

# CSE 510: Advanced Topics in HCI

Course Overview  
HCI History

James Fogarty  
Daniel Epstein

Tuesday/Thursday  
10:30 to 12:00  
CSE 403



# Today

Introductions

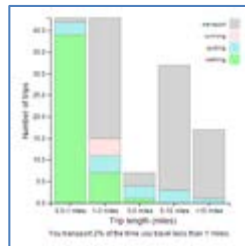
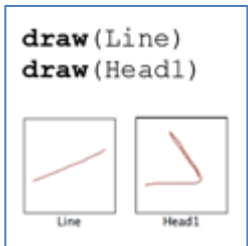
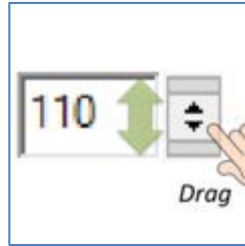
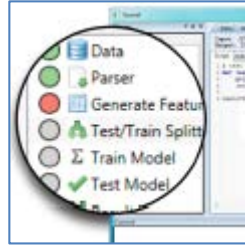
HCI in Computer Science

Course Structure Overview

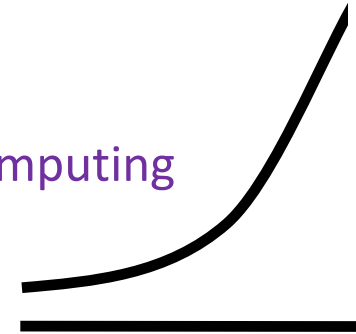
HCI History

Project Discussions

# Brief Research Introduction



Computing



You

# HCI & Design at UW

University of Washington research in HCI & Design research is centered in DUB

The screenshot shows the DUB website interface. At the top, there is a navigation bar with the 'dub' logo and links for 'Home', 'About DUB', 'Calendar', and 'Getting Involved'. Below the navigation bar is a hero section with the text 'Design. Use. Build.' and 'HCI & Design at the University of Washington'. The main image shows a person's hand interacting with a tablet displaying a coffee menu. Below the image, the word 'Use.' is displayed, followed by the tagline 'Creating better user experiences with technology.' and three small circles. The bottom section is divided into three columns: 'What is DUB?' with a paragraph about the organization's mission, 'Upcoming Seminars' with a list of events, and 'Connect with DUB' with a call to action and a 'Learn about DUB.' button.

**dub** Home About DUB Calendar Getting Involved

Design. Use. Build. HCI & Design at the University of Washington

Use.  
Creating better user experiences with technology.

**What is DUB?**  
DUB is a grassroots alliance of faculty, students, researchers, and industry partners interested in Human Computer Interaction & Design research and education at the University of Washington.  
The mission of DUB is to bring together an interdisciplinary set of people to share ideas, collaborate

**Upcoming Seminars**

JAN 6	CSE 691 12:00 PM
DUB Faculty Meeting / Student Group Lunches	
JAN 13	HUB 334 12:00 PM
TBD	

**Connect with DUB**  
Join us in one of the world's most vibrant communities for research and education addressing all aspects of Human Computer Interaction & Design.

**W** Learn about DUB.

# HCI & Design at UW

University of Washington research in  
HCI & Design research is centered in DUB

Consider attending the DUB seminar

Wednesdays @ 12:00

Food provided

See calendar and mailing lists

# Why do we do HCI in CSE?

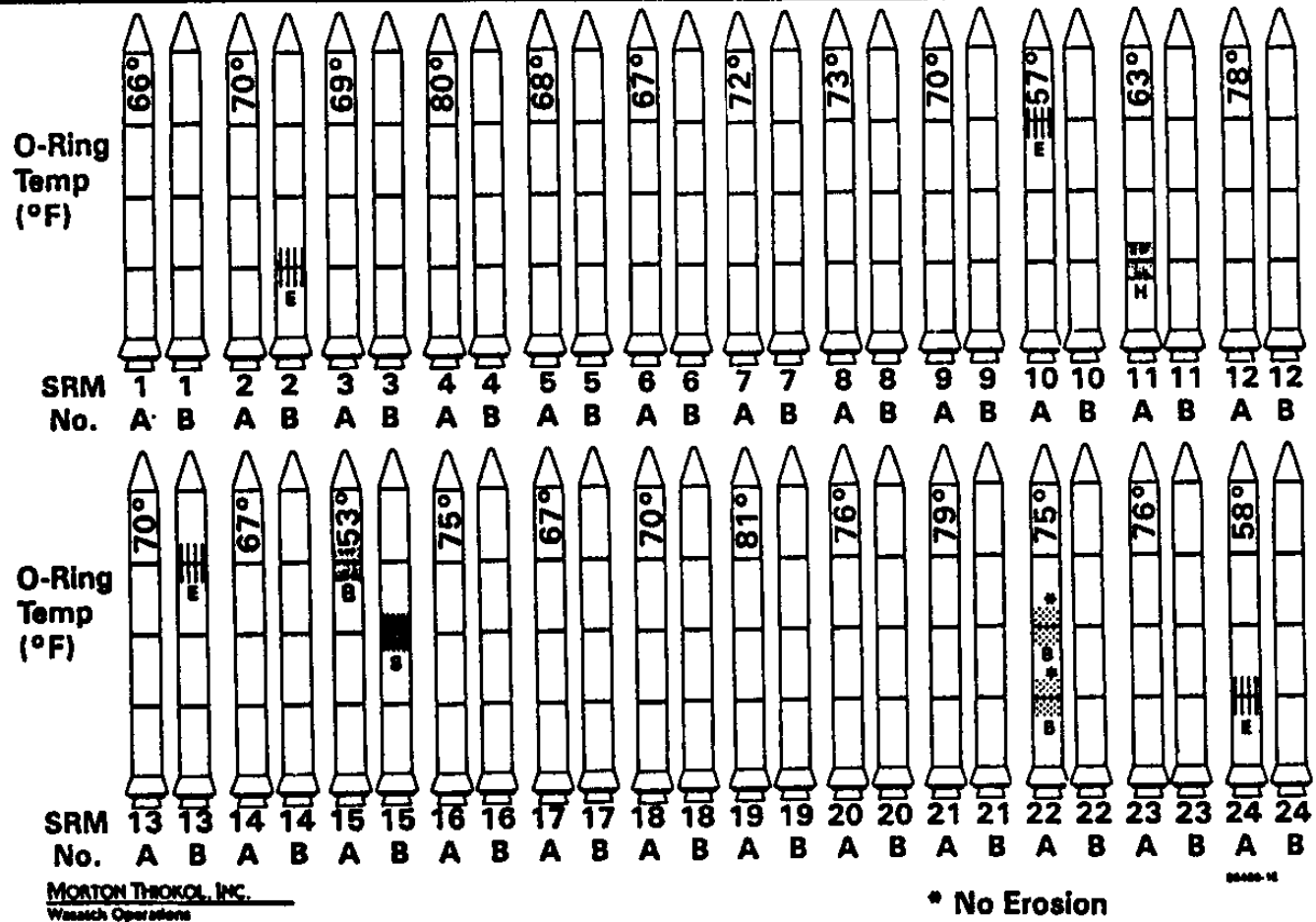
Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns

# Tacoma Narrows



# O-Rings

## History of O-Ring Damage in Field Joints (Cont)

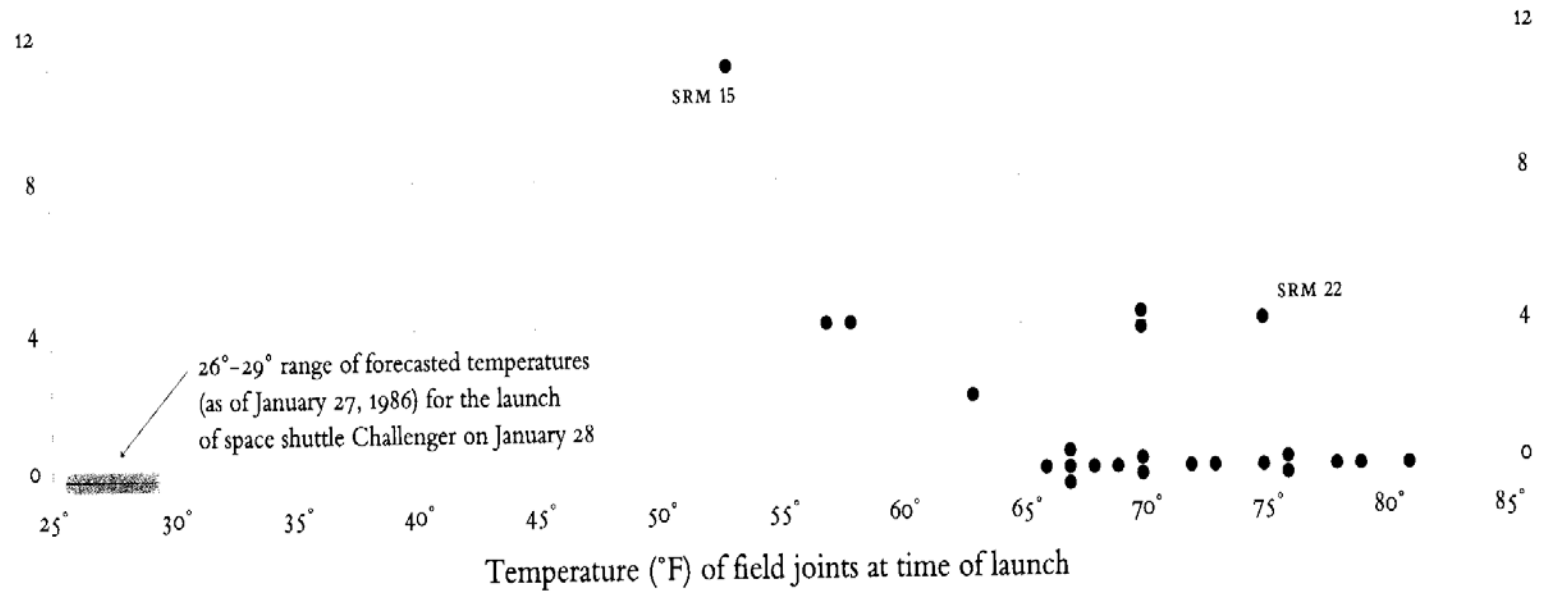


INFORMATION ON THIS PAGE WAS PREPARED TO SUPPORT AN ORAL PRESENTATION AND CANNOT BE CONSIDERED COMPLETE WITHOUT THE ORAL DISCUSSION



# O-Rings

O-ring damage index, each launch



# Tractors



# Tractors



# Tractors

## National Agricultural Safety Database Quotes



Older tractors with narrow front ends are easily upset

Tractor upsets cause more fatalities than other farm accidents

Injuries often include a broken or crushed pelvis

# Tractors

Tractor upsets used to be dismissed as driver error

But such accidents are less frequent because modern designs have:

roll cage

low center of gravity

wider wheel bases



# Human Factors Tradition

Emerges during and after WWII, as highly trained people are failing to effectively control the machinery they operate

The phrase “human factors” now often has a connotation of studying factory workers, ergonomics, or other physical tasks

See Grudin’s “A Moving Target” Optional Reading



# 1988: Iran Air Flight 655

In 1987, *USS Stark* was struck by two missiles launched by an Iraqi Mirage F-1, killing 37 with no weapons fired in self-defense during the attack.



In 1988, the crew of the *USS Vincennes* Combat Information Center confusingly reported the plane as ascending and descending at the same time (there were two "camps").



# 1988: Iran Air Flight 655

The Airbus's original track, number 4474, had been replaced by the *Sides* track, number 4131, when the computer briefly recognized them as one and the same. Shortly thereafter, track 4474 was re-assigned by the system to an American A-6, several hundred miles away, following a descending course at the time. Apparently not all the crew in the CIC realized the track number had been switched on them.





# Why do we do HCI in CSE?

Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns

Understanding how and why human interaction breaks down is fundamental to designing better computing systems

This study must include computer scientists, as we are the ones creating the technology

# Today

Introductions

HCI in Computer Science

Course Structure Overview

HCI History

Project Discussions

# Course Overview

## Course Website

<http://www.cs.washington.edu/510/>

## Calendar Overview

## Workload Overview

Readings

Project

Exam

Statistics Lab

# Calendar Overview

## 2.5 Weeks of Context and Methods

Jan 5: Overview and History

Jan 7: Visions of HCI

Jan 12, Jan 14: Contributions

Jan 28: Experiments and Statistics

## 5.5 Weeks of Research Topics

11 Topics

## 1 Week of Project Presentations

Jan 26, Feb 23

## 1 Week of HCI as Design

Mar 8, Mar 10

# Guest Lecturers



# Readings (see course webpage)

Topic readings will emphasize:

- 1 framing paper per topic

- 2 instances of contribution with that topic

Read the framing paper, 1 of the instance papers

- Discussion will be expected throughout course

Doing the reading is major component of course

- Minimal other assignments

# Project (see course webpage)

Expected to be in groups of 2

... singles and groups of 3 considered

... singles very highly discouraged

Proposal, Two Self-Defined Milestones, Report

Policy on projects relating to existing research

Gathered potential project ideas

Optional meetings on Friday

# Exam and Lab (see course webpage)

## Exam

Open-note, take-home

Demonstrate substantial understanding

Keeping up with the readings will be critical

## Statistics Lab

Intended to be straightforward and instructive



# Grading (see course webpage)

20% Readings

45% Group Project

15% Exam

10% Statistics Lab

10% Participation

Necessarily subjective, communicate with us if you need guidance or are concerned with this

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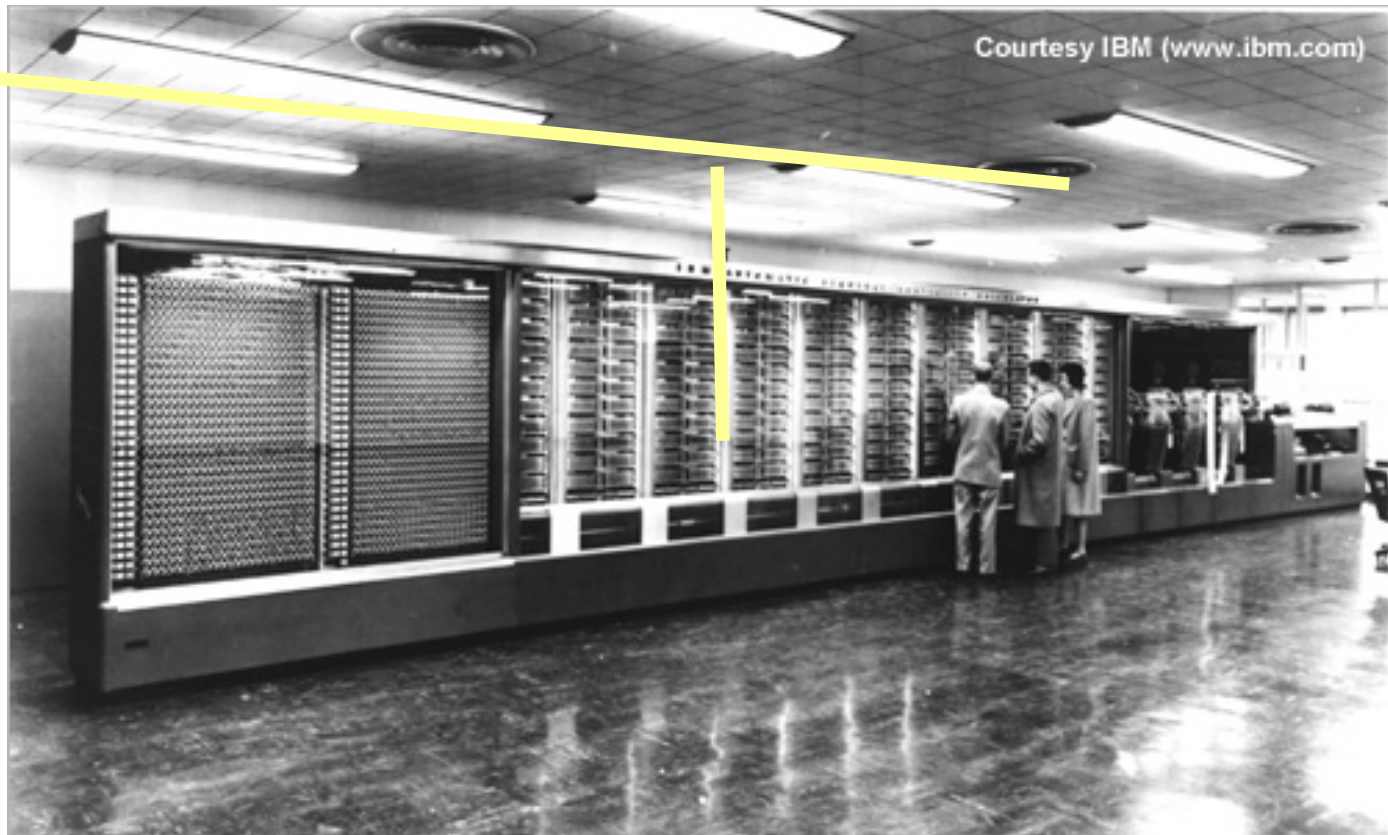
# Thursday's "Visions of HCI" Readings

# A History Question

Who invented hypertext? When?

# Computing in 1945

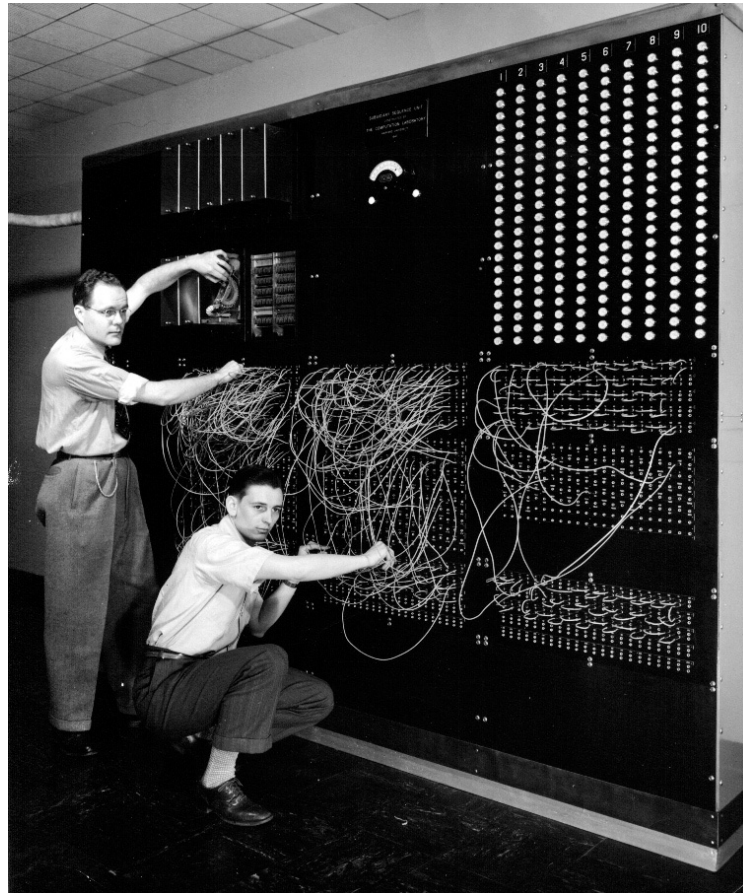
Harvard Mark I, 55 feet long, 8 feet high, 5 tons



The Harvard Mark I

# Computing in 1945

Harvard Mark I, 55 feet long, 8 feet high, 5 tons



# Computing in 1945

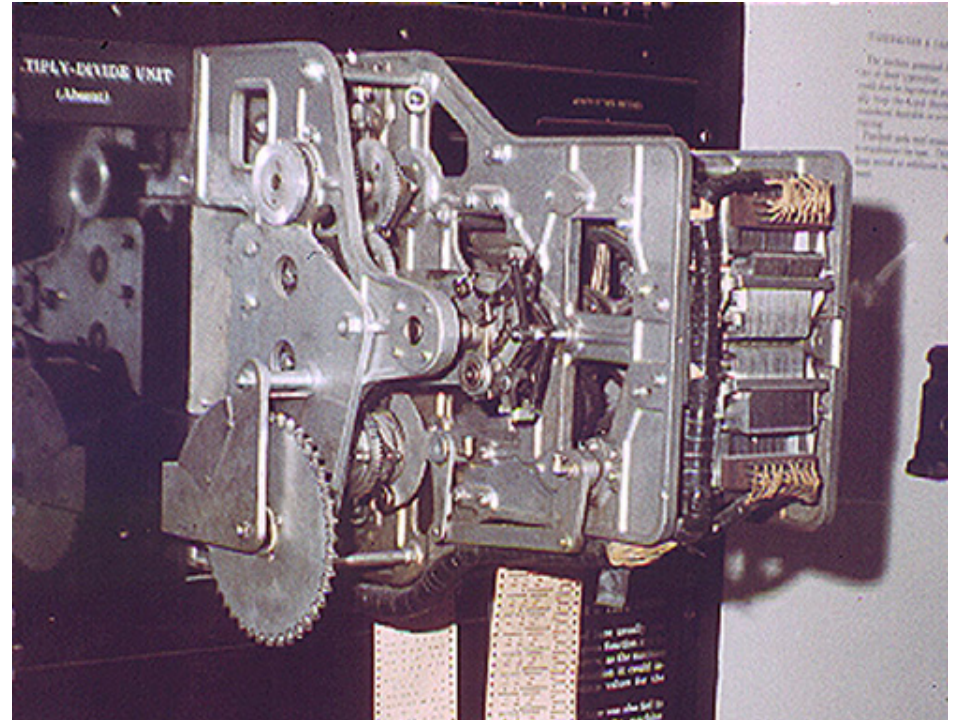
Ballistics calculations

Physical switches  
(no microprocessor)

Paper tape

Simple arithmetic  
& fixed calculations  
(before programs)

3 sec. to multiply





# Computing in 1945

First computer bug  
(Harvard Mark II)

Adm. Grace Murray Hopper



1100 Started Cosine Tape<sup>80</sup> (Sine check)  
1525 Started Multi-Adder Test.

1545



Relay #70 Panel F  
(moth) in relay.

First actual case of bug being found.  
~~1630~~ 1630 exchange started.  
1700 closed down.



# A Little About Vannevar Bush

Name rhymes with “Beaver”

Faculty member at MIT

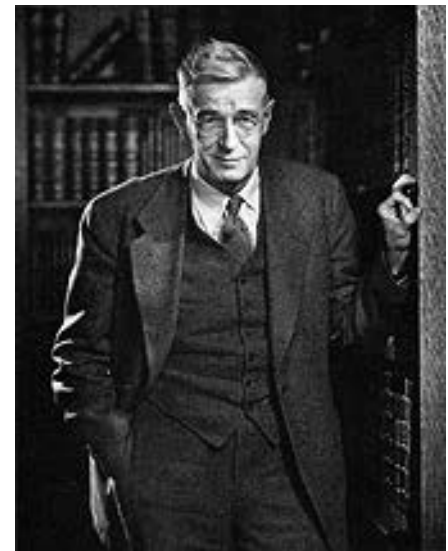
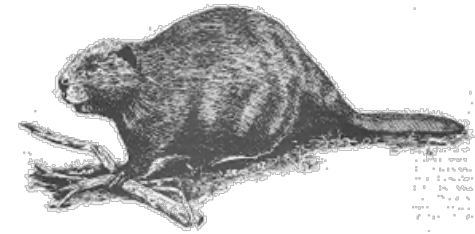
Coordinated WWII effort  
with 6000 US scientists

Social contract for science

Federal government funds universities

Universities do basic research

Research helps economy and defense



# As We May Think

Published in the Atlantic Monthly in 1945

<http://www.theatlantic.com/magazine/print/1945/07/as-we-may-think/3881/>

Motivated in part by defining a scientific grand challenge as WWII was ending

# As We May Think

“There is a growing mountain of research. ... The investigator is staggered by the findings and conclusions of thousands of other workers—conclusions which he cannot find time to grasp, much less to remember, as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between disciplines is correspondingly superficial.”

# As We May Think

“The world has arrived at an age of cheap complex devices of great reliability; and something is bound to come of it.”

“Had a Pharaoh been given detailed and explicit designs of an automobile, and had he understood them completely, it would have taxed the resources of his kingdom to have fashioned the thousands of parts for a single car, and that car would have broken down on the first trip to Giza.”

# MicroPhotography

Describes a combination of photocells, facsimile transmission, and electron beam technology

Enables capturing a photograph into micro form

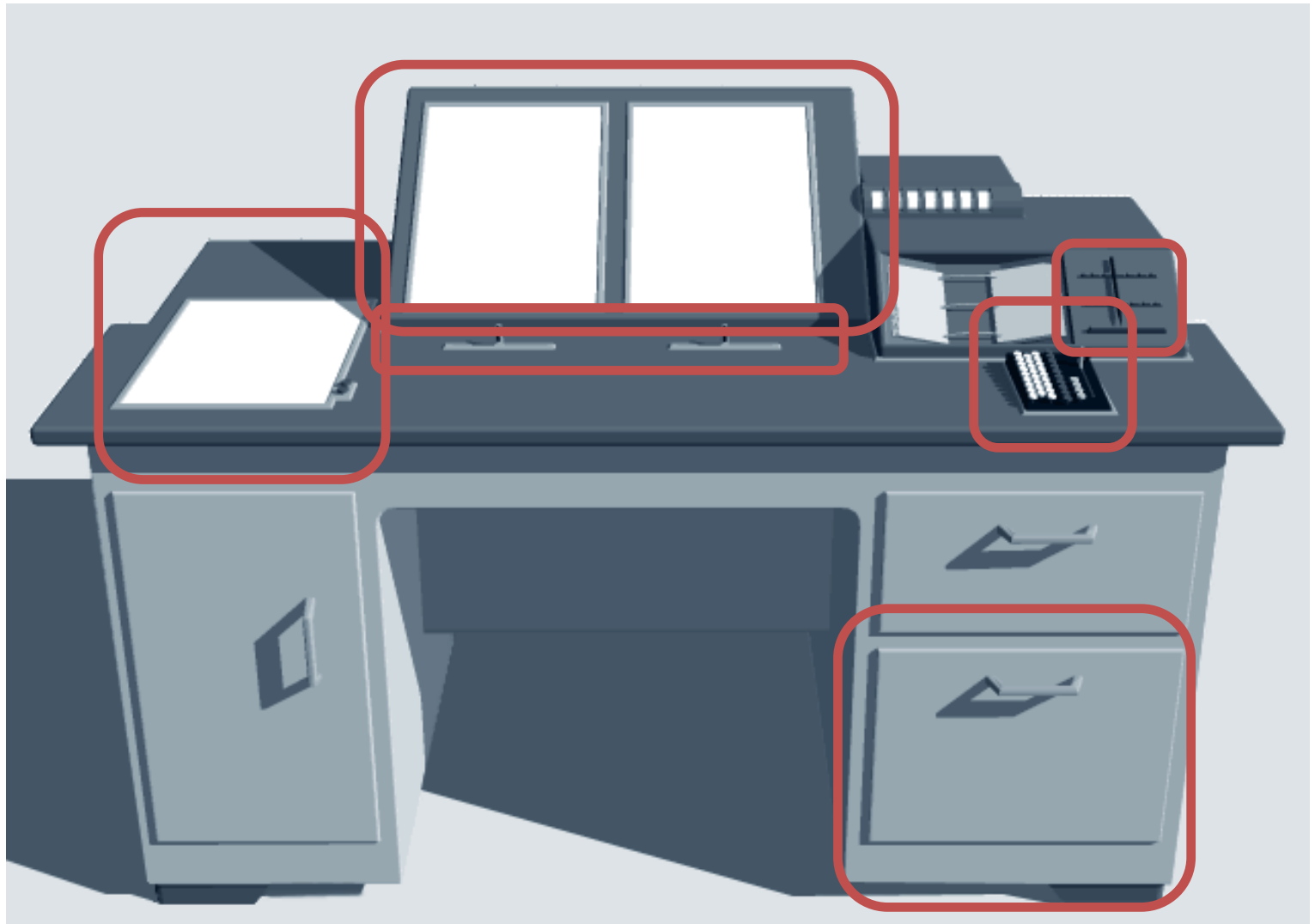
“It would be a brave man who would predict that such a process will always remain clumsy, slow, and faulty in detail.”

# MicroPhotography

“Assume a linear ratio of 100 for future use. Consider film of the same thickness as paper, although thinner film will certainly be usable. Even under these conditions there would be a total factor of 10,000 between the bulk of the ordinary record on books, and its microfilm replica. The Encyclopedia Britannica could be reduced to the volume of a matchbox. A library of a million volumes could be compressed into one end of a desk.”



# Memex





# Memex

“If the user wishes to consult a certain book, he taps its code on the keyboard...”

“Frequently-used codes are mnemonic, so that he seldom consults his code book;”

“He can add marginal notes and comments ... even ... by a stylus scheme”

“All this is conventional...”

# Memex

“It affords an immediate step, however, to associative indexing”

“tying two items together is the important thing”

“Before him are the two items to be joined, projected onto adjacent viewing positions. At the bottom of each there are a number of blank code spaces, and a pointer is set to indicate one of these on each item. The user taps a single key, and the items are permanently joined.”

# Memex

“Thereafter, at any time, when one of these items is in view, the other can be instantly recalled merely by tapping a button below the corresponding code space. Moreover, when numerous items have been thus joined together to form a trail, they can be reviewed in turn, rapidly or slowly, by deflecting a lever like that used for turning the pages of a book.”

# Memex

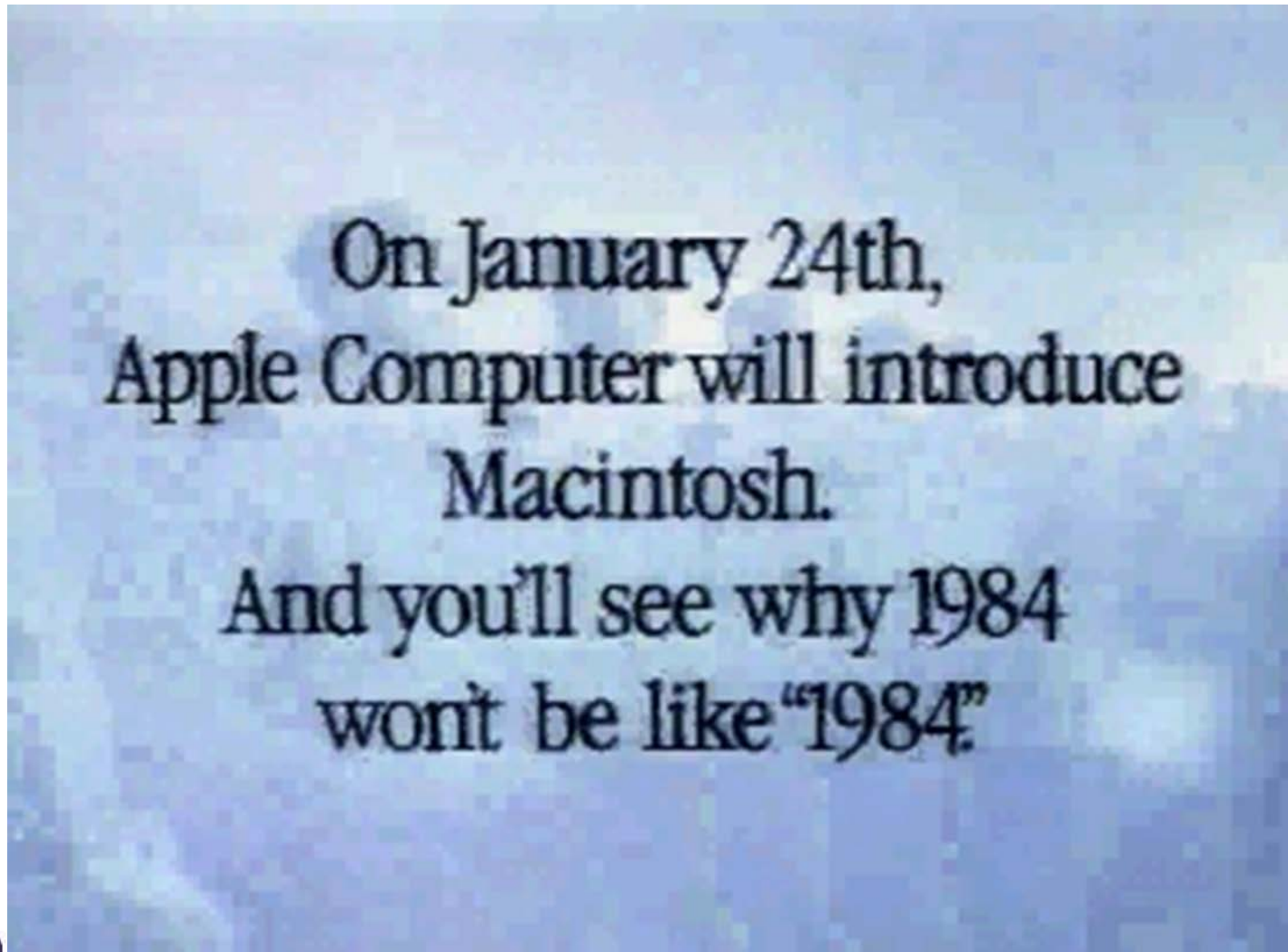
“Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified.”

Memex is the first proposed hypertext system

# A History Question

Who invented desktop computing? When?

# Macintosh in 1984 is well known



# Alan Kay on Early Interface Work

Narrator is Alan Kay, speaking in 1987

This video is almost 20 years old

It was a historical account when it was filmed

Speaks to four systems

Sketchpad

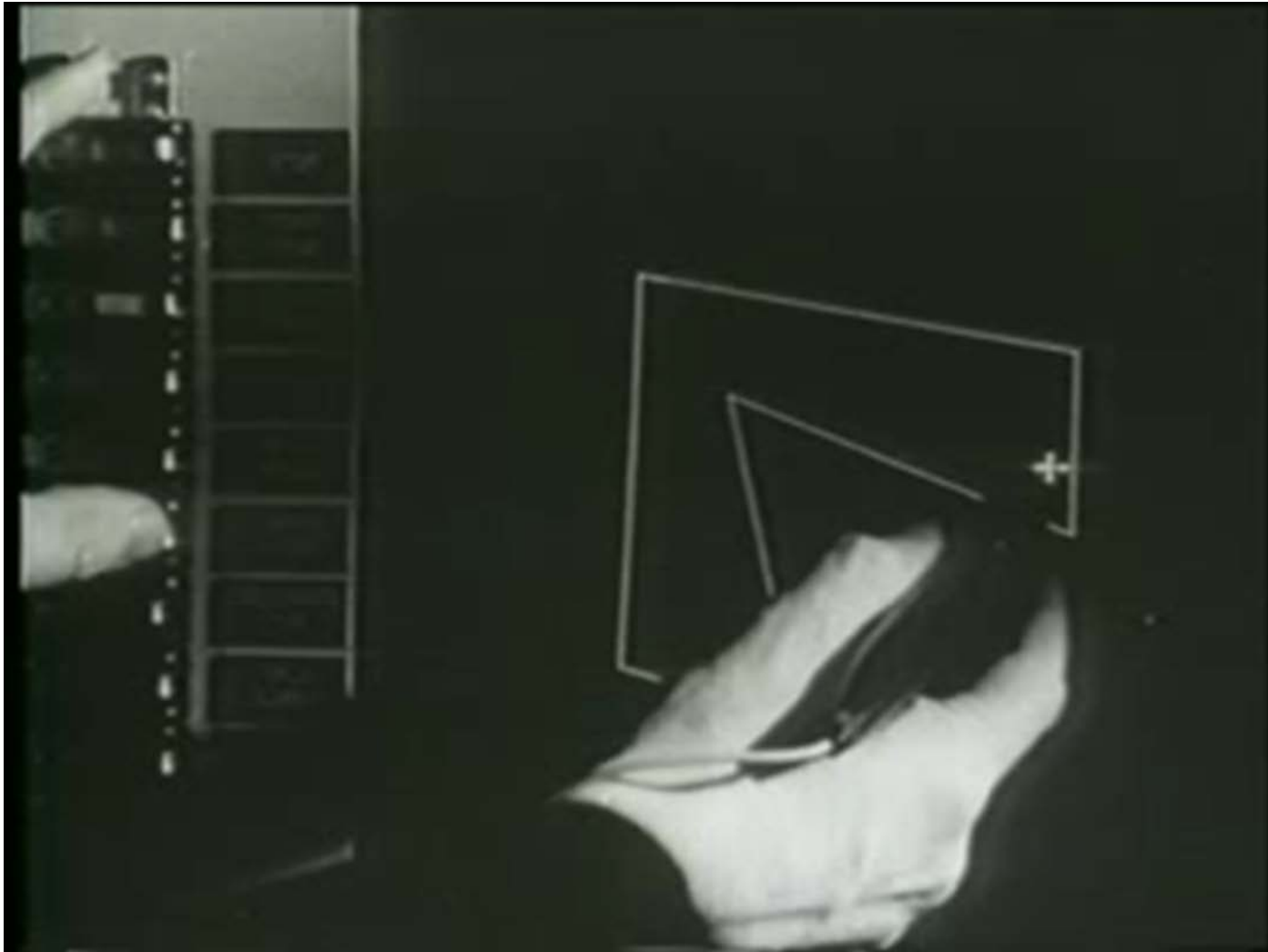
NLS

GRAIL

Dynabook

<http://courses.cs.washington.edu/courses/cse510/videos/history/AlanKay1987.m4v>

# Ivan Sutherland's Sketchpad





# Ivan Sutherland's Sketchpad

When do we think this was done?



# Ivan Sutherland's Sketchpad

When do we think this was done?



1962

Windows

Constraints

(i.e., non-procedural)

Prototype/Instance Inheritance

(i.e., object-oriented)

# Doug Engelbart's NLS (Online System)

```
REPLACE CHARACTER
1
2: MARKET SEE 1
  2A: PRODUCE
    2A1: ORANGE
    2A2: APPLES
    2A3: BANANAS
    2A4: CARROTS
    2A5: LETTUCE
    2A6: BEANS
  2B: CANS
    2B1: APPLE SAUCE
    2B2: BEAN SOUP
    2B3: TOMATO SOUP
  2C: CEREALS
    2C1: BREAD
    2C2: NOODLES
    2C3: FRENCH BREAD
  2D: COLD LOCKER
    2D1: MILK
```

# Doug Engelbart's NLS (Online System)

When do we think this was done?

# Doug Engelbart's NLS (Online System)

When do we think this was done? 1968

Invention of the mouse

First working hypertext system

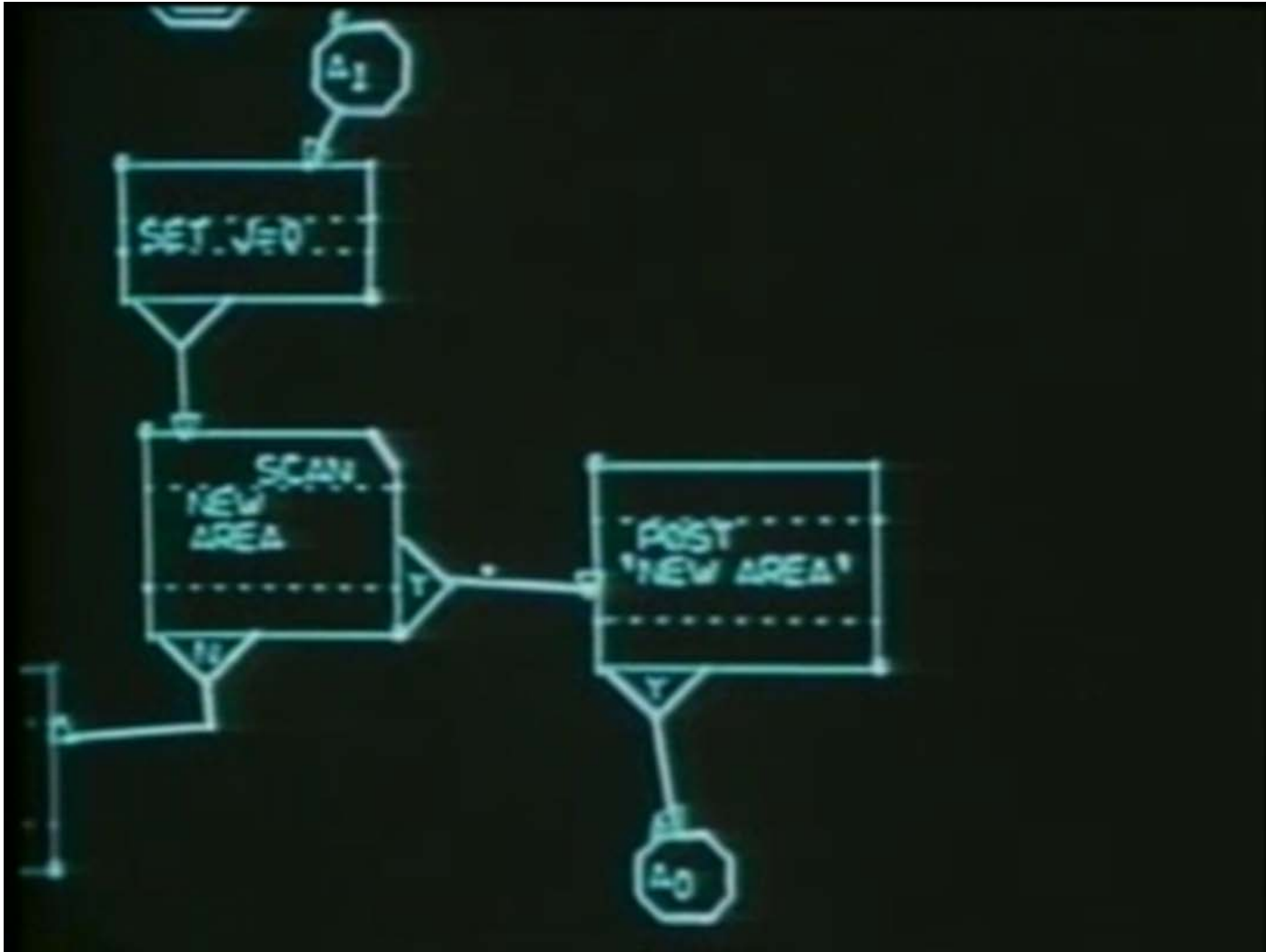
Chording keyboard to reduce hand movement

Remote collaboration

Analog Mouse leads to heavy moding

Reactions include accusations of “faking it” and claims of irrelevance because “terminal can do that”

# GRAIL



# GRAIL

When do we think this was done?

# GRAIL

When do we think this was done? 1968

Window handles

Modeless interaction via direct action

Gesture recognition

Proposed for end-user programming via flow charts



# Dynabook



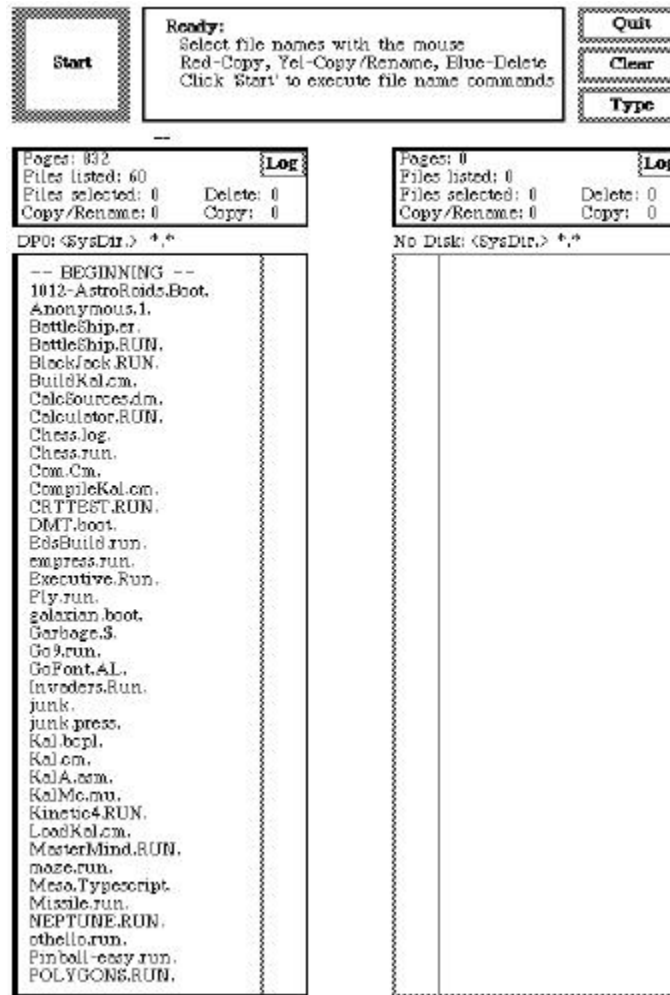
# Xerox to Apple and Microsoft

XEROX Alto 1973

# Xerox Alto



# Xerox Alto



# Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

# Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

XEROX STAR 1981

# Xerox Star





# Xerox Star

**XEROX 6085 Workstation**

**User-Interface Design**

To make it easy to compose text and graphics, to do electronic filing, printing, and mailing all at the same workstation, requires a revolutionary user interface design.

**Bit-map display** - Each of the pixels on the 19" screen is mapped to a bit in memory; thus, arbitrarily complex images can be displayed. The 6085 displays all texts and graphics as they will be printed. In addition, familiar office objects such as documents, folders, file drawers and in-baskets are portrayed as recognizable images.

**The mouse** - A unique pointing device that allows the user to quickly select any text, graphic or office object on the display.

**See and Point**

All functions are visible to the user on the keyboard or on the screen. The user does filing and retrieval by selecting them with the mouse and touching the mouse, COPY, DELETE or RESPONSE command keys. Text and graphics are edited with the same keys.

**Shorter Production Times**

Experience at Xerox with prototype work stations has shown shorter production times and that fewer costs, as a function of the percentage of use of the workstation. The following equation can be used to express this:

$$M = \sum_{i=1}^n \frac{A + P_i}{R_i}$$

where  $M$  is the mean time to produce a document,  $A$  is the average time to set up the workstation,  $P_i$  is the time to produce the  $i$ th document, and  $R_i$  is the rate of production of the  $i$ th document.

**Table 1: Percentage of use of methods**

Year	See	Point
1978	85.2	14.8
1980	41.1	58.9
1982	45	55
1984	30	70
1986	10	90
1988	5	95

**Figure 1: Data from Table 1**

Workstation usage percentage Table 1 and illustrated in Figure 1. Xerox 6085 users are likely to do the composition and layout, create printer including printing and distribution.

**Text and Graphics**

To replace typewriting, the 6085 offers a choice of type faces and sizes, from 6 point to 36 point.

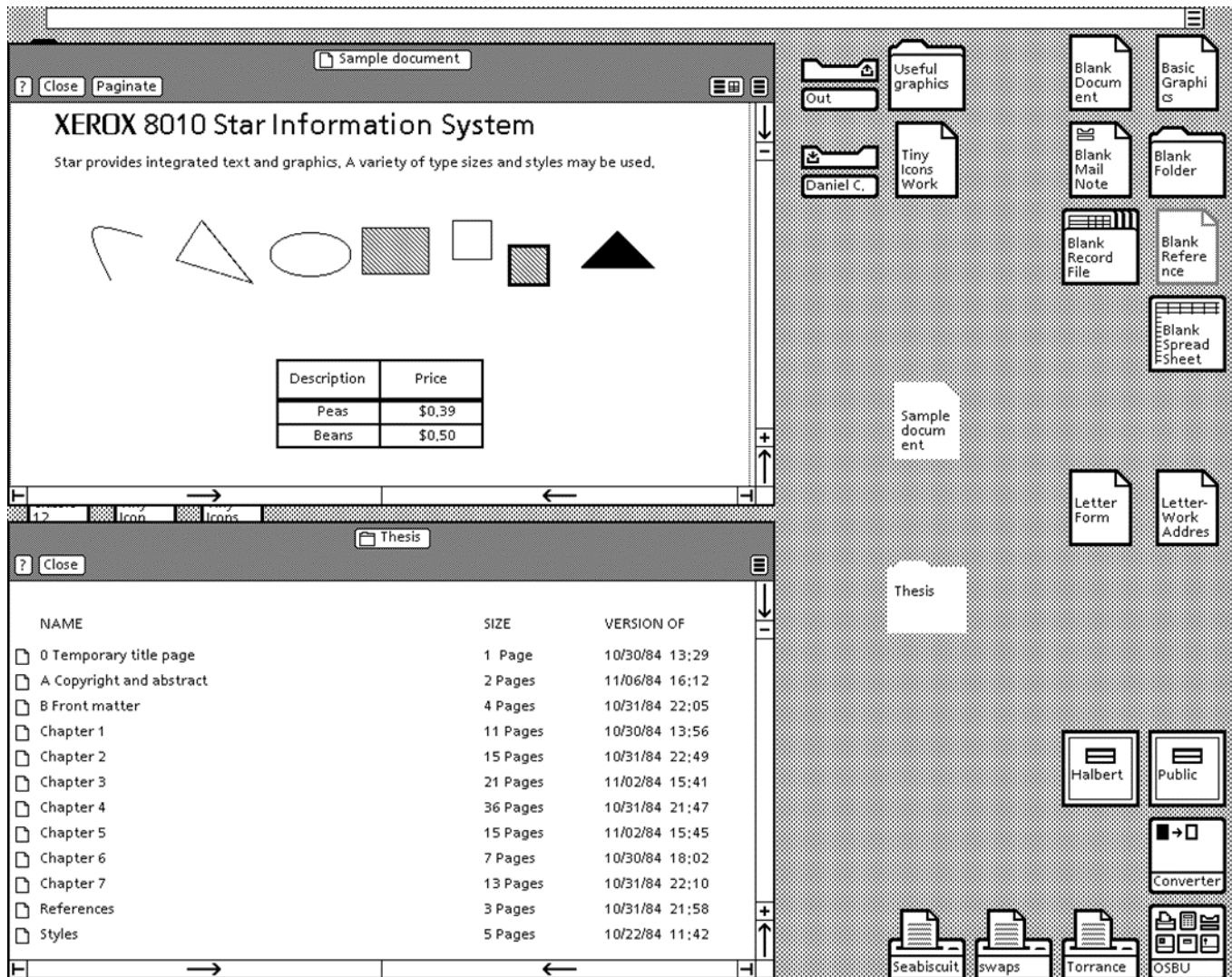
Here is a sentence of 12 point text.  
 Here is a sentence of 18 point text.  
 Here is a sentence of 24 point text.  
 Here is a sentence of 36 point text.

**DOS & Lotus data**

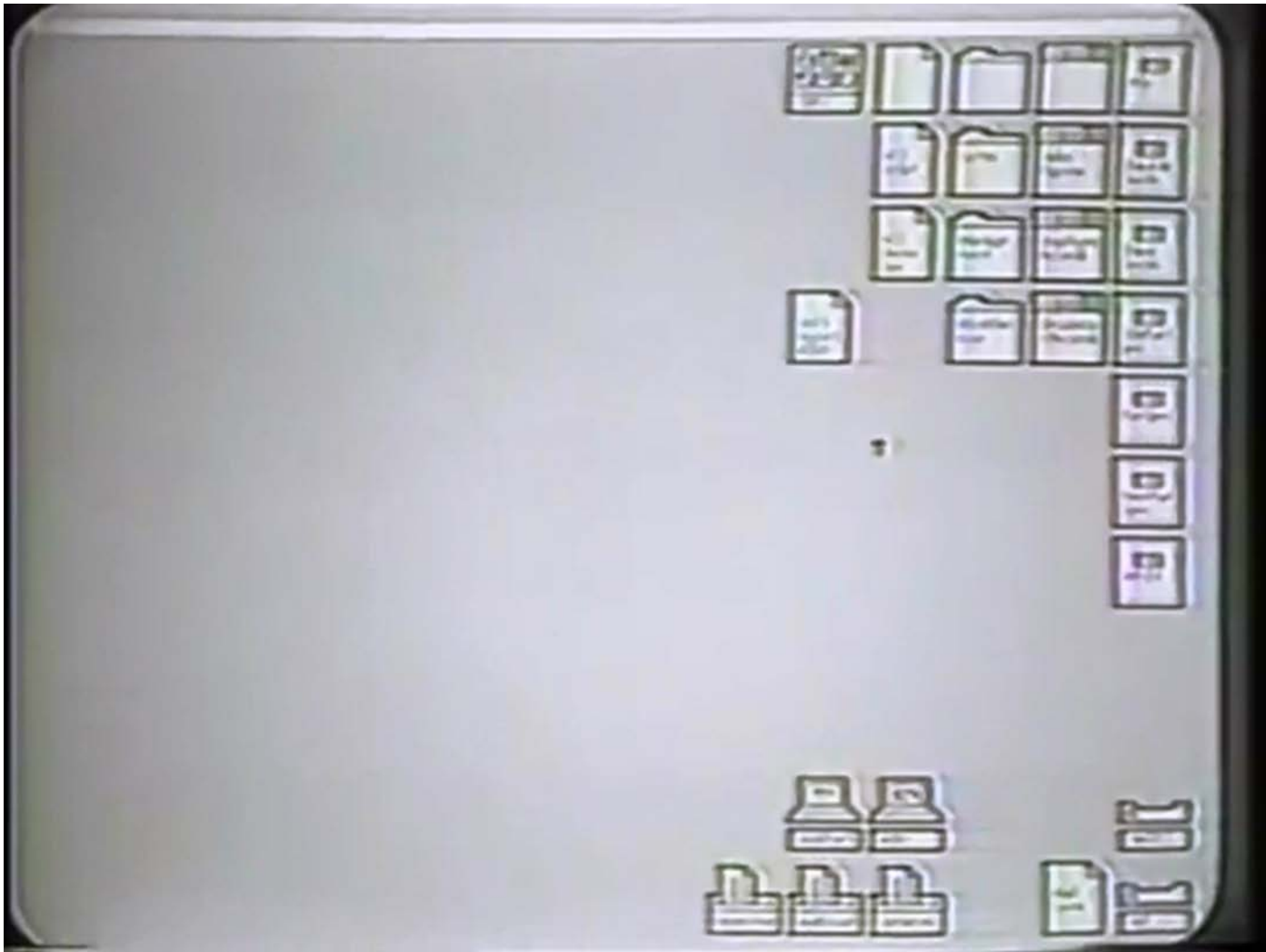
NAME	EXTENSION	SIZE	DATE
COMMAND	COM	32677	15-10-88
ANSI	SV5	2556	18-10-88
ASSIGN	COM	864	28-10-88
ATTEND	EXE	15091	14-10-88
BACKUP	COM	17024	28-10-88
CHKDSK	COM	9425	24-10-88
CHMOD	COM	6520	27-10-88
COMP	COM	3018	10-10-88
DEBUG	EXE	15364	15-10-88



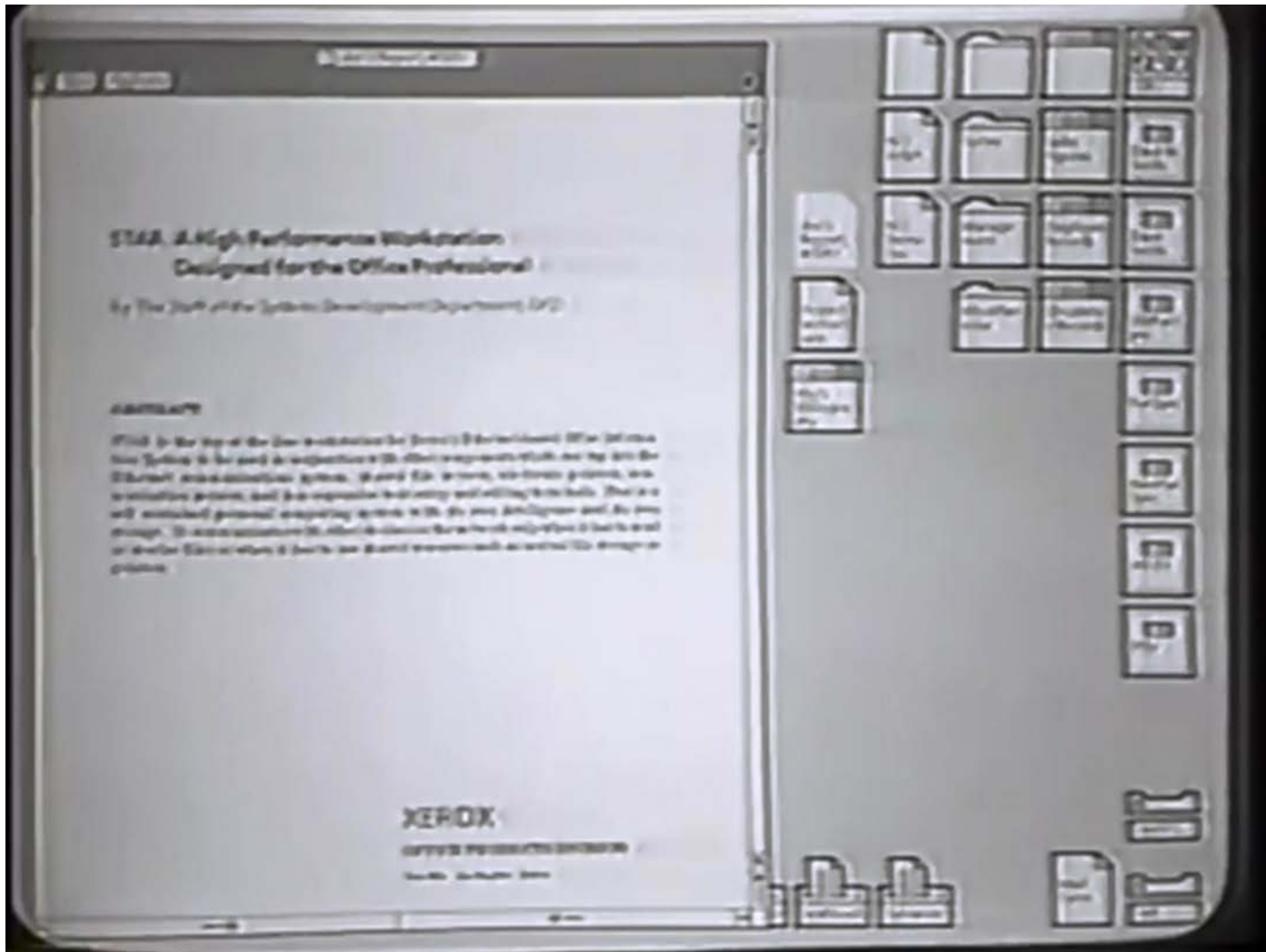
# Xerox Star



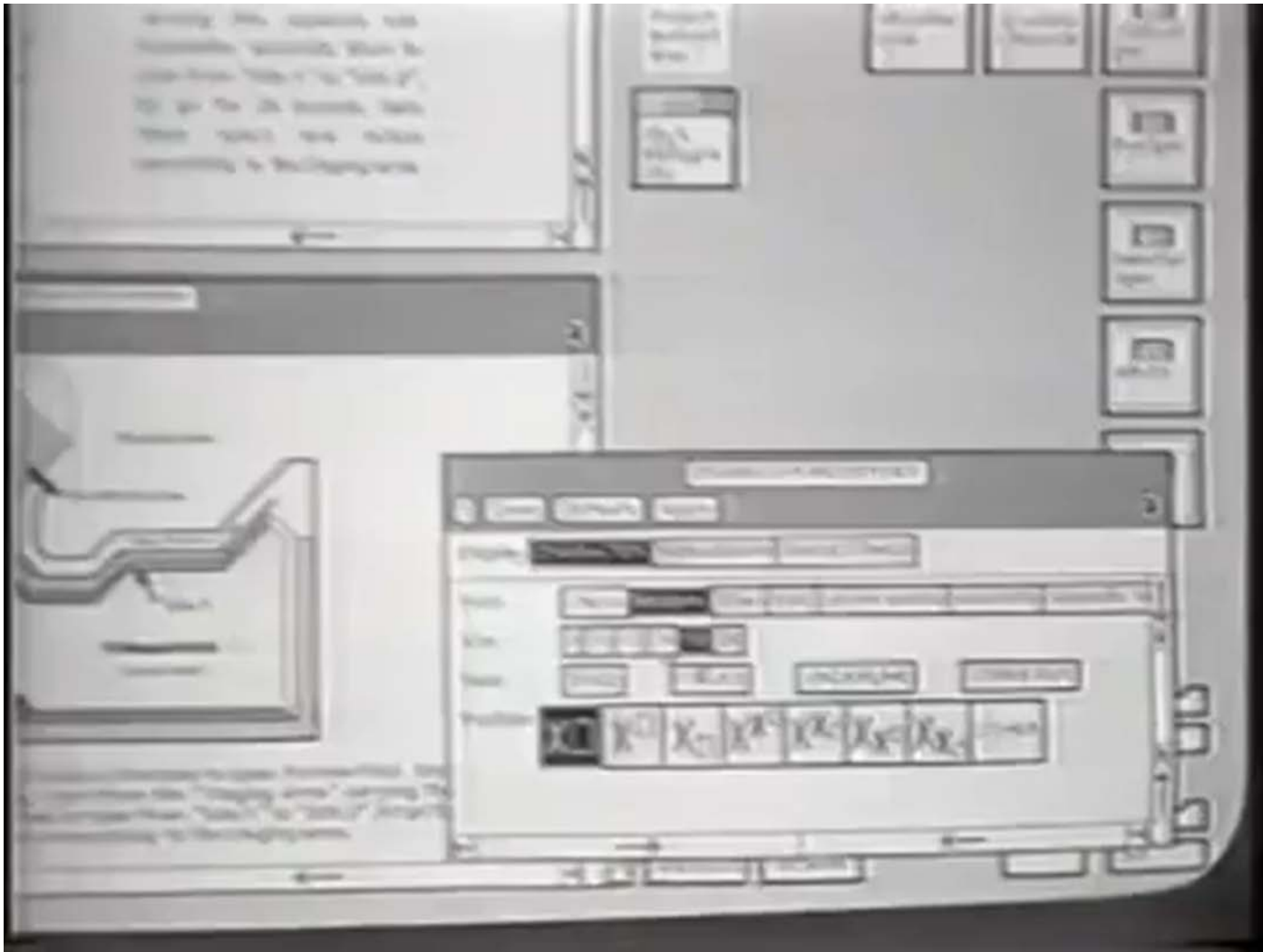
# Xerox Star



# Xerox Star



# Xerox Star



# Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

XEROX STAR 1981

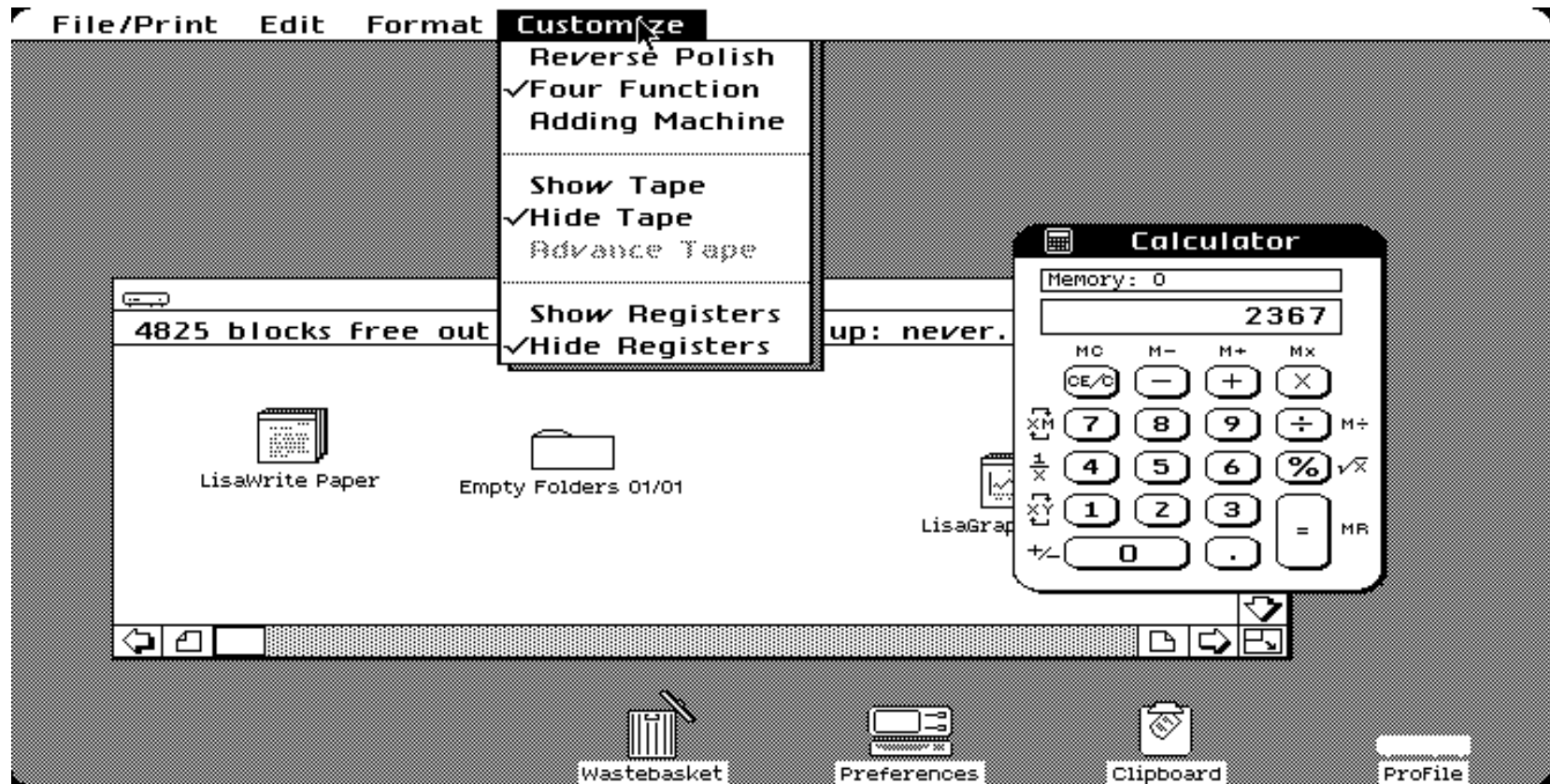
Apple Lisa 1981



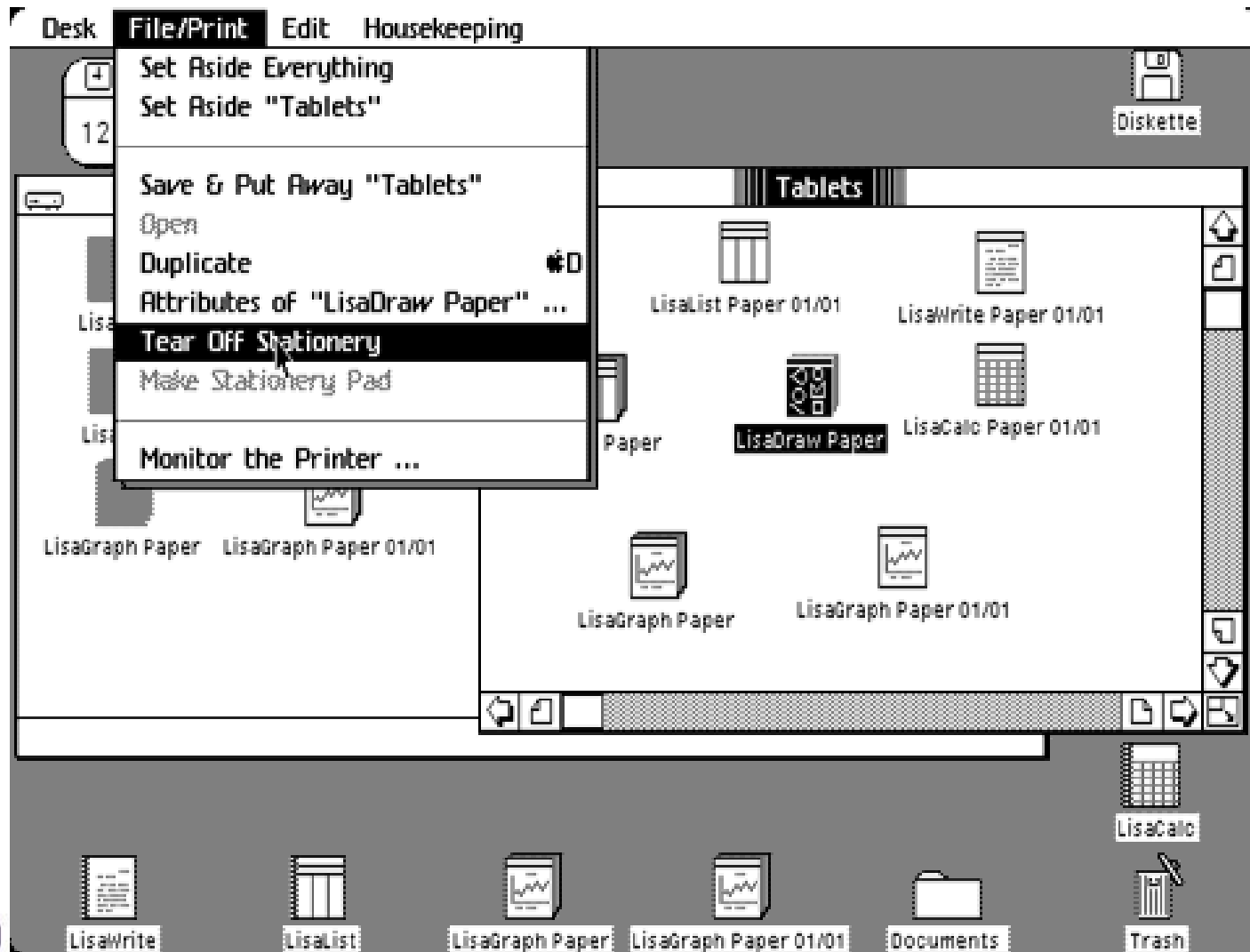
# Apple Lisa



# Apple Lisa

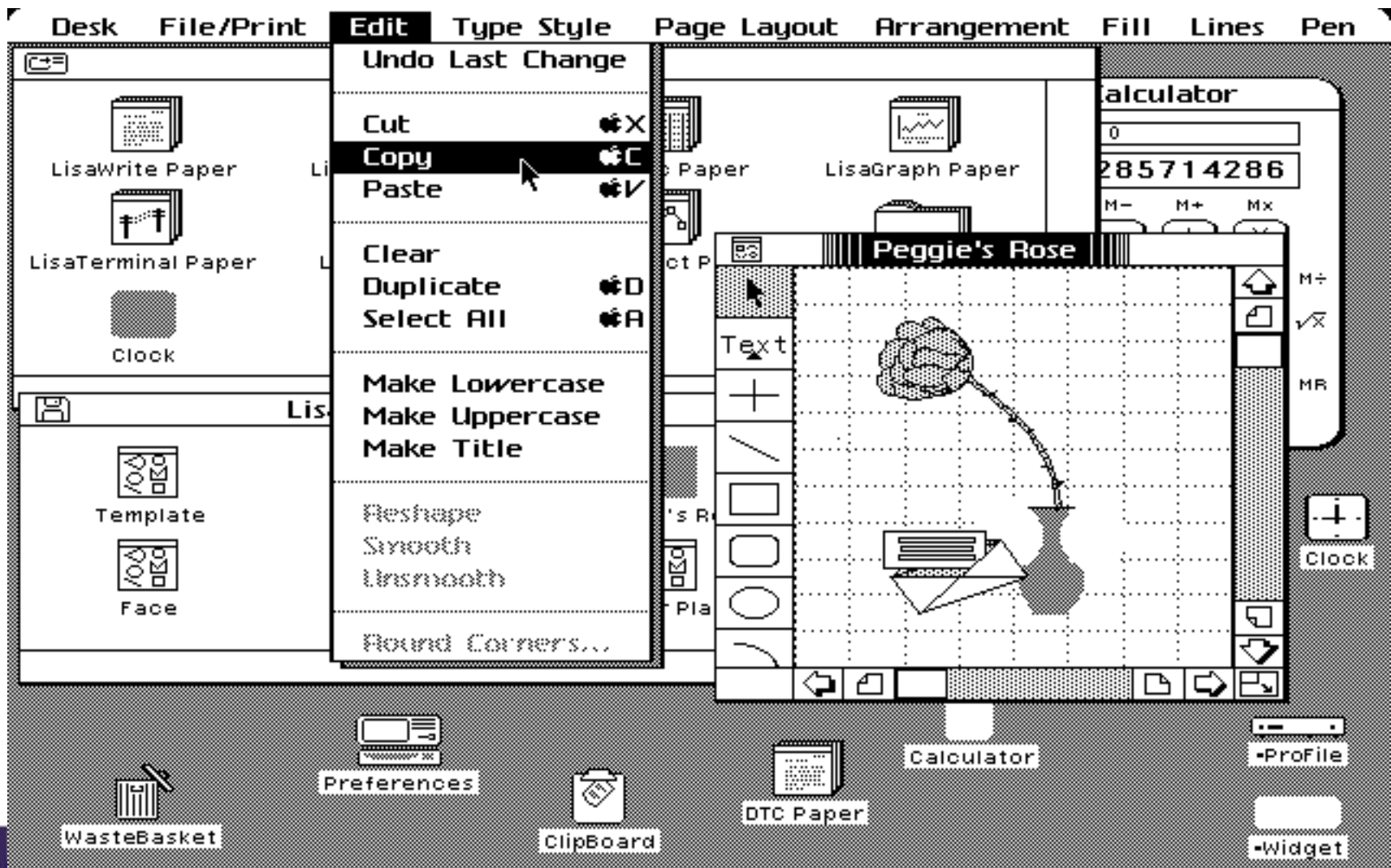


# Apple Lisa





# Apple Lisa



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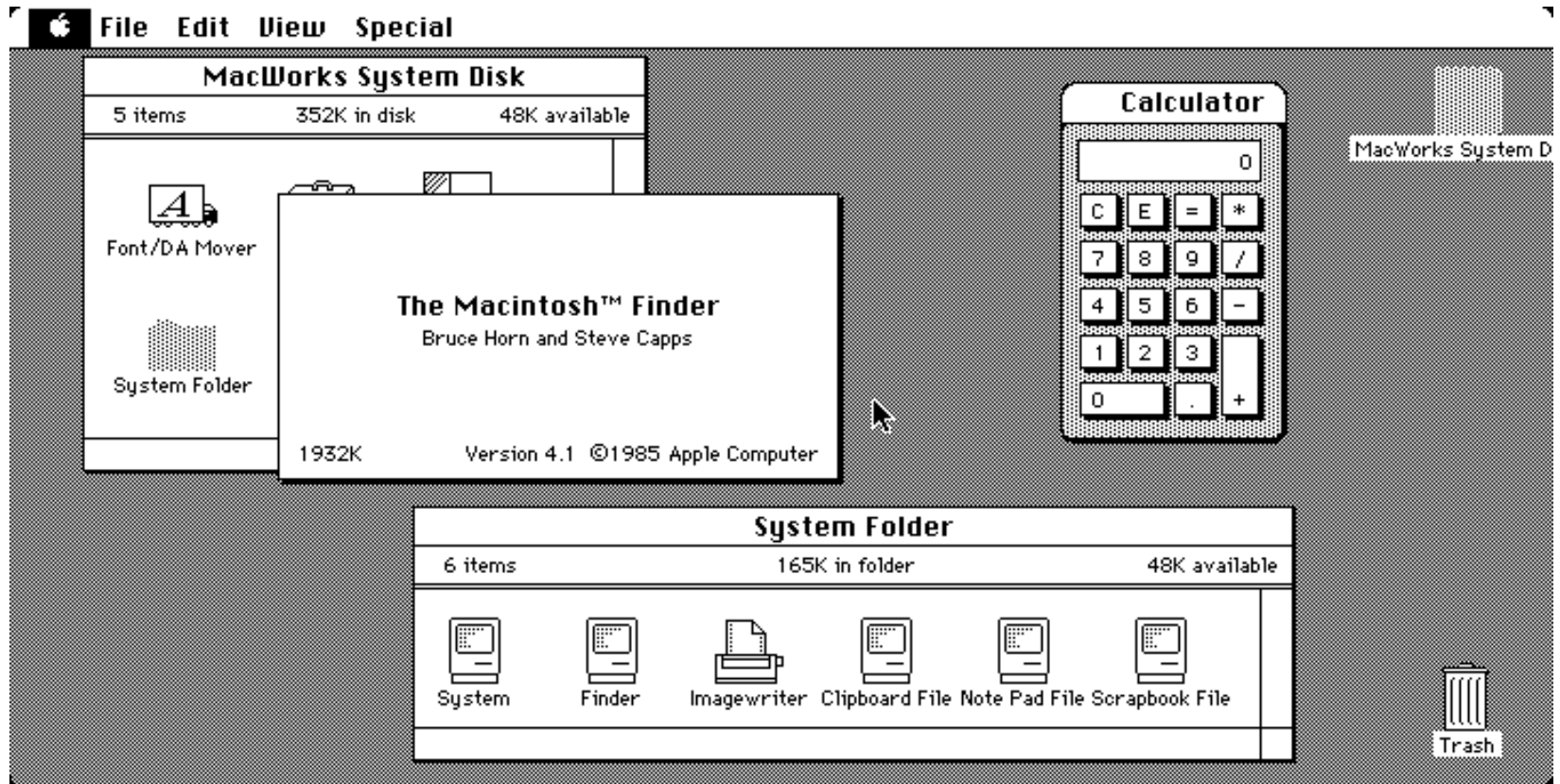
Apple Lisa 1981

Apple Macintosh 1984

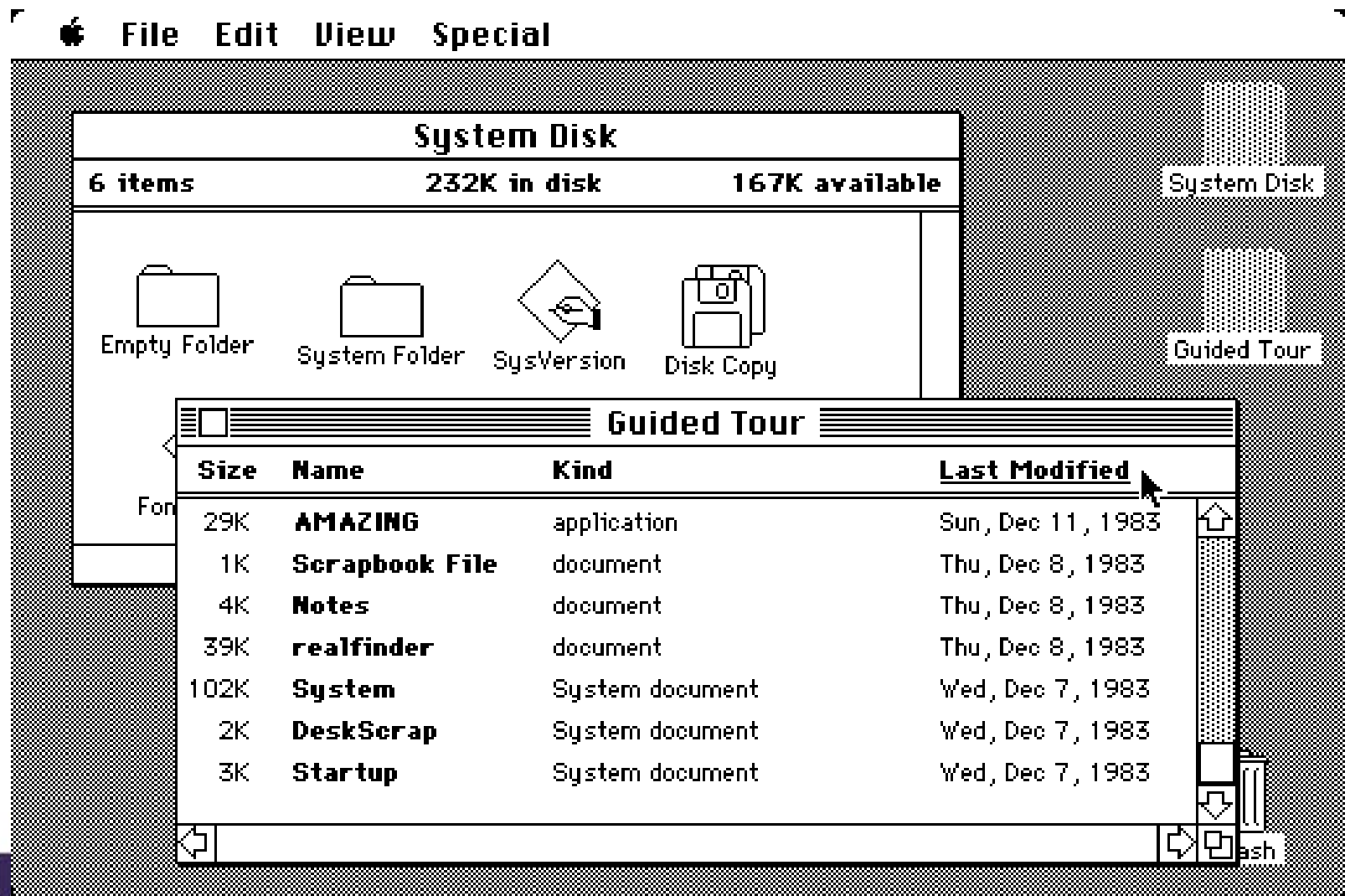
# Macintosh



# Macintosh



# Macintosh



# Xerox to Apple and Microsoft

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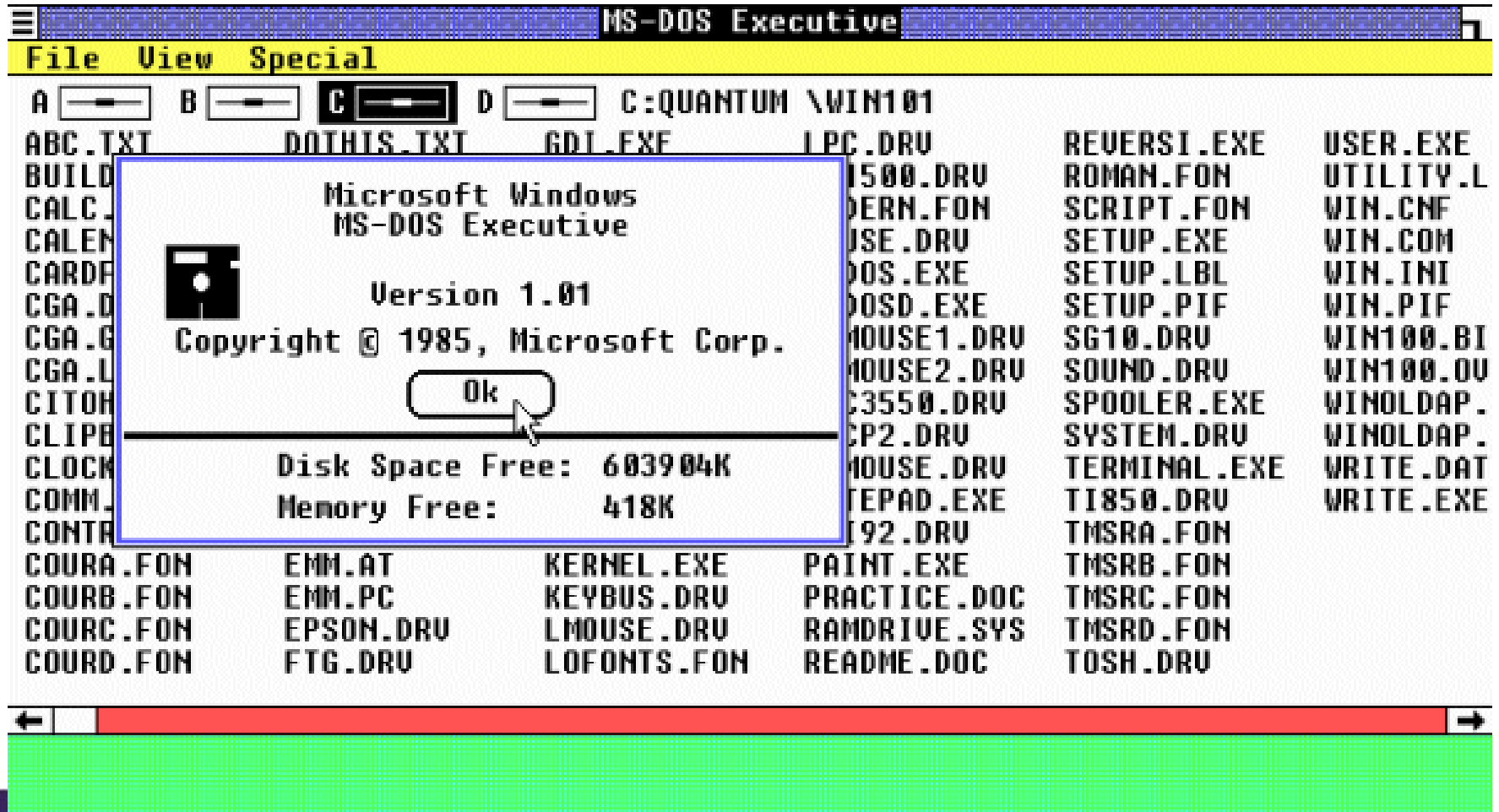
XEROX STAR 1981

Apple Lisa 1981

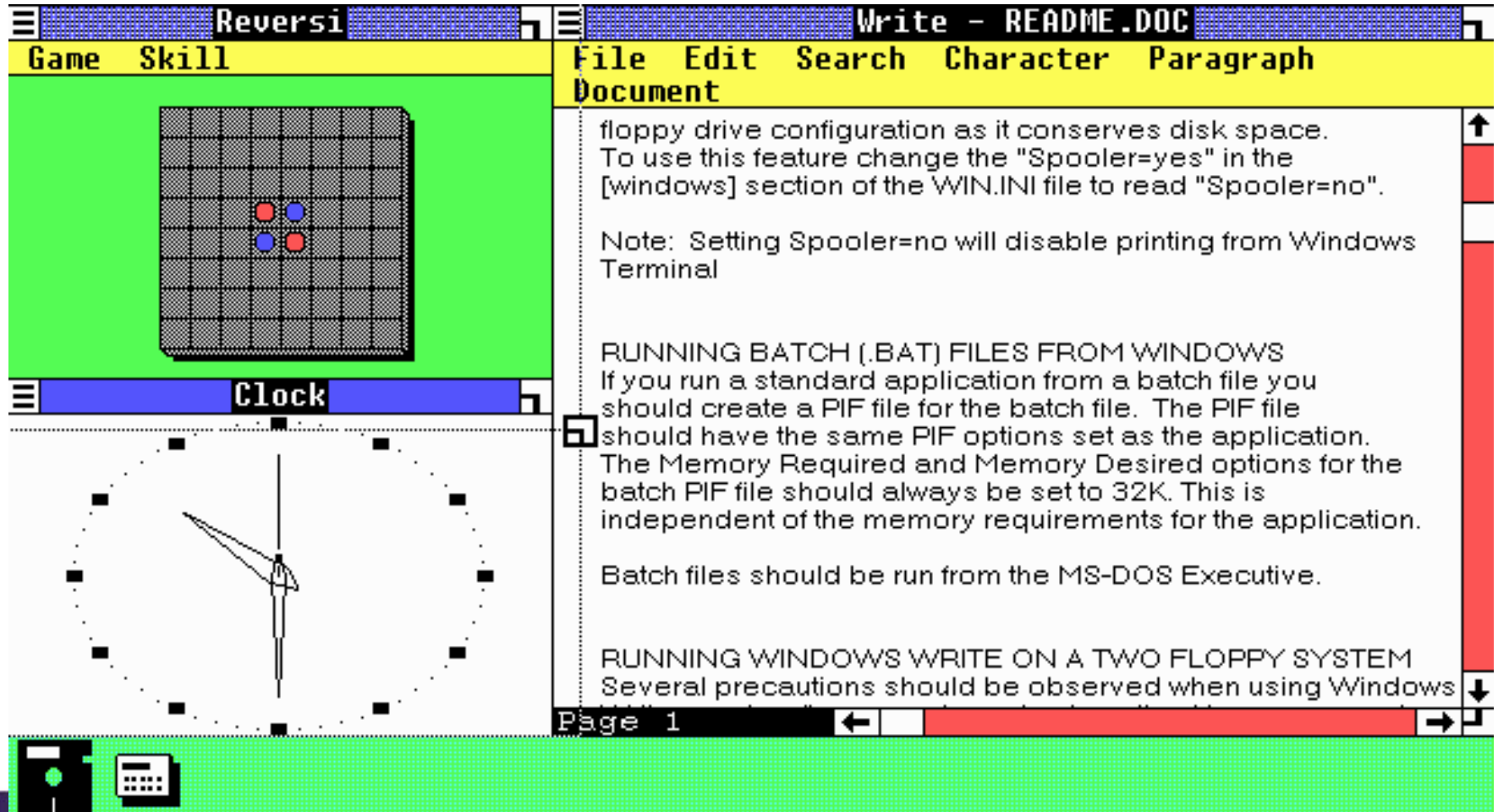
Apple Macintosh 1984

Windows 1.0 1985

# Windows 1.0

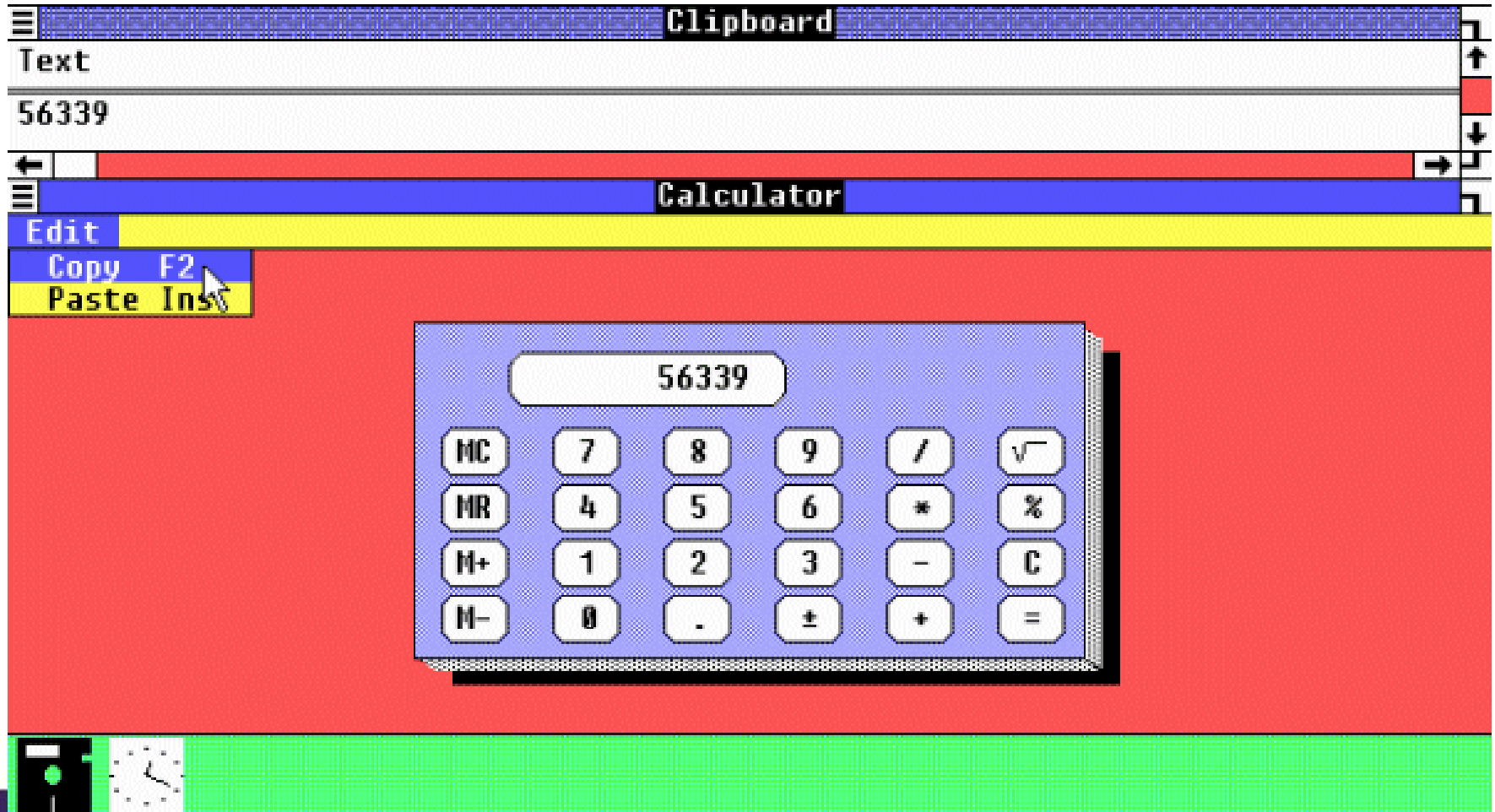


# Windows 1.0





# Windows 1.0



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XEROX STAR 1981

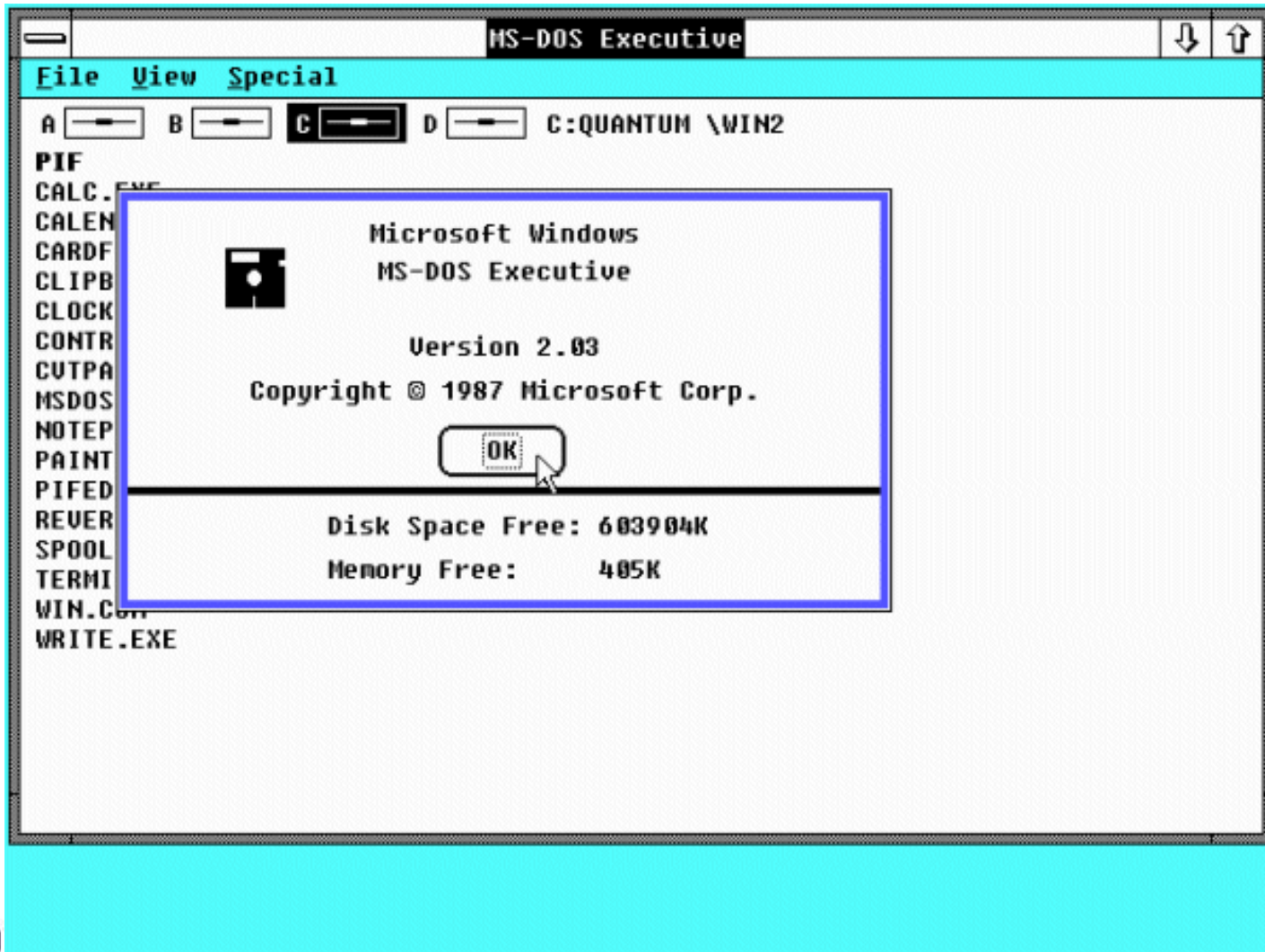
Apple Lisa 1981

Apple Macintosh 1984

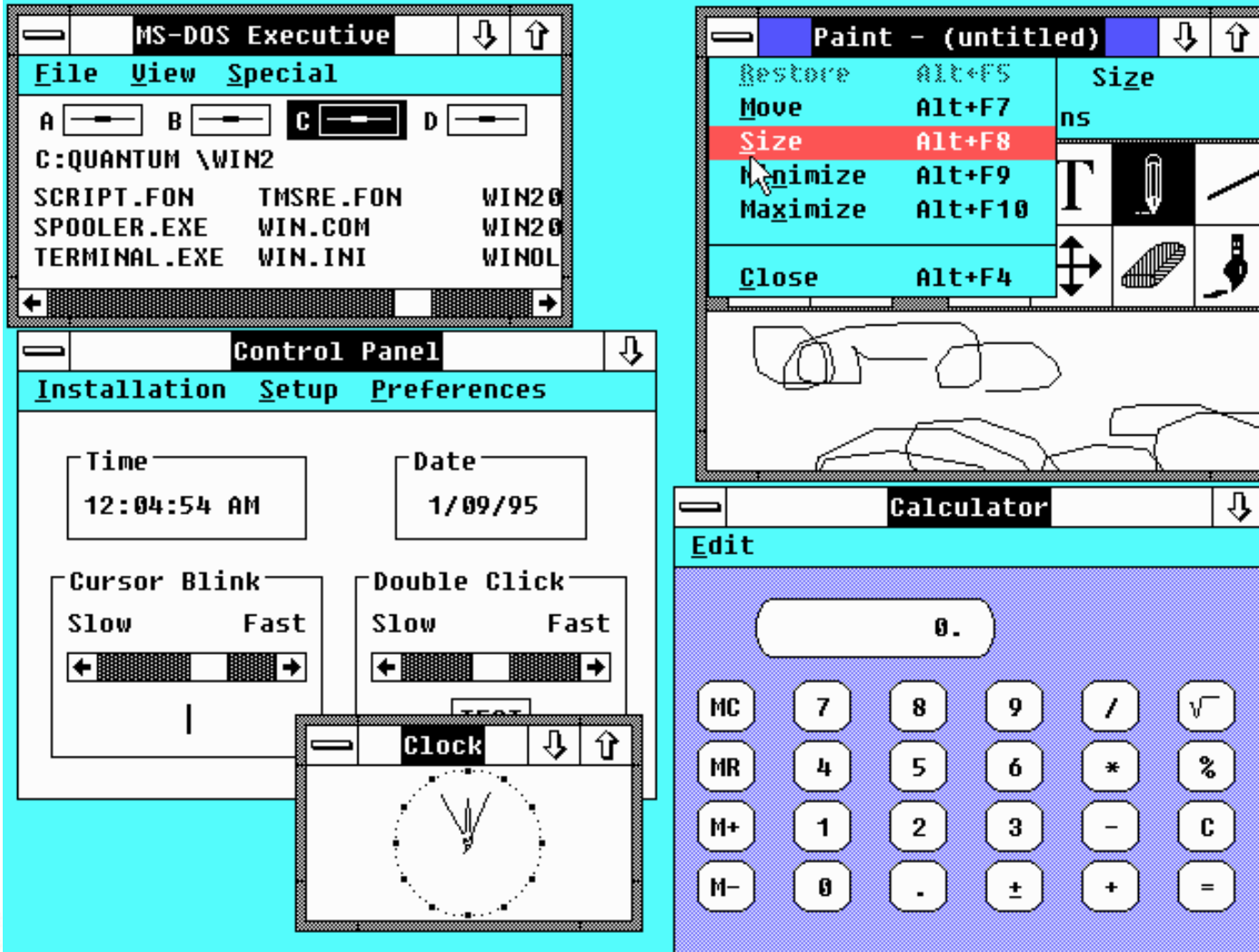
Windows 1.0 1985

Windows 2.0 1987

# Windows 2.0 (1987)



# Windows 2.0



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XEROX STAR 1981

Apple Lisa 1981

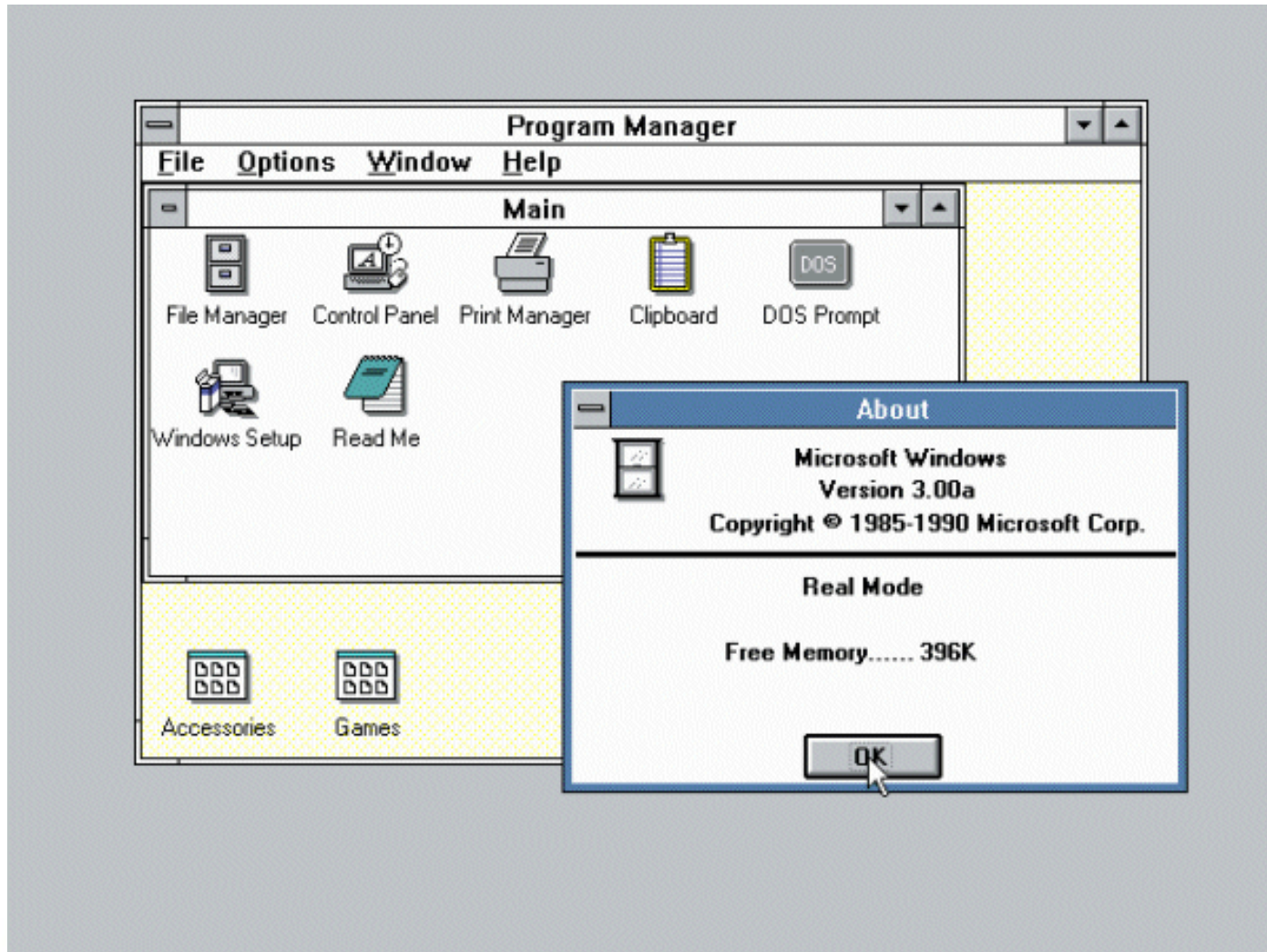
Apple Macintosh 1984

Windows 1.0 1985

Windows 2.0 1987

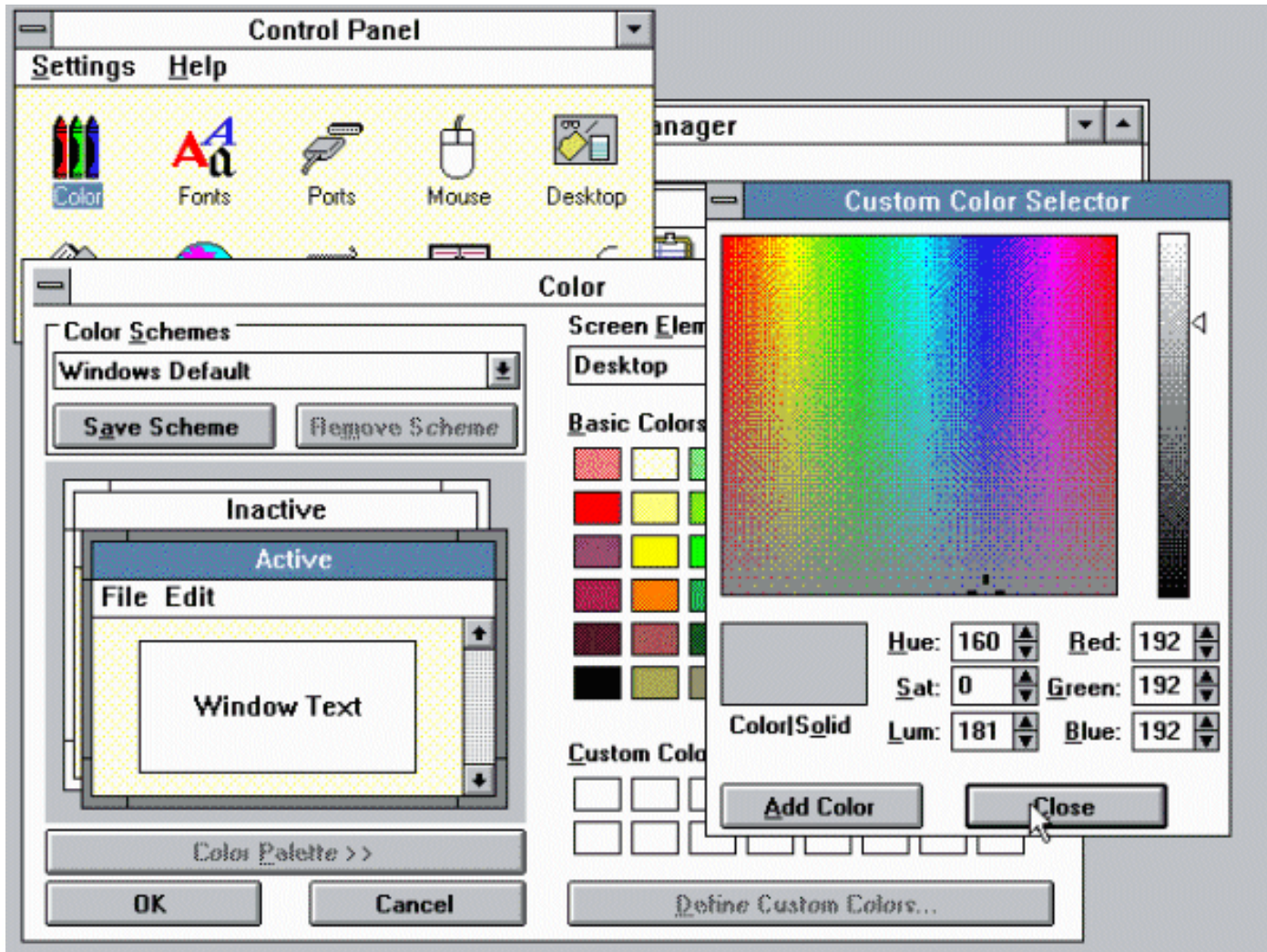
Windows 3.0 1990

# Windows 3.0

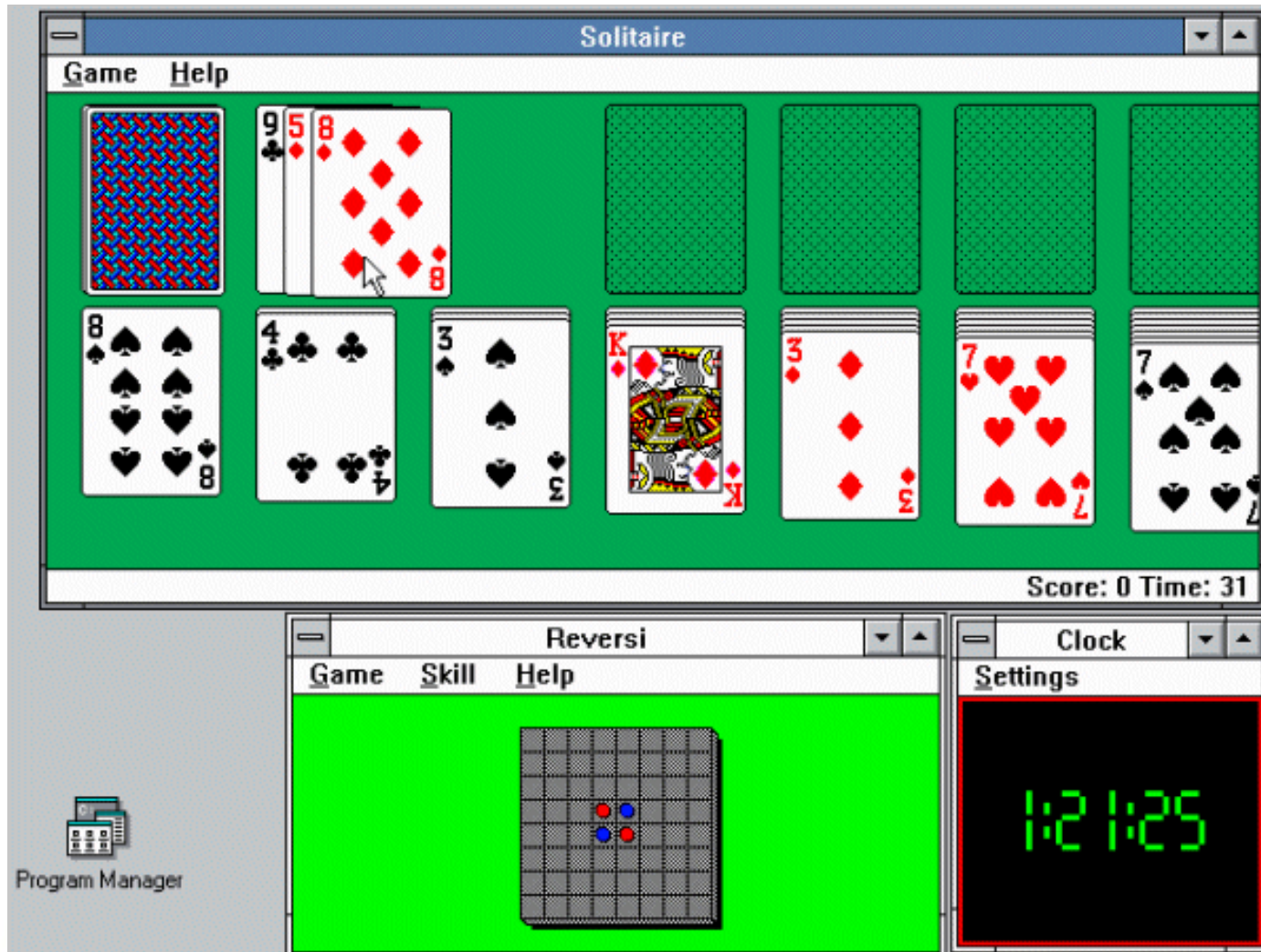




# Windows 3.0



# Windows 3.0





# Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

XEROX STAR 1981

Apple Lisa 1981

Apple Macintosh 1984

Windows 1.0 1985

Windows 2.0 1987

Windows 3.0 1990

Bill Gates: "Hey, Steve, just because you broke into Xerox's house before I did and took the TV doesn't mean I can't go in later and take the stereo"

# HCI Turing Awards

Sutherland wins 1988 Turing Award

Engelbart wins 1997 Turing Award

Alan Kay wins 2003 Turing Award

(in part for SmallTalk and OOP,  
though he says OOP is linked to the GUI)

# CSE 510: Advanced Topics in HCI

Course Overview  
HCI History

James Fogarty  
Daniel Epstein

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CSE 403

