$2500
  - GUI affordable to huge new user community
  - Targeted at hobbyists, not just office use
  - Most consistent commercial WIMP UI
    - Macintosh Human Interface Guidelines
    - Apple Evangelists
- MacPaint & Quickdraw now open source
  - (<http://www.computerhistory.org/highlights/macpaint/>)





## Macintosh System 1.1



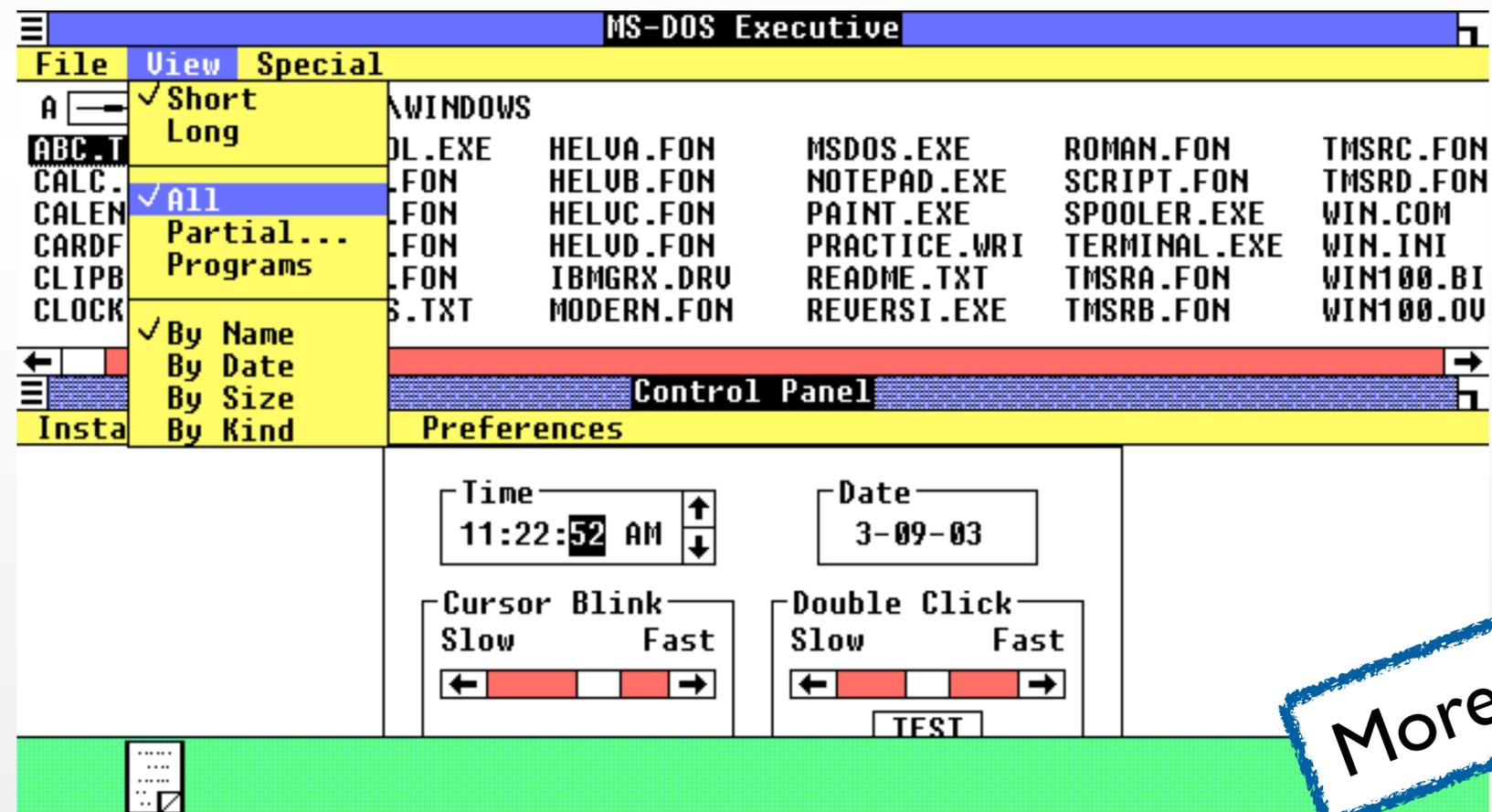


elRellano.com

<https://www.youtube.com/watch?v=EtuDS0ntaJY>

# Microsoft Windows (1985)

- Key advances: Bringing Alto/Star/Mac interaction style to huge populations of DOS and Unix computers



More in DIS2

[www.guidebookgallery.org](http://www.guidebookgallery.org)

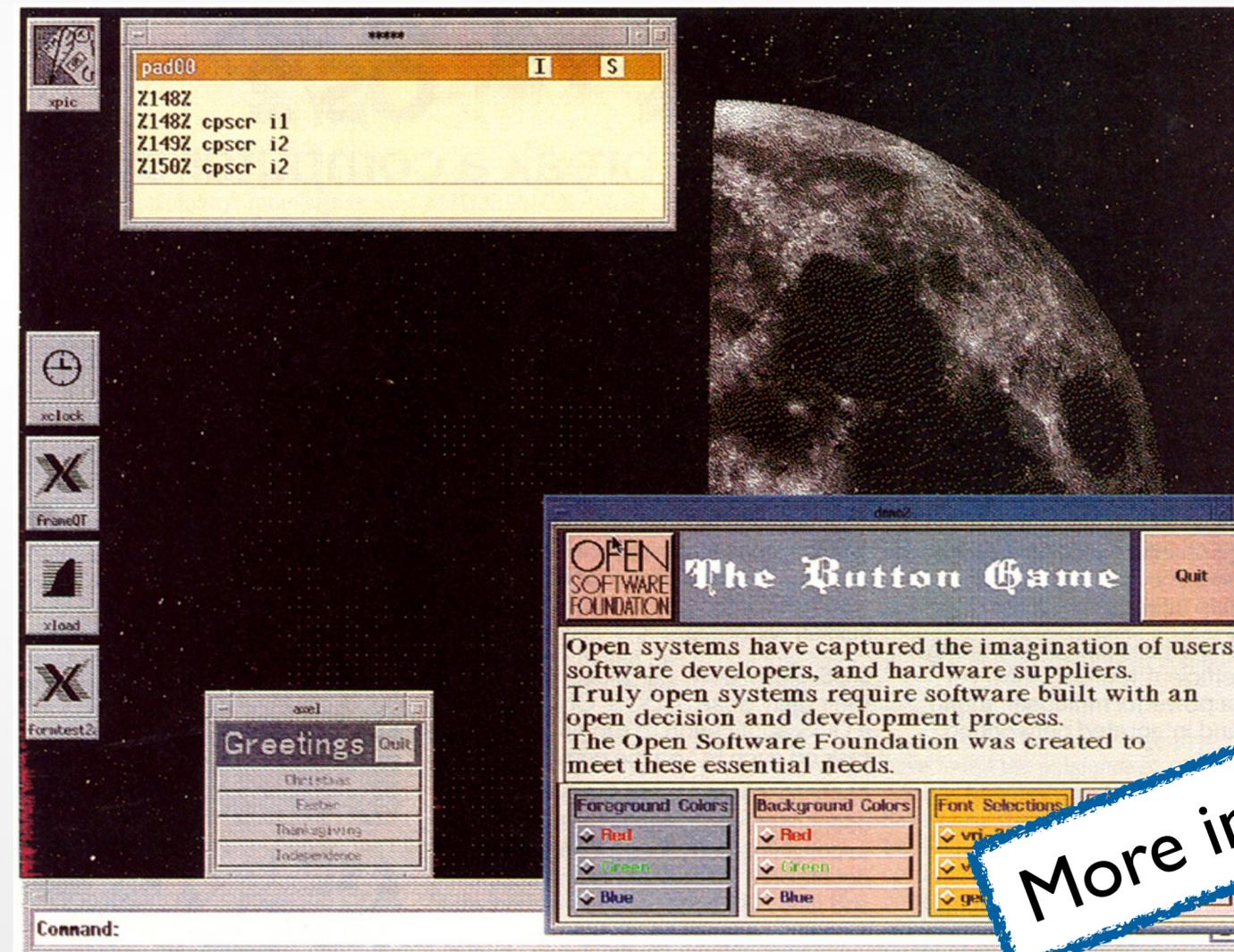
# Steve Ballmer: Developers



[https://www.youtube.com/watch?v=Vhh\\_GeBPOhs](https://www.youtube.com/watch?v=Vhh_GeBPOhs)

# OSF/Motif (1980's)

- Key advances: OO toolkit architecture (simpler dev.)



More in DIS2

[www.guidebookgallery.org](http://www.guidebookgallery.org)

