

Designing Interactive Systems I

History I – From Abacus to Macintosh

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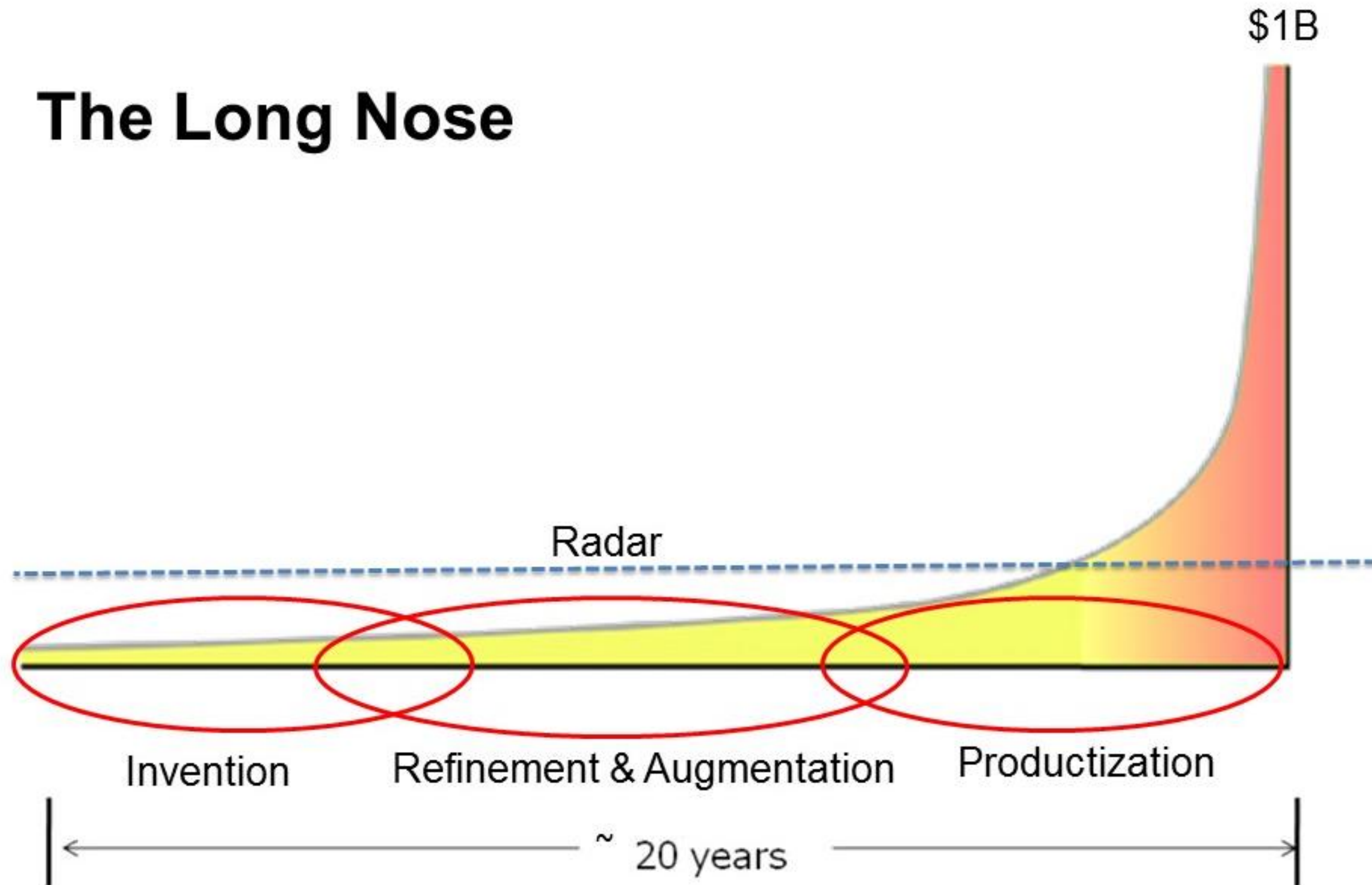
Radically New Interface



Image: Buxton Collection
research.microsoft.com/en-us/um/people/bibuxton/buxtoncollection/

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

The Long Nose



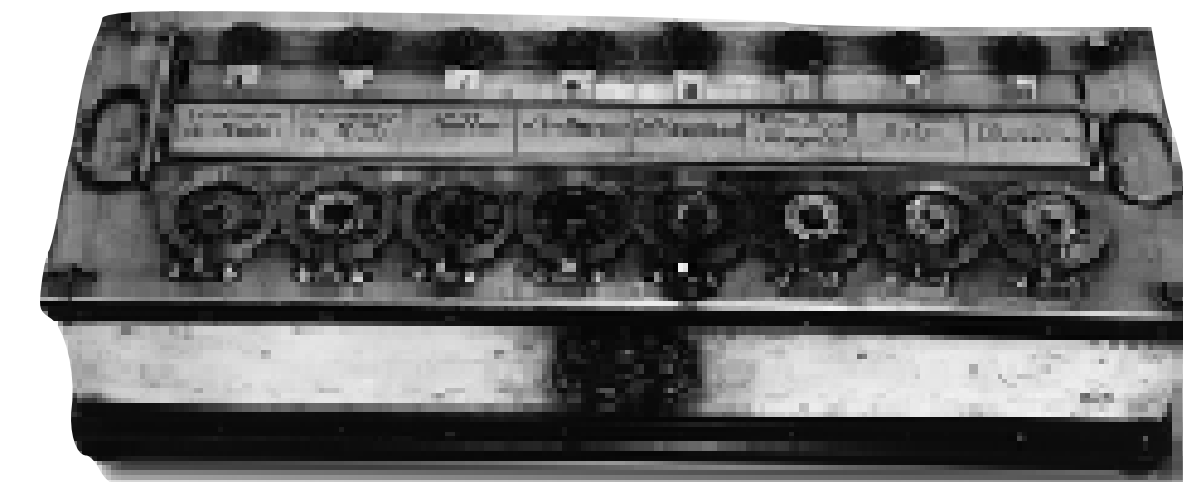
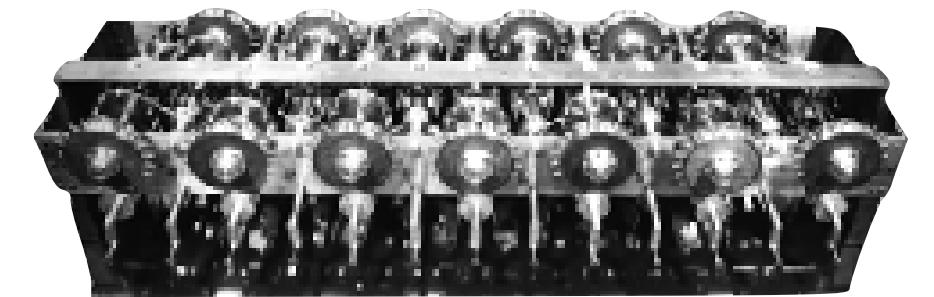
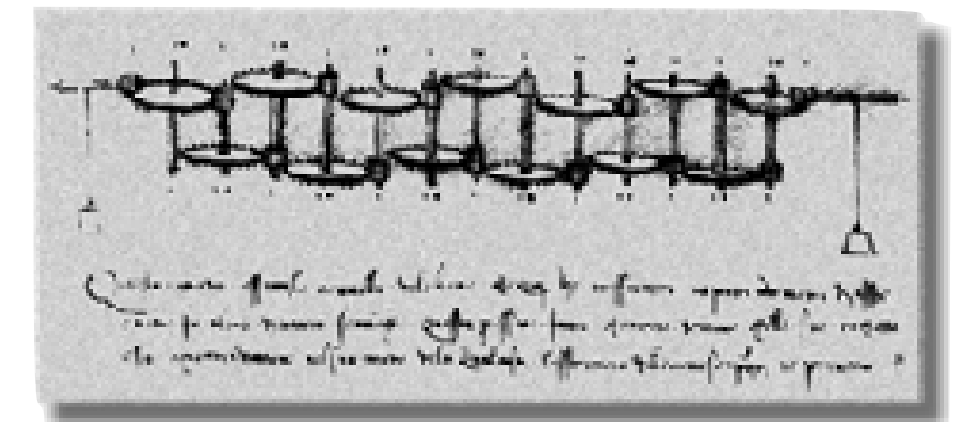
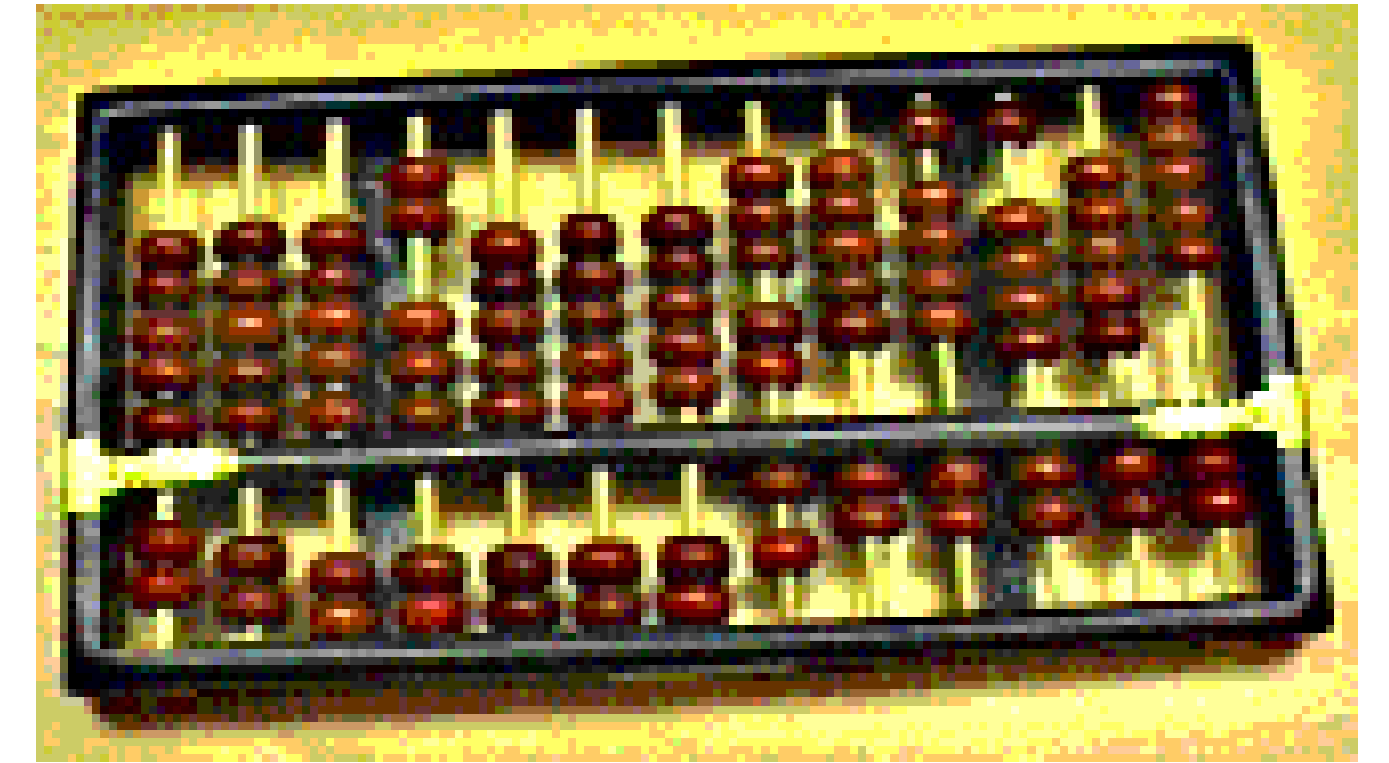
Bill Buxton, The Long Nose of Innovation, BusinessWeek 2008

**“Picasso knew everything about art history,
because he had to know the rules
before he could break them.”**

— Bill Buxton, CHI '11

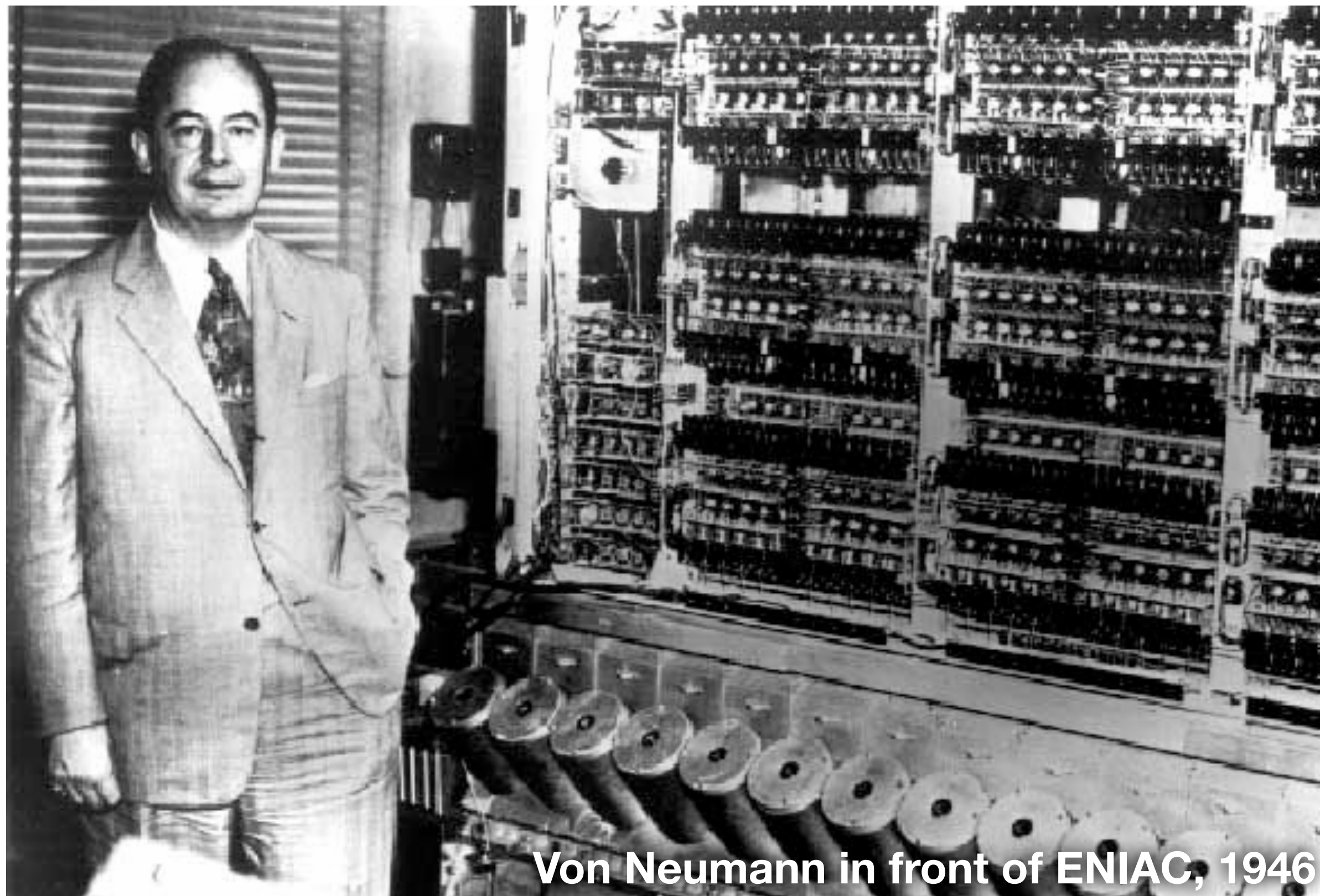
Pre-Computing

- 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

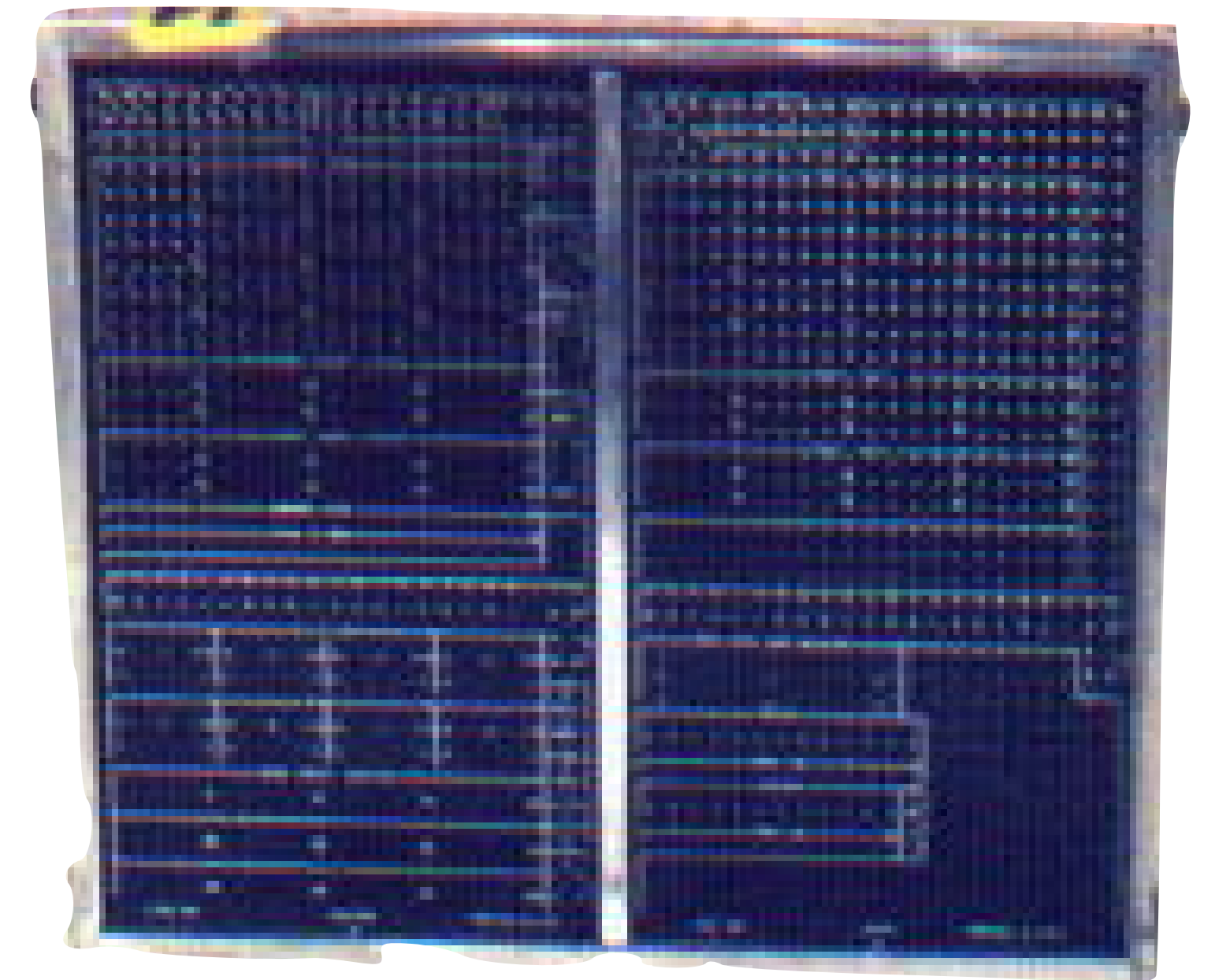


First Computers

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



Von Neumann in front of ENIAC, 1946

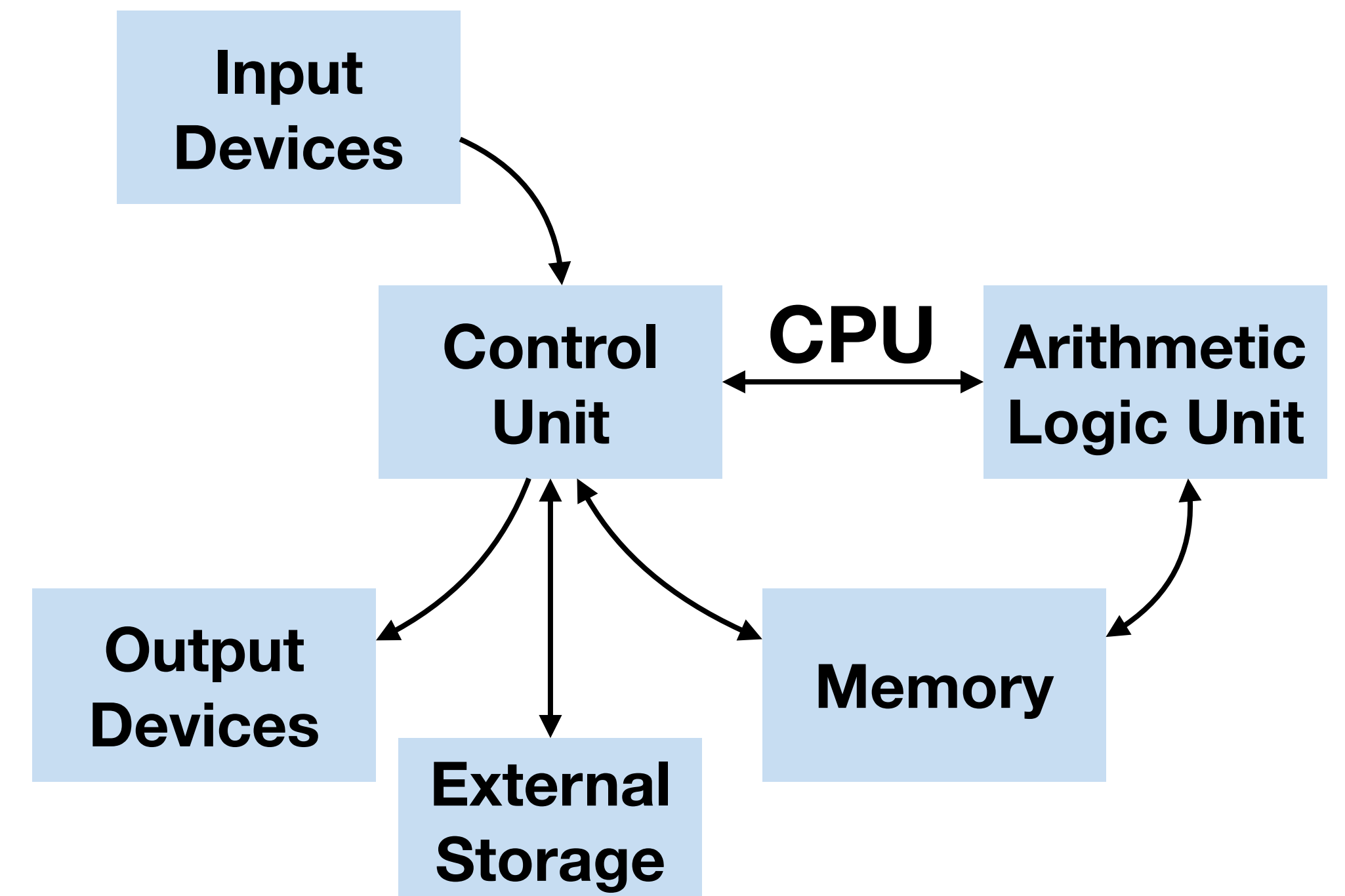


IBM 557 plugboard and resistor plugs, ca. 1965



First Computers

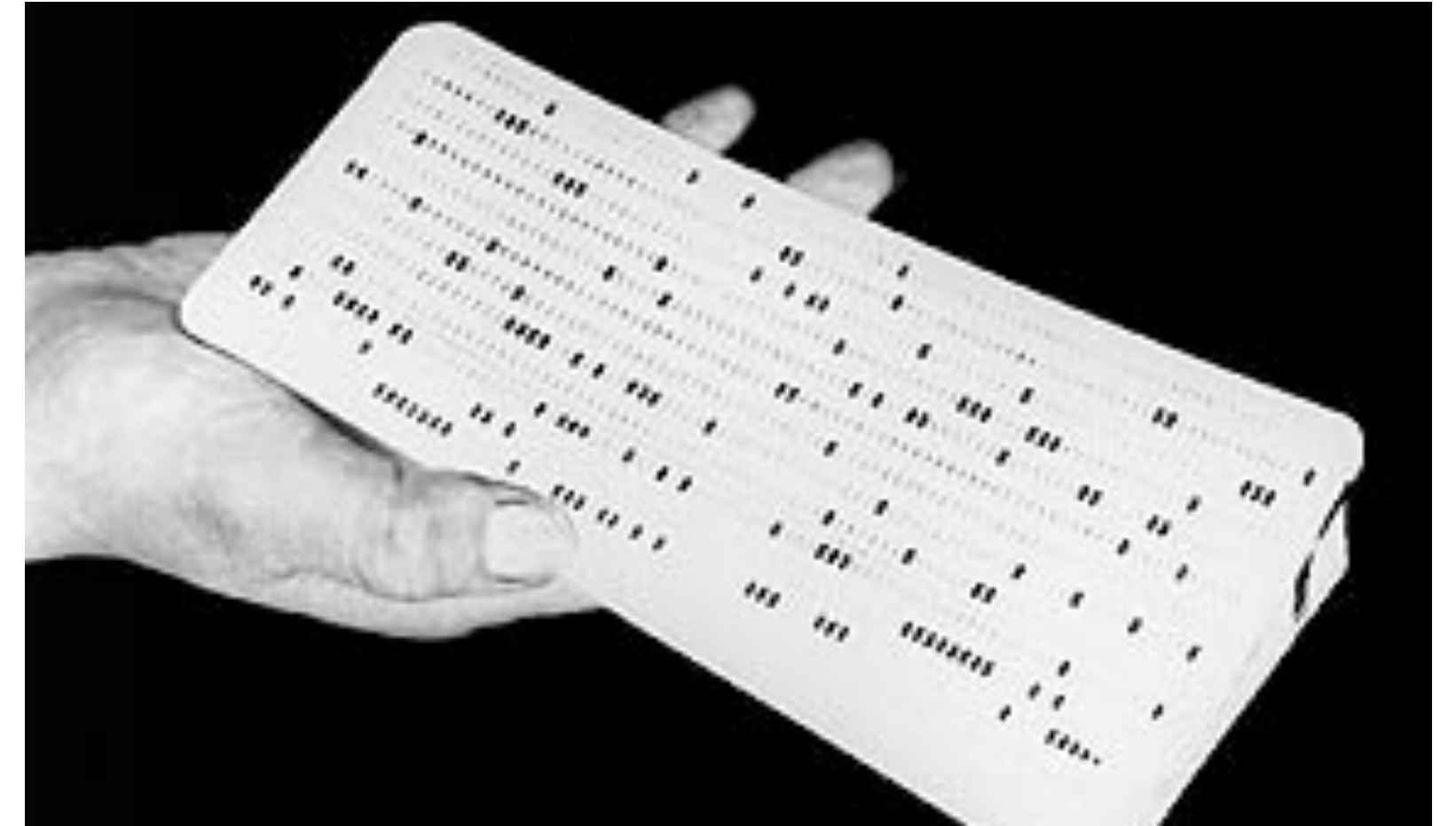
- Von Neumann architecture (1945)
- Key advances:
 - Defined basic components of today's computer
 - Storing instructions in memory
- ~ Zuse Z1–Z4 (1936–50)



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: Usability Engineering]
 - Single point in time for submission of the batch job as a single unit



Machine for punching cards

Transaction Systems

- SABRE system (1960)
- IBM 3270 (1971)
- Key advances: Immediate response for lots of users from distant terminals (for a special-purpose application)

```
VM/ESA ONLINE

      VV      VV MM      MM
      VV      VV MMM     MMM
      VV      VV MM M     M MM
      VV      VV MM M     M MM
      VV      VV MM M M    MM
      VV      VV MM M    MM
      VV      VV MM M    MM
EEEEEEEEEEEE SSSSSSSSSSS MAAAAA
EE      VV SS      MM SS      AA      AA
EE      VVSS     MM      AAM      AA
EE      VSS      MM      AAMM     AA
EEEEEEEEEEEE SSSSSSSSSSS AAAAAAAAAAAAA
EE      SS      SS      AA      AA
EE      SS      SS      AA      AA
EE      SS      SS      AA      AA
EEEEEEEEEEEE SSSSSSSSSSS AA      AA

Fill in your USERID and PASSWORD and press ENTER
(Your password will not appear when you type it)
USERID   ==> █
PASSWORD ==>
COMMAND ==>
```

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
- “1-D interfaces” [Nielsen’93: Usability Engineering]
 - Enter and edit one command line, then hit SEND key

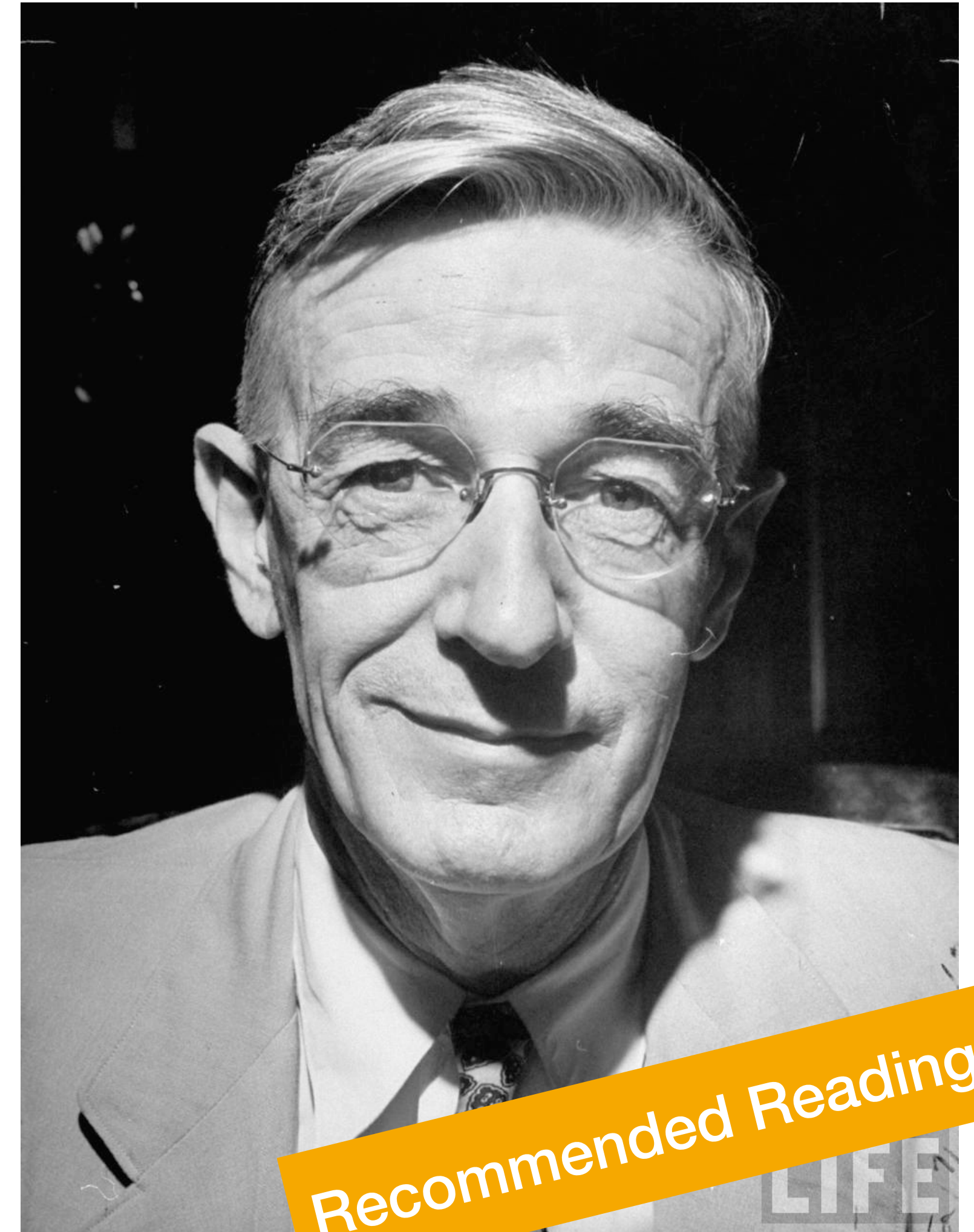


Teletype



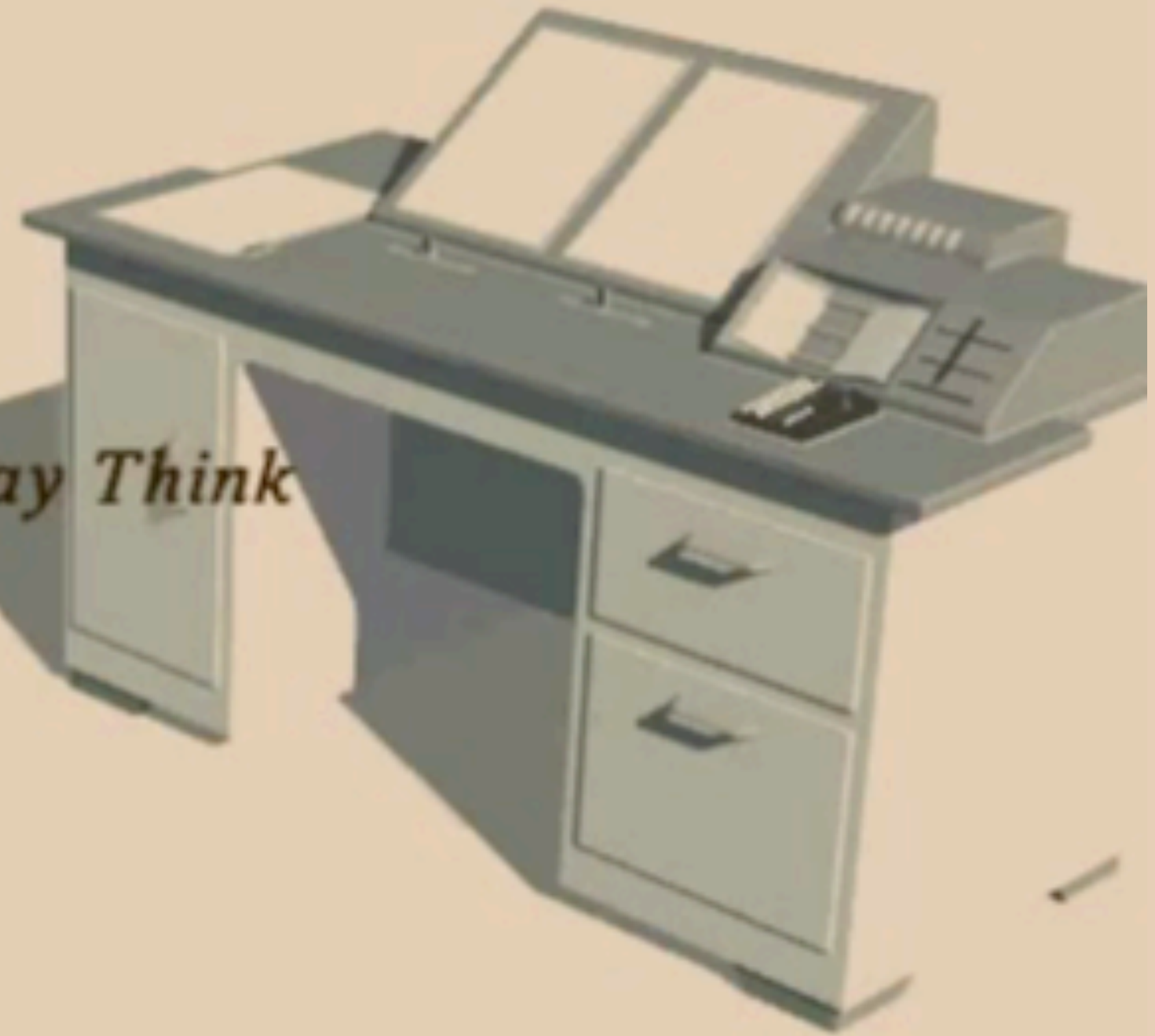
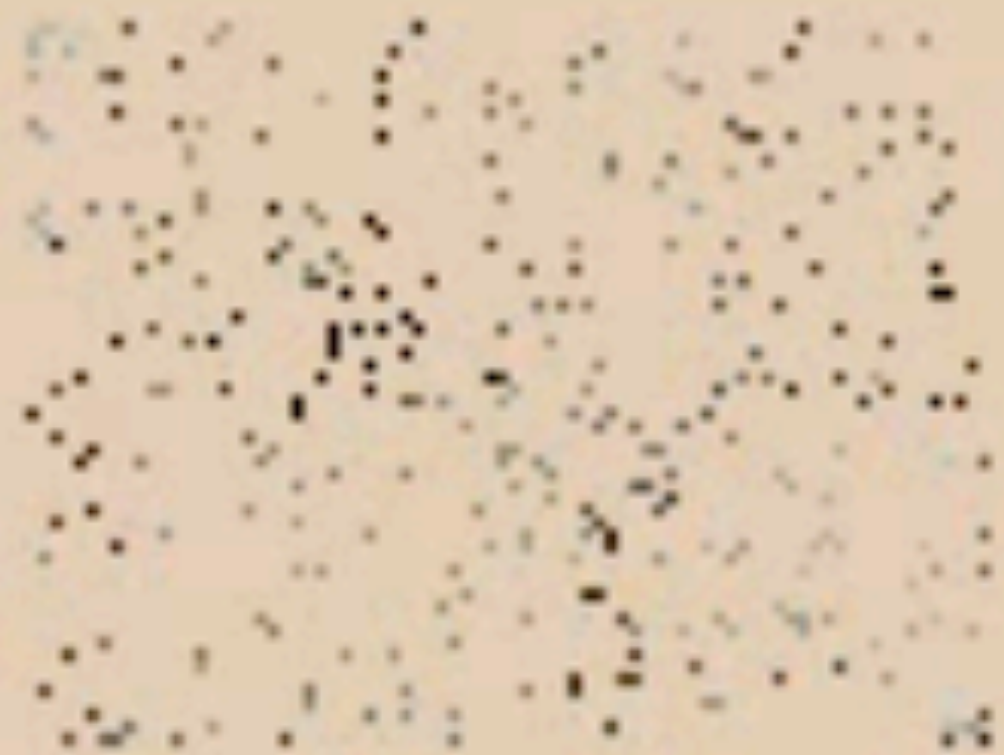
Memex: A Vision of Computing

- 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

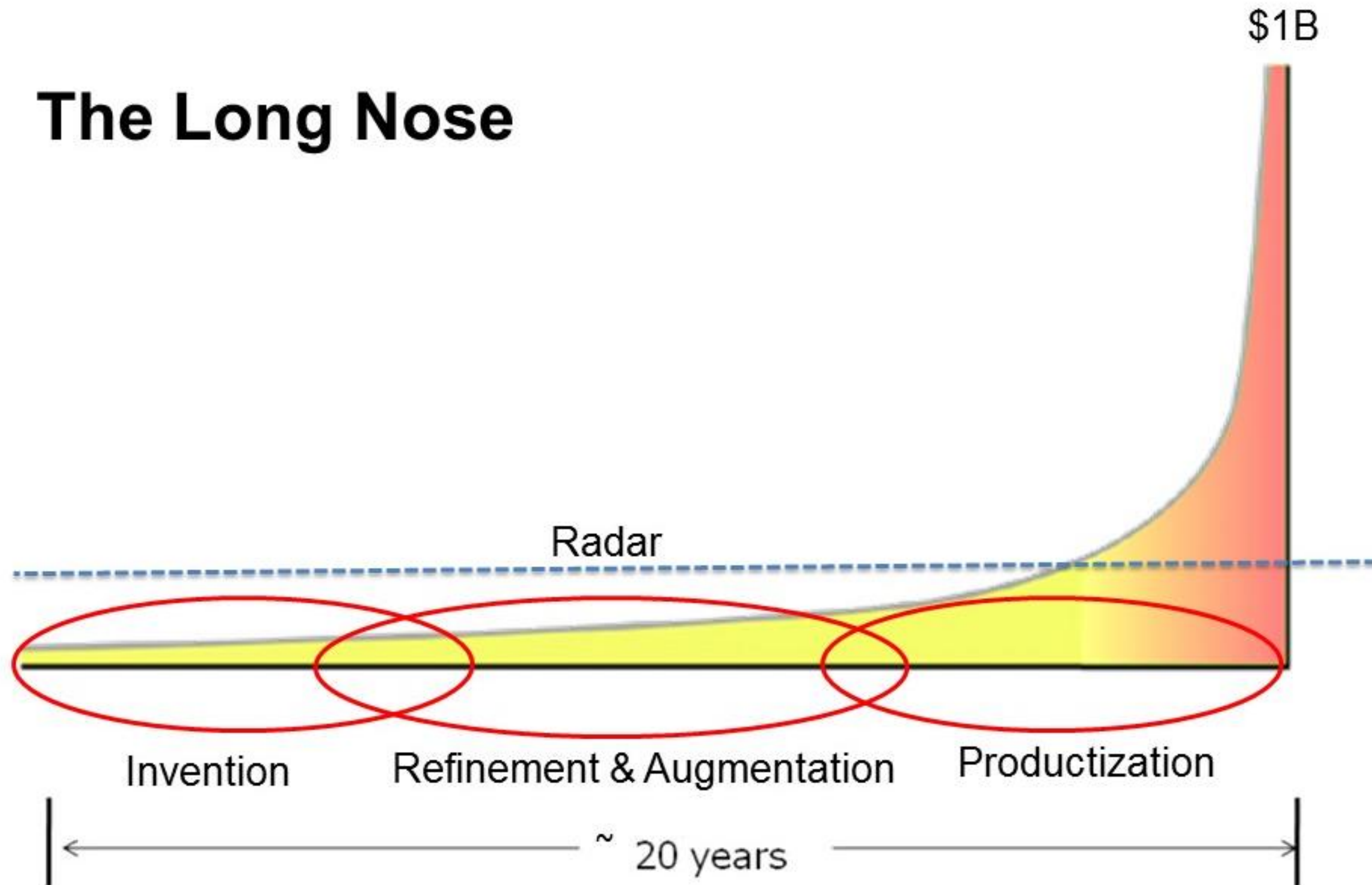


Memex

From Vannevar Bush's Essay *As We May Think*



The Long Nose



Bill Buxton, The Long Nose of Innovation, BusinessWeek 2008



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 constrained input
- * introduced instantiation

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

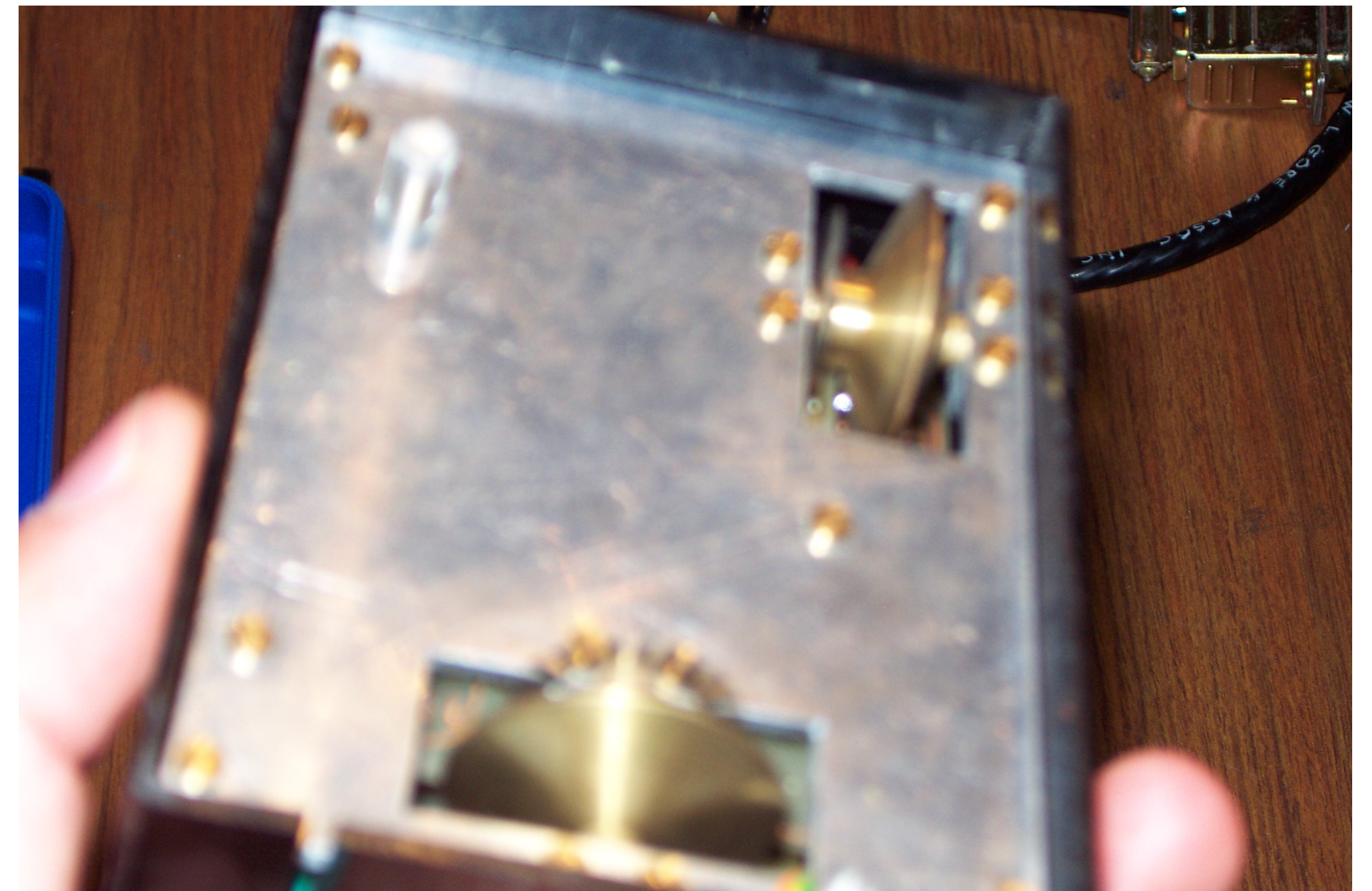
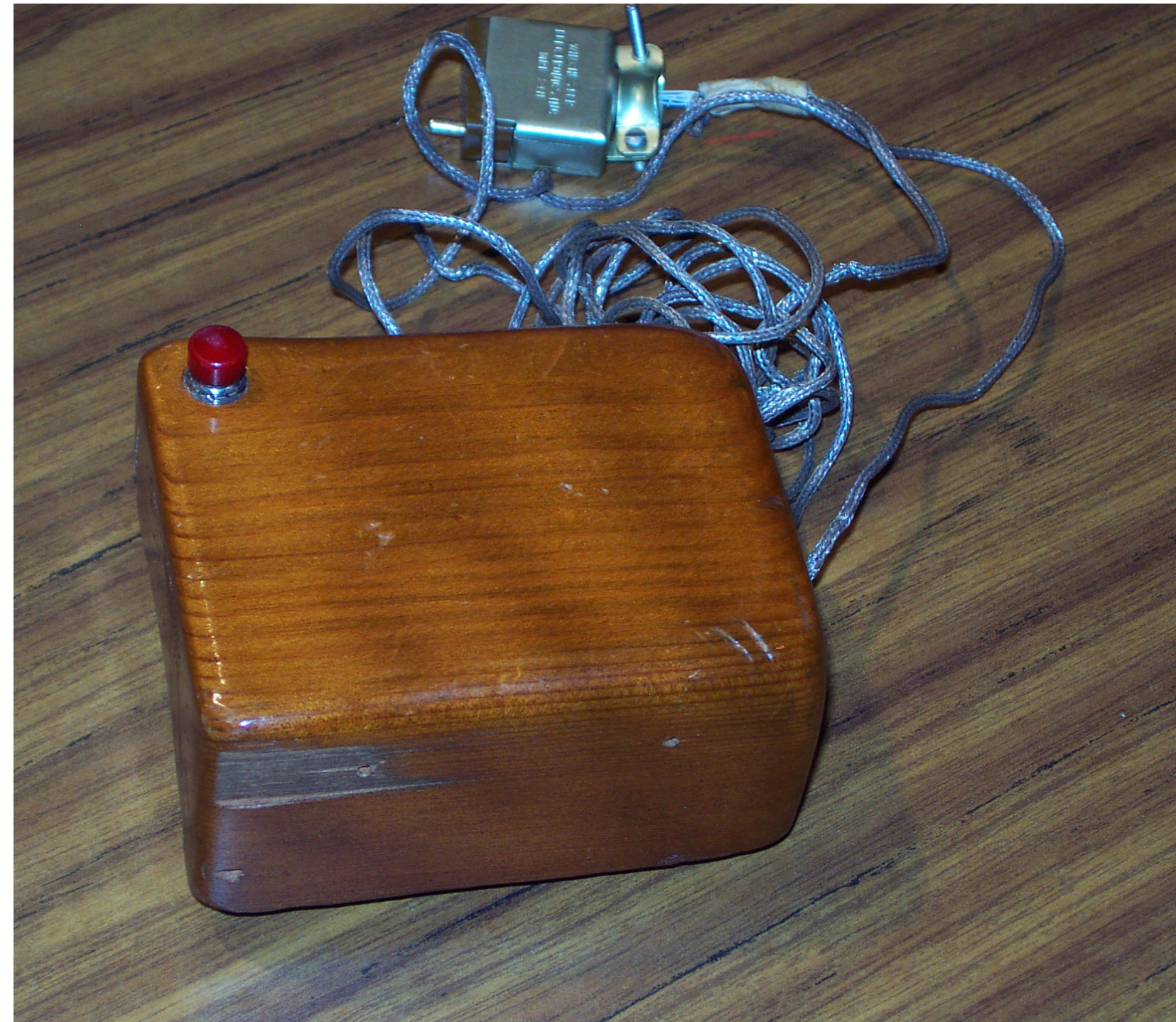
TEST STATEMENT

STATEMENT ONE: VOSS VOSS VOSS VOSS ...



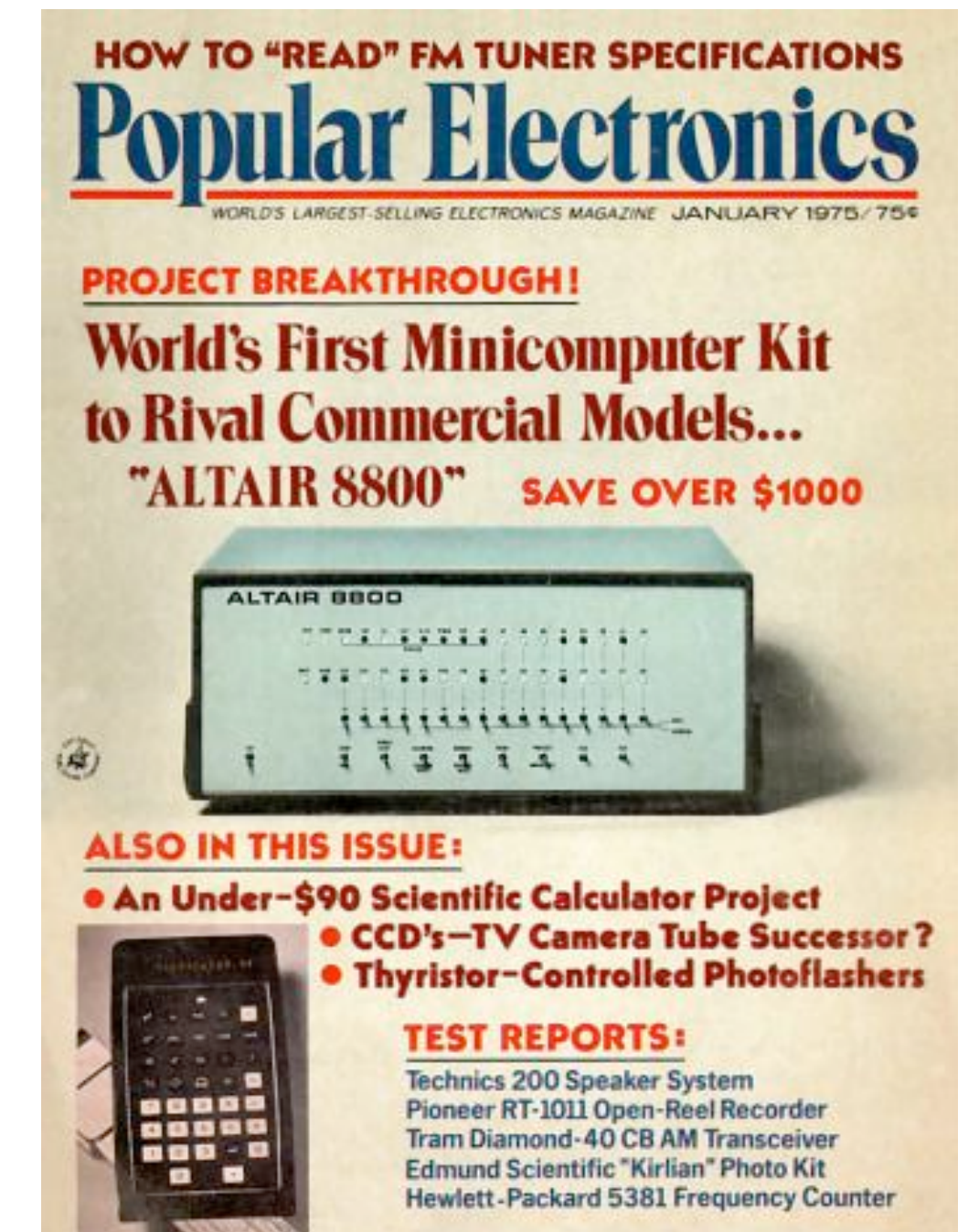
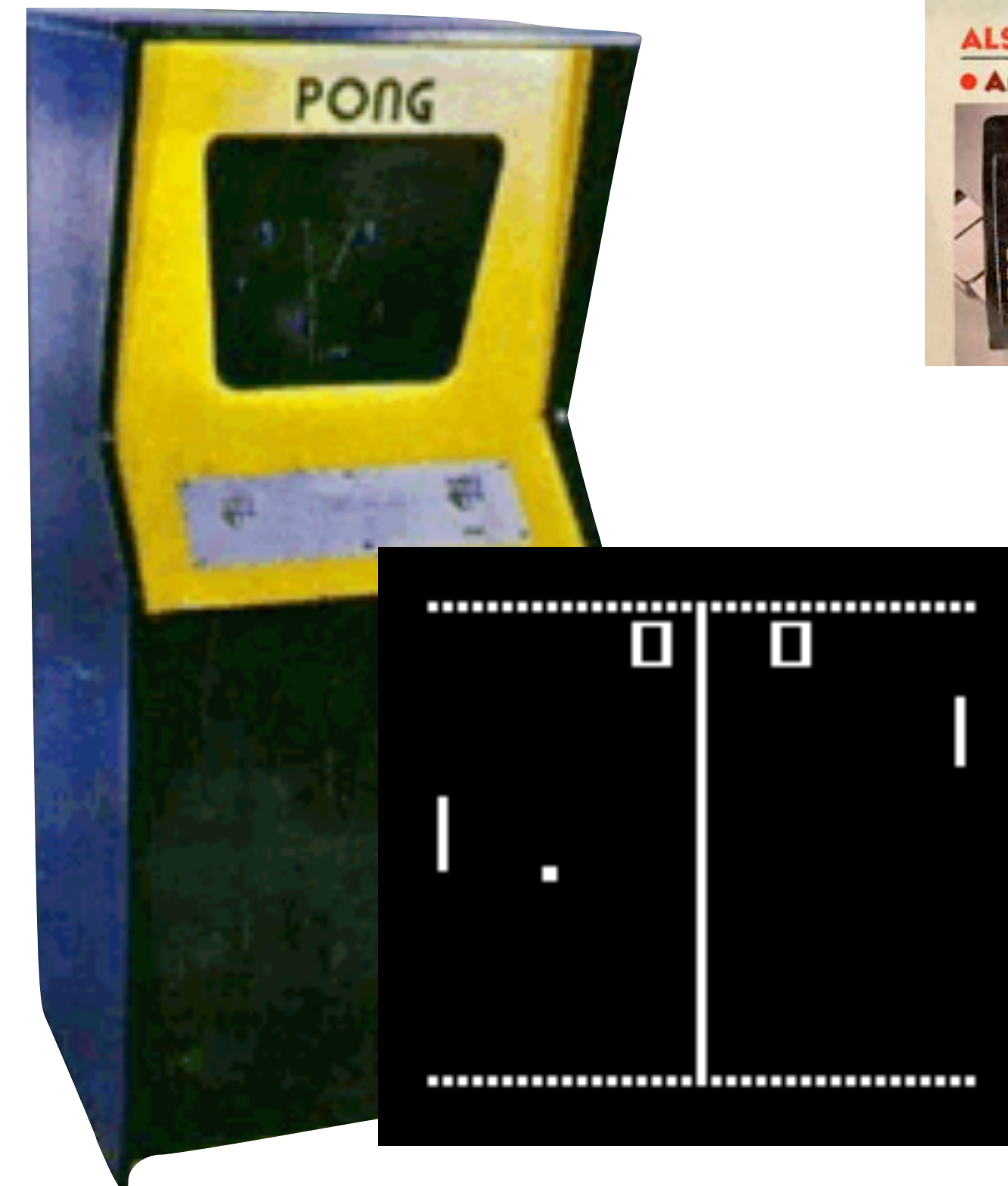
Engelbart's First Mouse (1964)

- Outperformed other devices of that time:
 - Light pen, track ball, foot-pedal, knee-operated devices, head-operated devices



Early Hobbyist PCs & Games

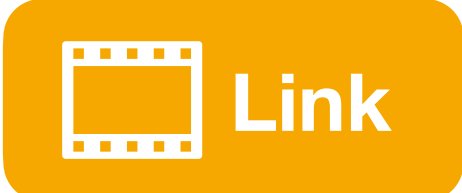
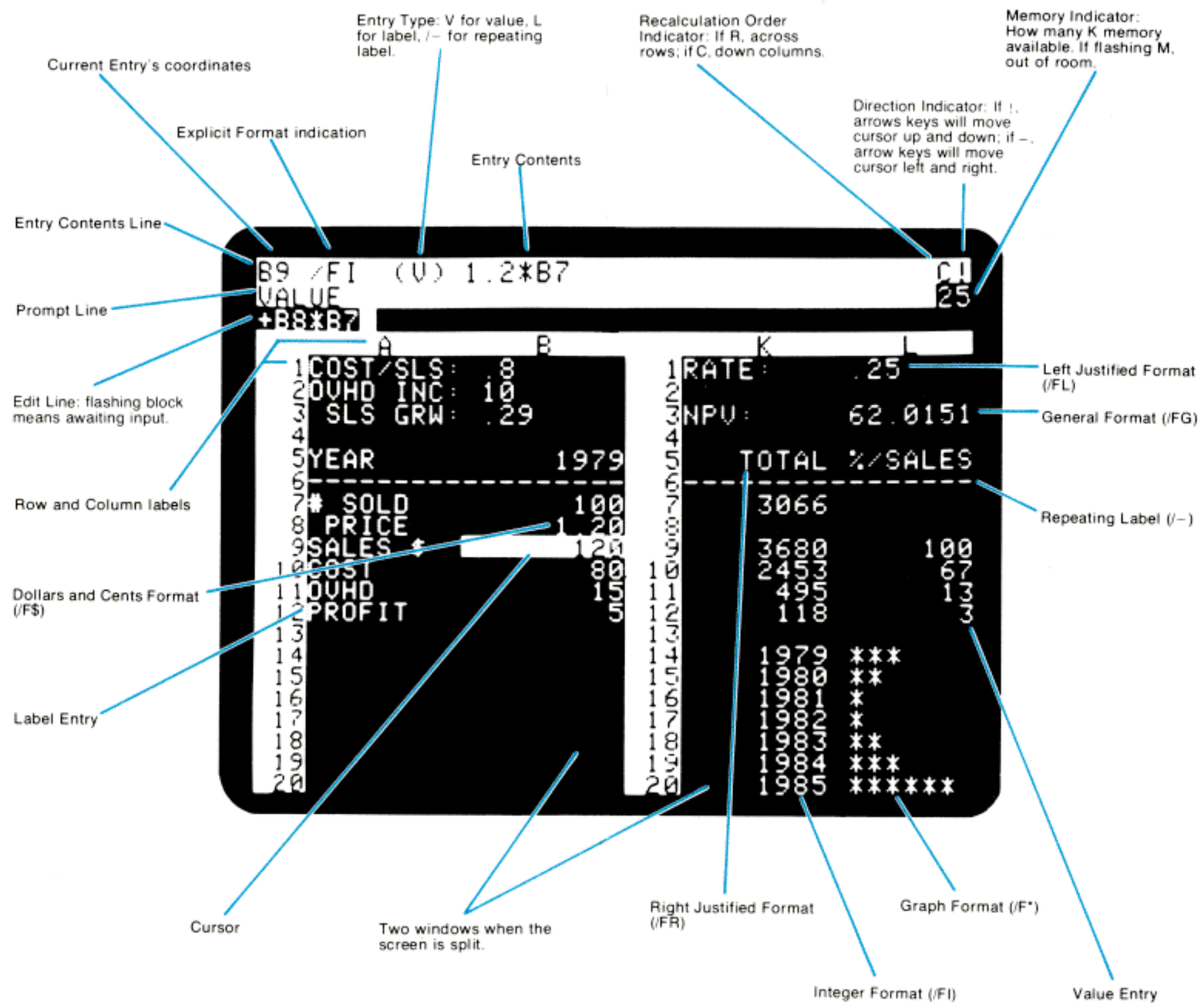
- Atari PONG (Bushnell, 1972)
- MITS Altair (1975)
- Key advances:
 - Machines cheap enough to be used by someone other than government and big business or research labs



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







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)

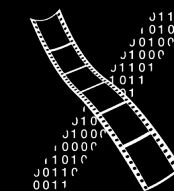
- Introduced window systems commercially, \$17K
- Key advances:
 - Integrated networked document environment, WYSIWYG text editing, icons, property sheets, window management, ...
- Built to improve Alto
- Unique design process (8 years of prototyping)
- “2.5-D interfaces” [Nielsen’93]
 - Interacting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



XEROX

 Part 1

 Part 2



Xerox Star keyboard and mouse

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



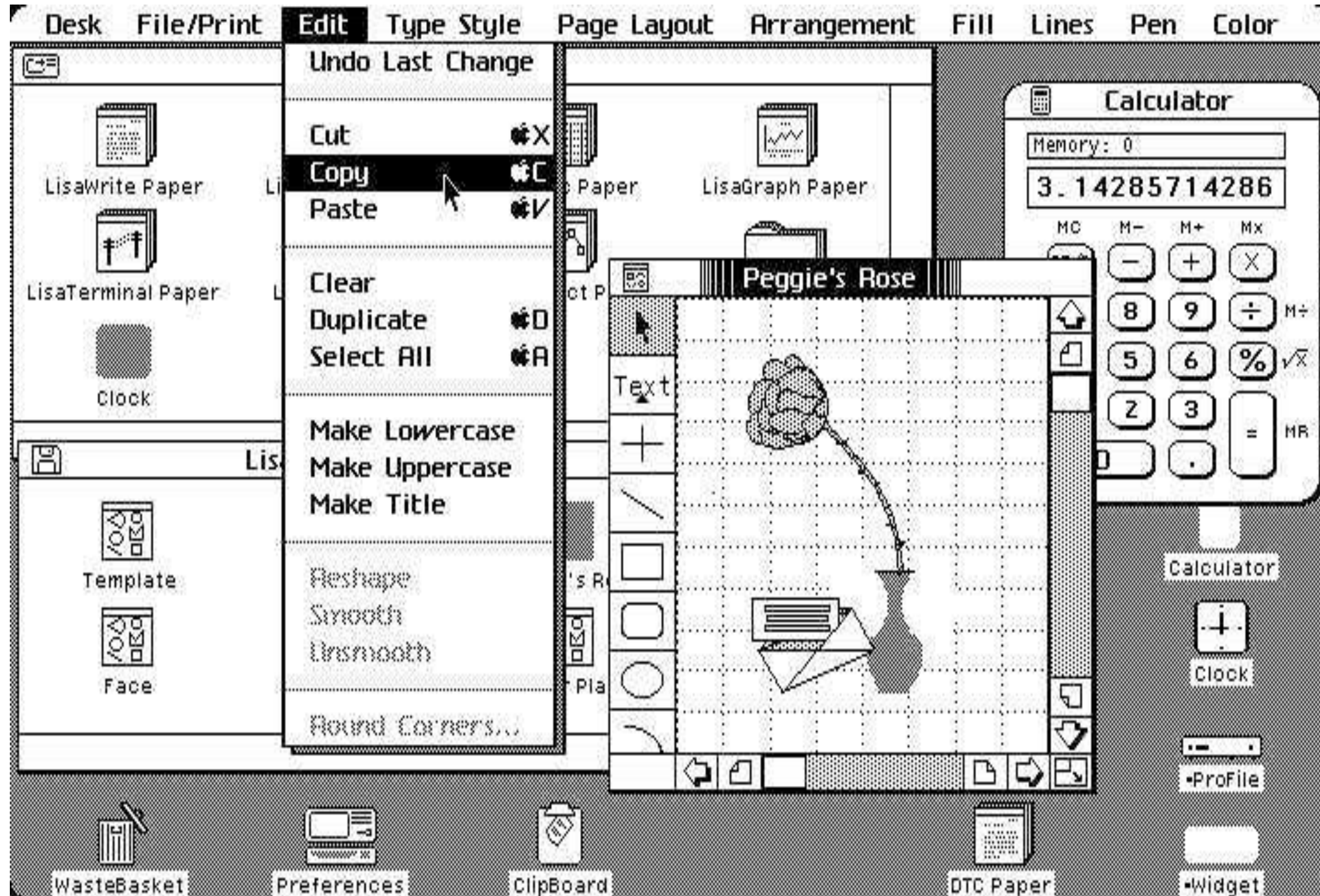
Apple Lisa (1983)

- 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)



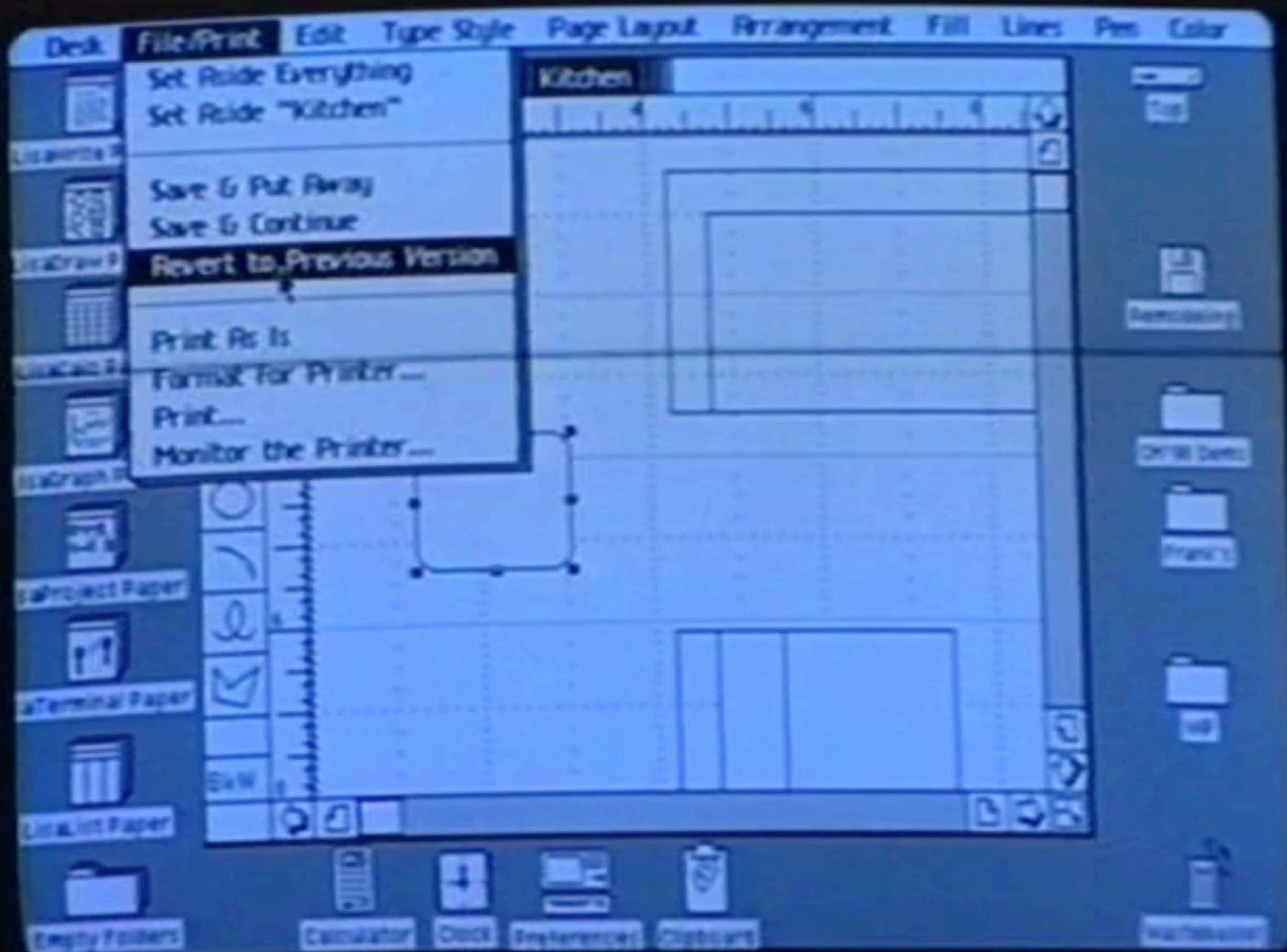
Lisa User Interface

[Craig, 1993]



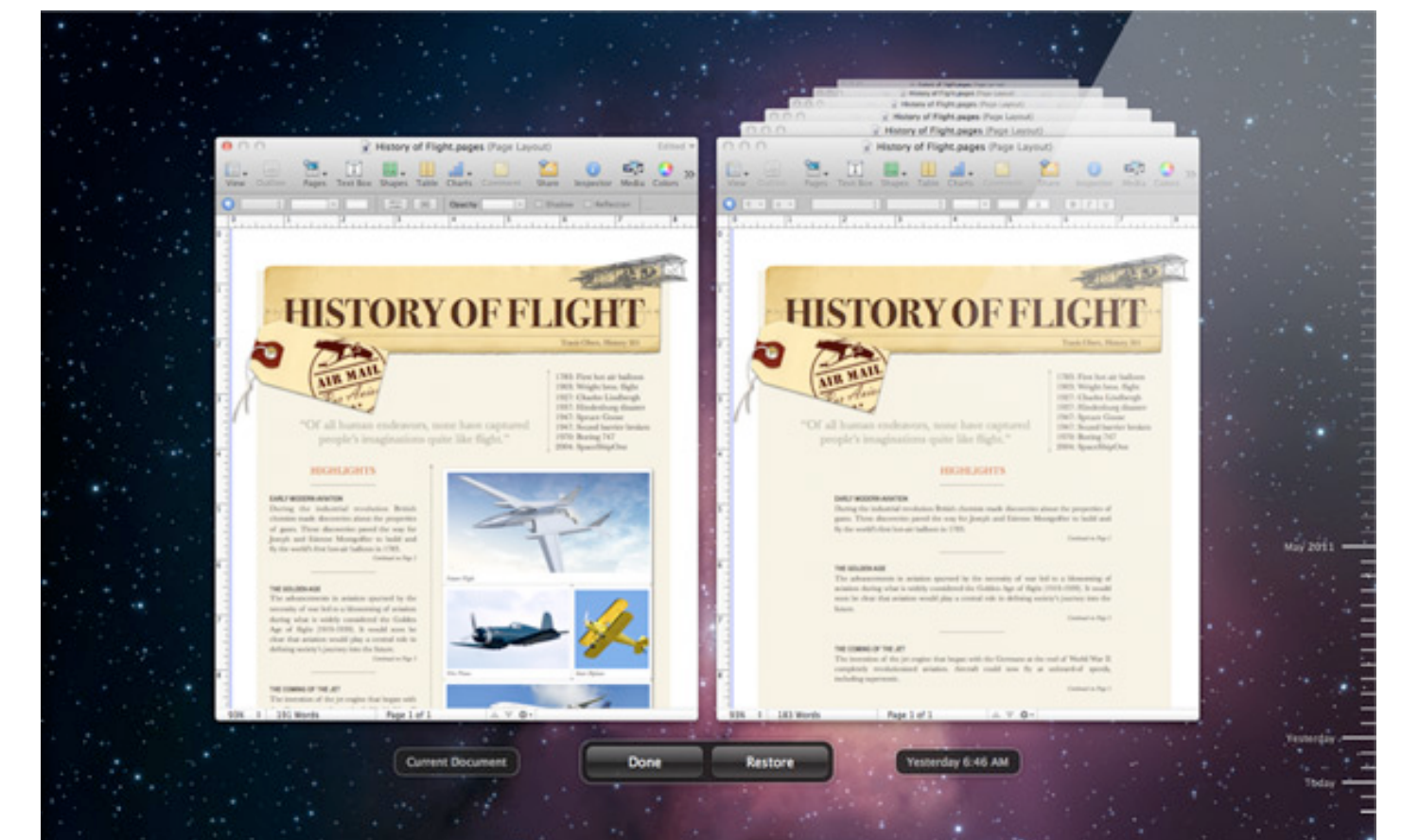
Auto Save in Lion (2011)





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



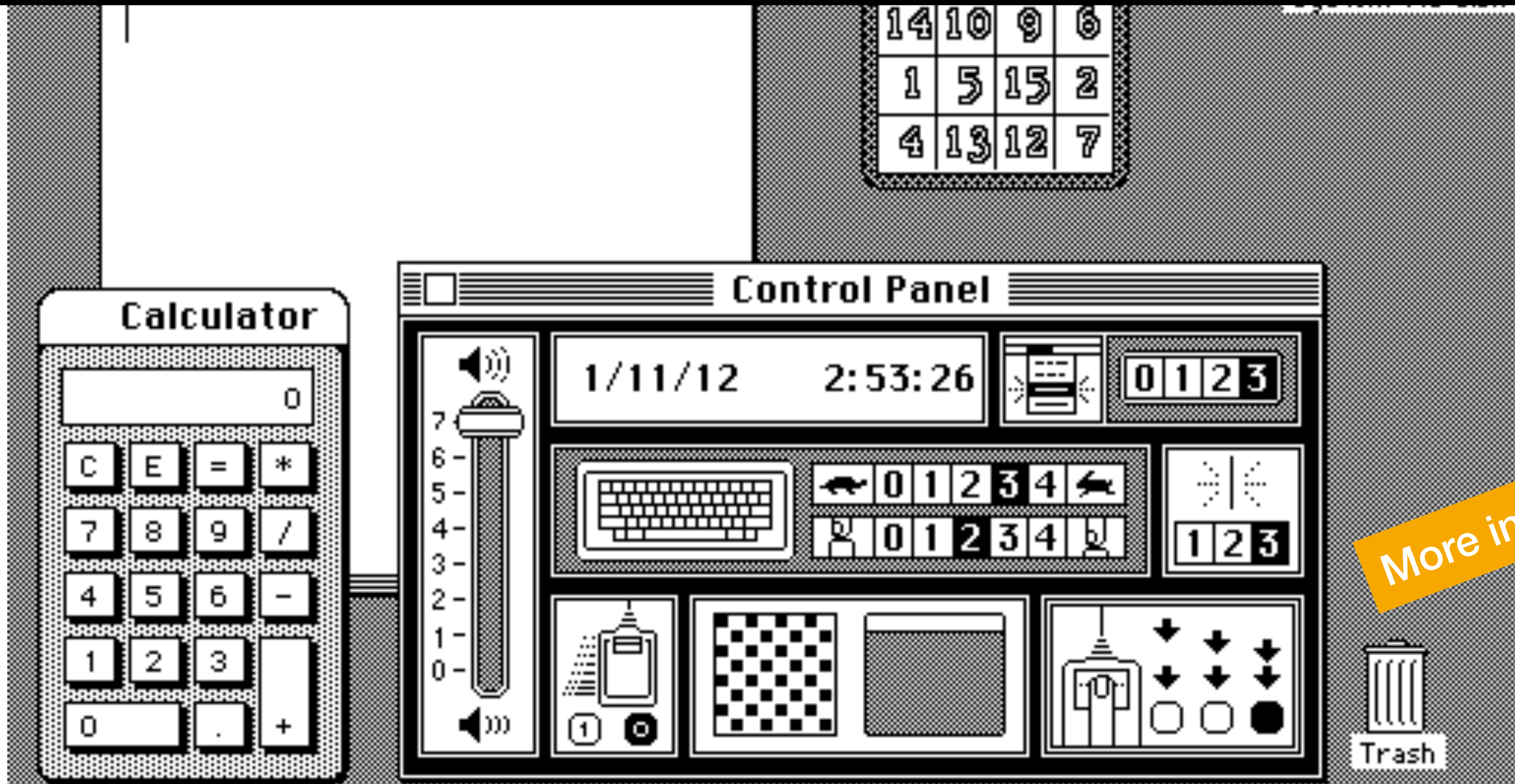


Apple Macintosh (1984)

- 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



More in DIS2

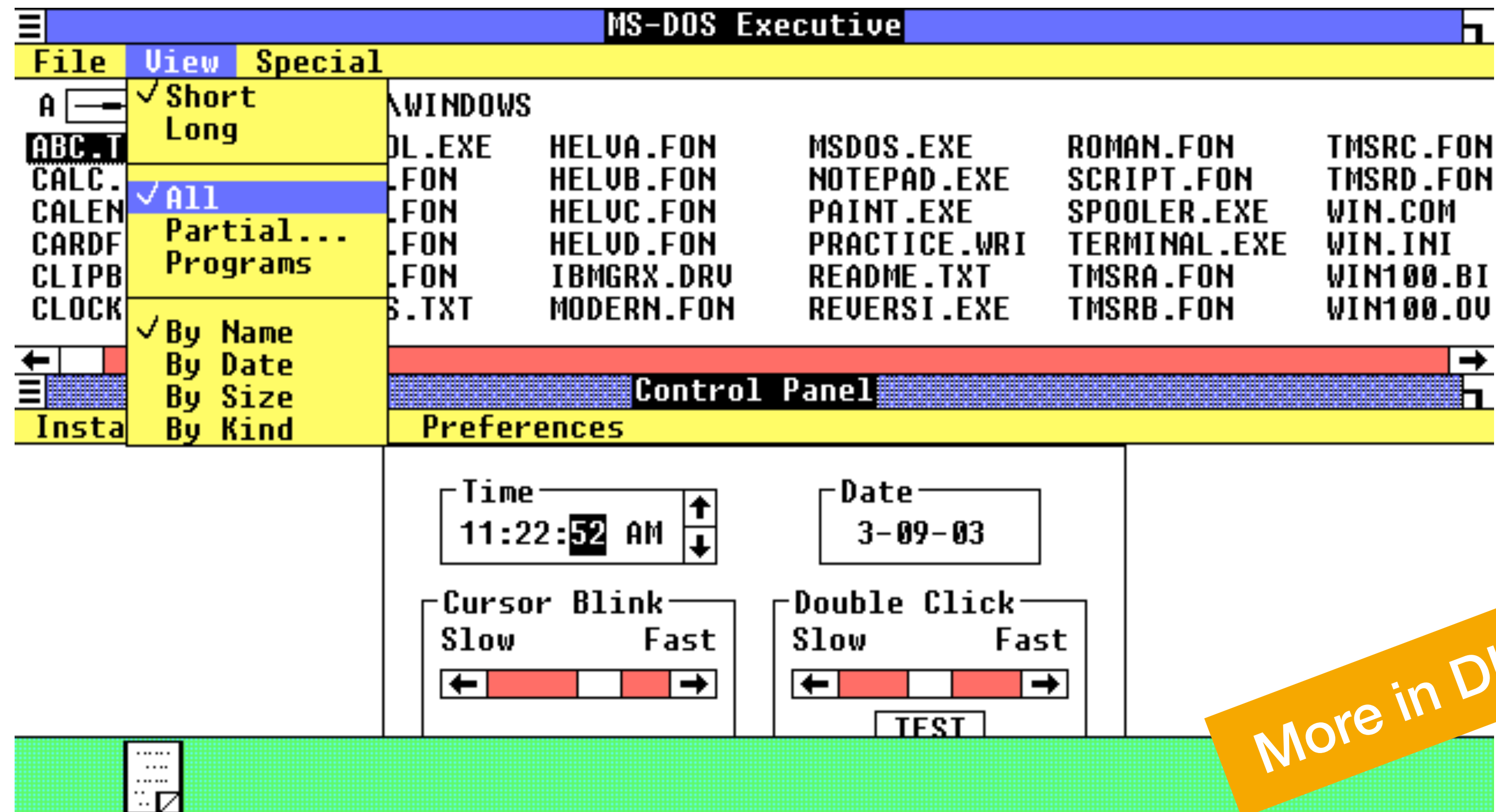




elRellano.com

Microsoft Windows (1985)

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

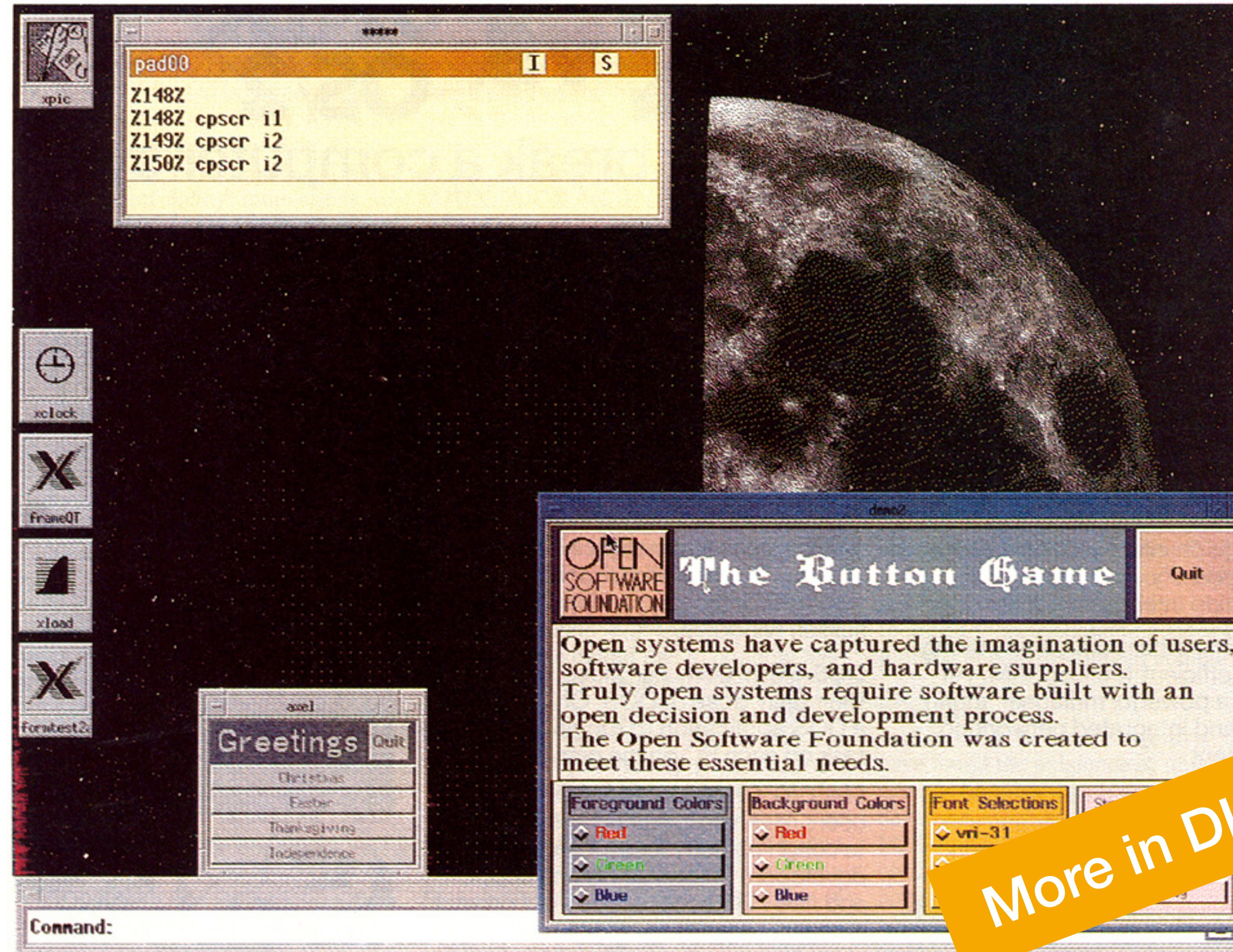


www.guidebookgallery.org



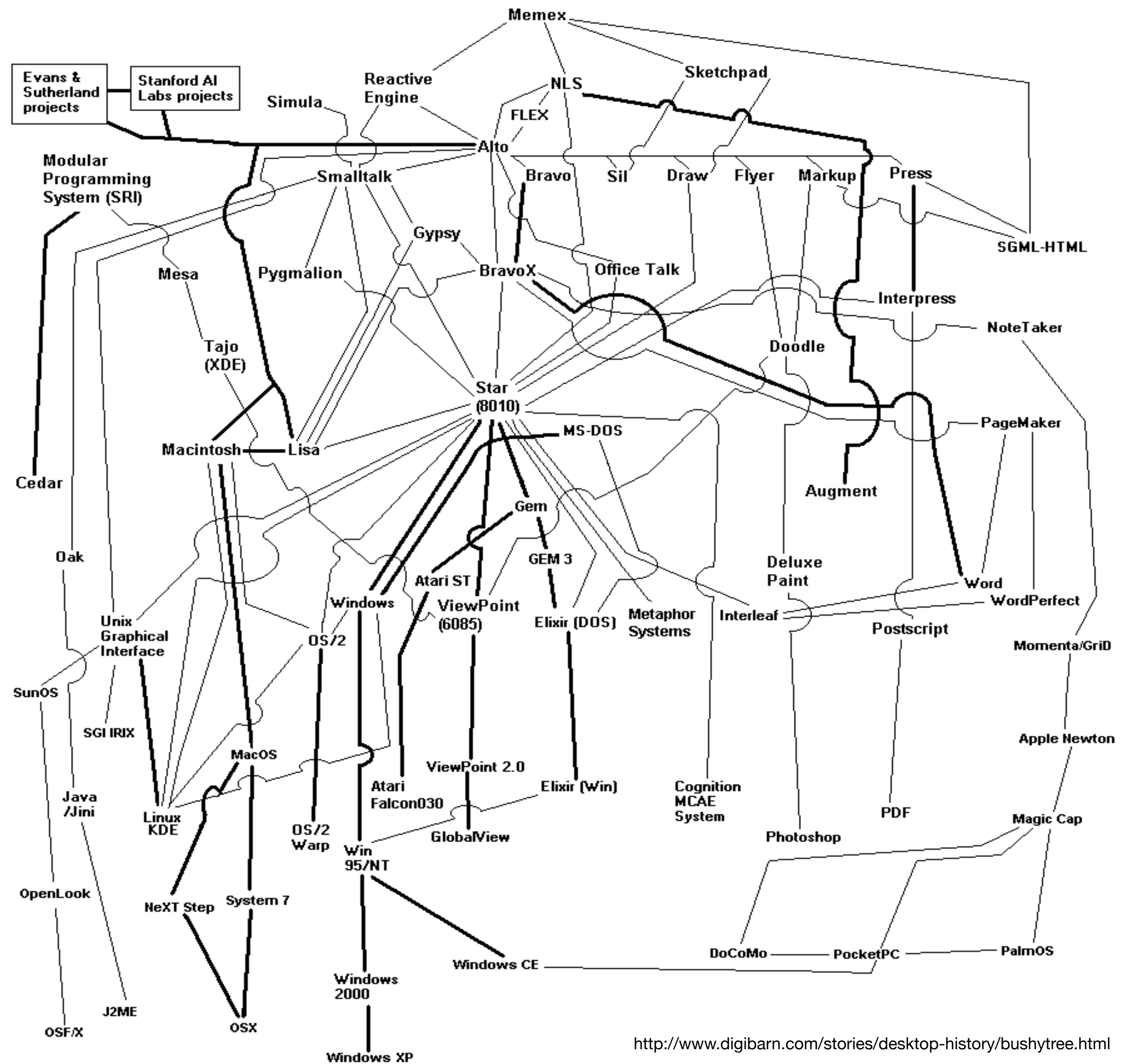
OSF/Motif (1980's)

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



www.guidebookgallery.org

Lineage of Visual Computing Systems (2000)



Summary

- There are no single heroes in interface design
- Interfaces have evolved from 0D interfaces to 2.5D interfaces
- Many “new” interaction principles and technologies were envisioned and/or implemented decades ago.
 - Long Nose of Innovation

