

CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 09:
History

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234



Today

Milestones

Design Review (“1x2”) Due Tonight

Getting the Right Design Due Tuesday

Presentations Start Thursday

Class

HCI History

Design Feedback

Why do we do HCI in CSE?

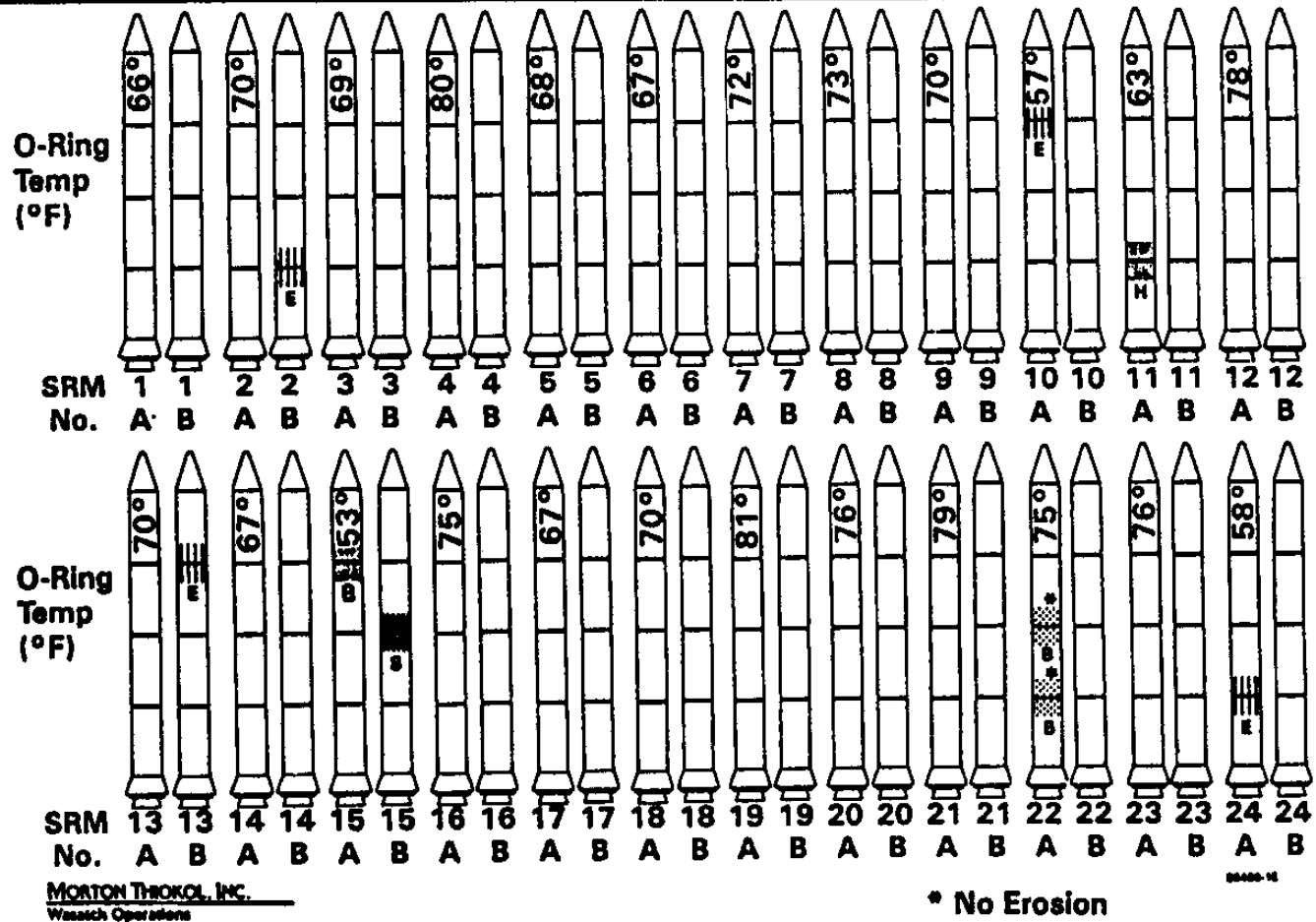
Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns

Tacoma Narrows



O-Rings

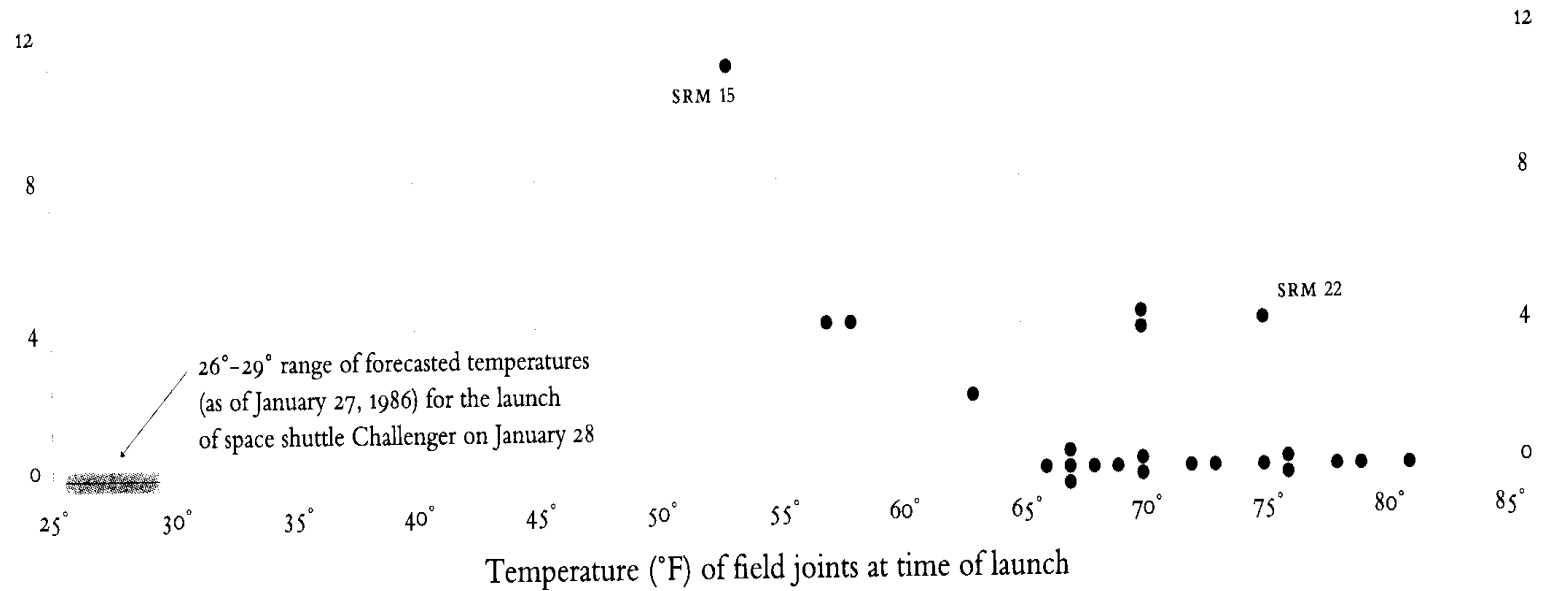
History of O-Ring Damage in Field Joints (Cont)



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

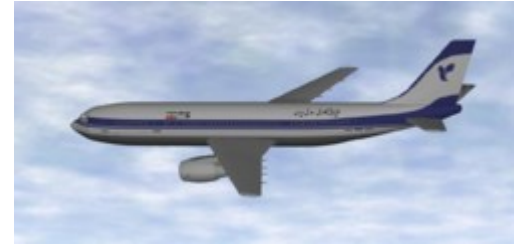
(pilots are crashing planes)

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

(ask me about Grudin article if you're interested)

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.

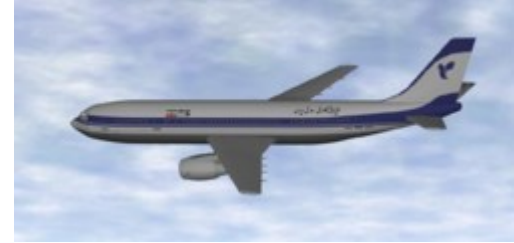


In 1988, the crew of the *USS Vincennes* Combat Information Center confusingly reported the plane as ascending and descending at the same time (there were two "camps").



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

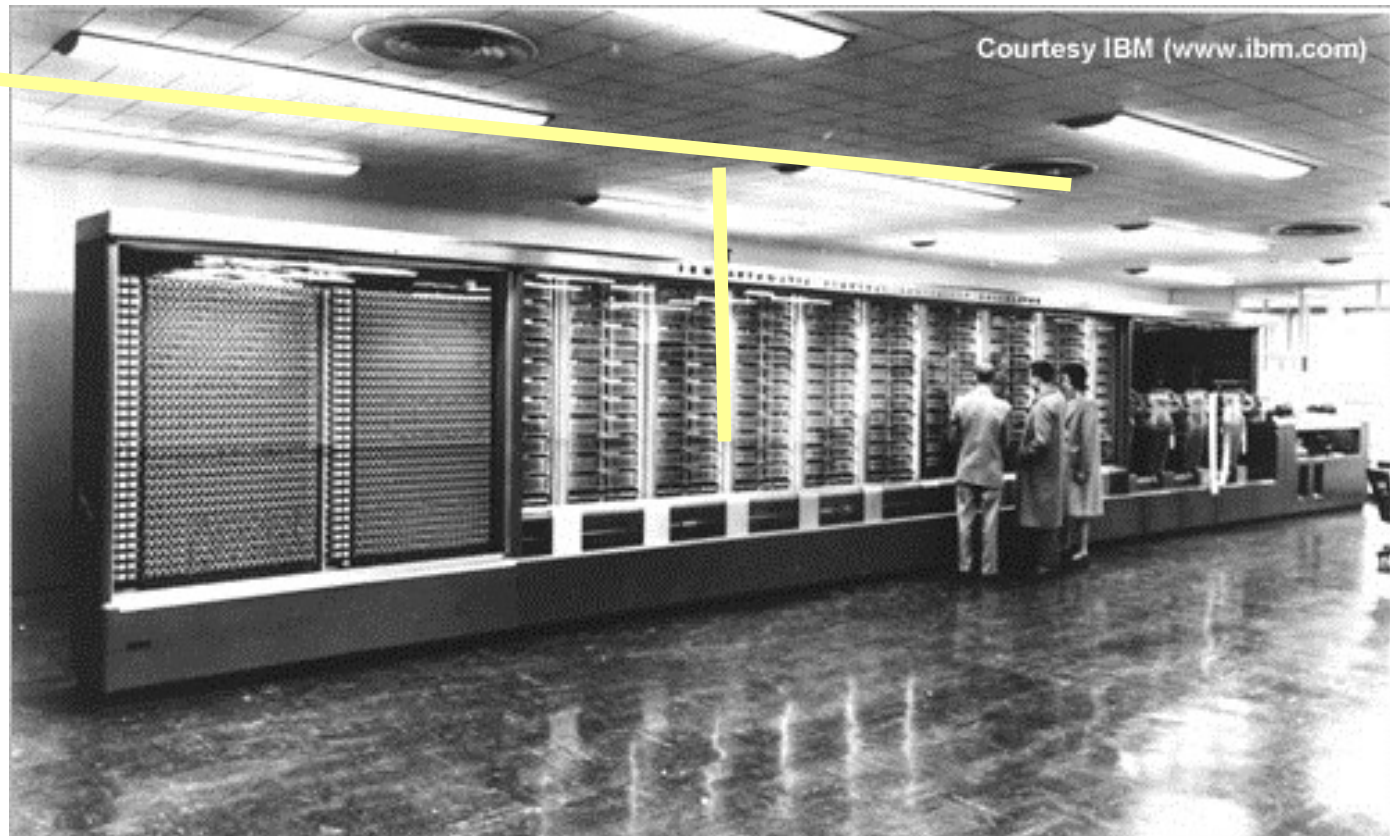
This study must include computer scientists, as we are the ones creating the technology

A History Question

Who invented hypertext? When?

Computing in 1945

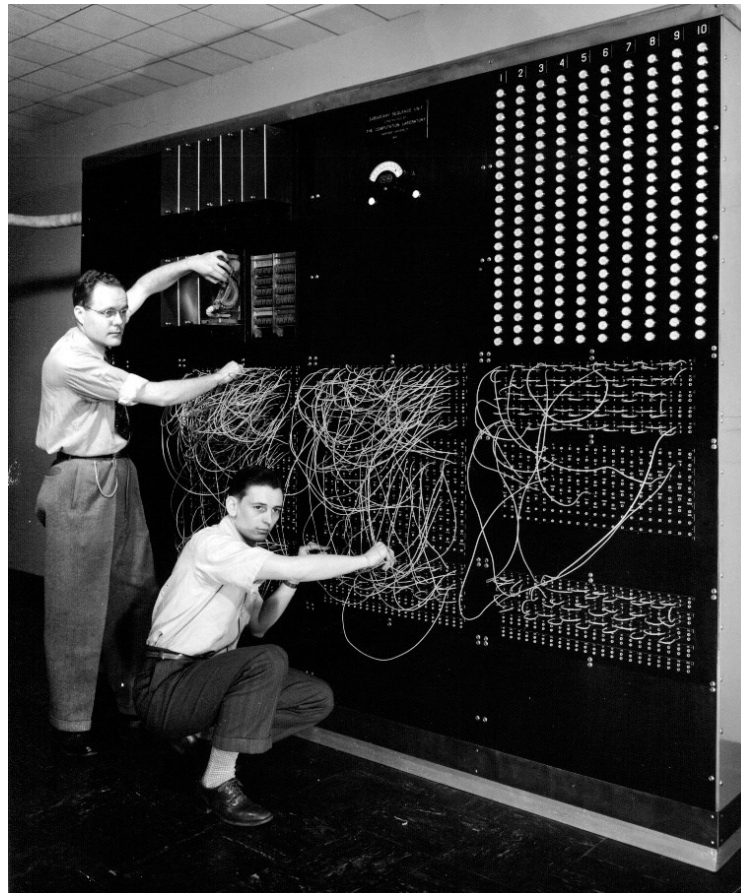
Harvard Mark I, 55 feet long, 8 feet high, 5 tons



The Harvard Mark I

Computing in 1945

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



Computing in 1945

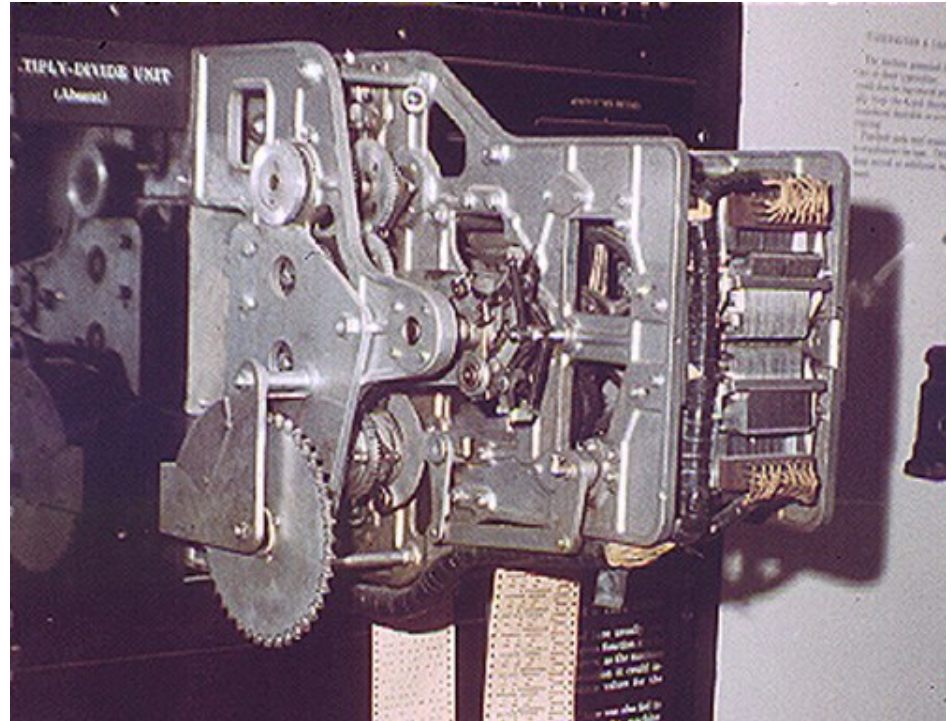
Ballistics calculations

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 (Sine check)
1525 Started Multi-Adder Test.

1545



Relay #70 Panel F
(moth) in relay.

~~1630~~ 1630 exchanges started.
1700 closed down.

A Little About Vannevar Bush

Name rhymes with “Beaver”

Faculty member at MIT

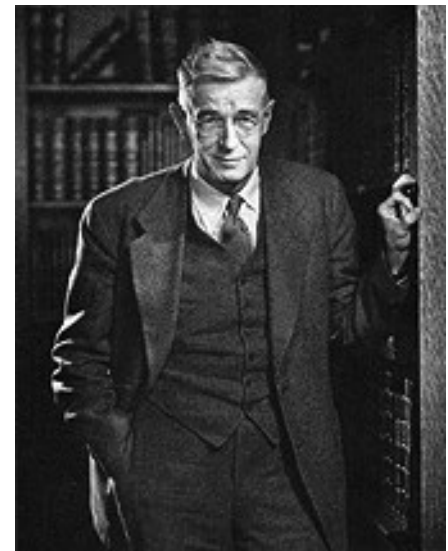
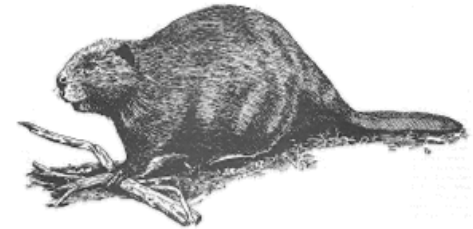
Coordinated WWII effort
with 6000 US scientists

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

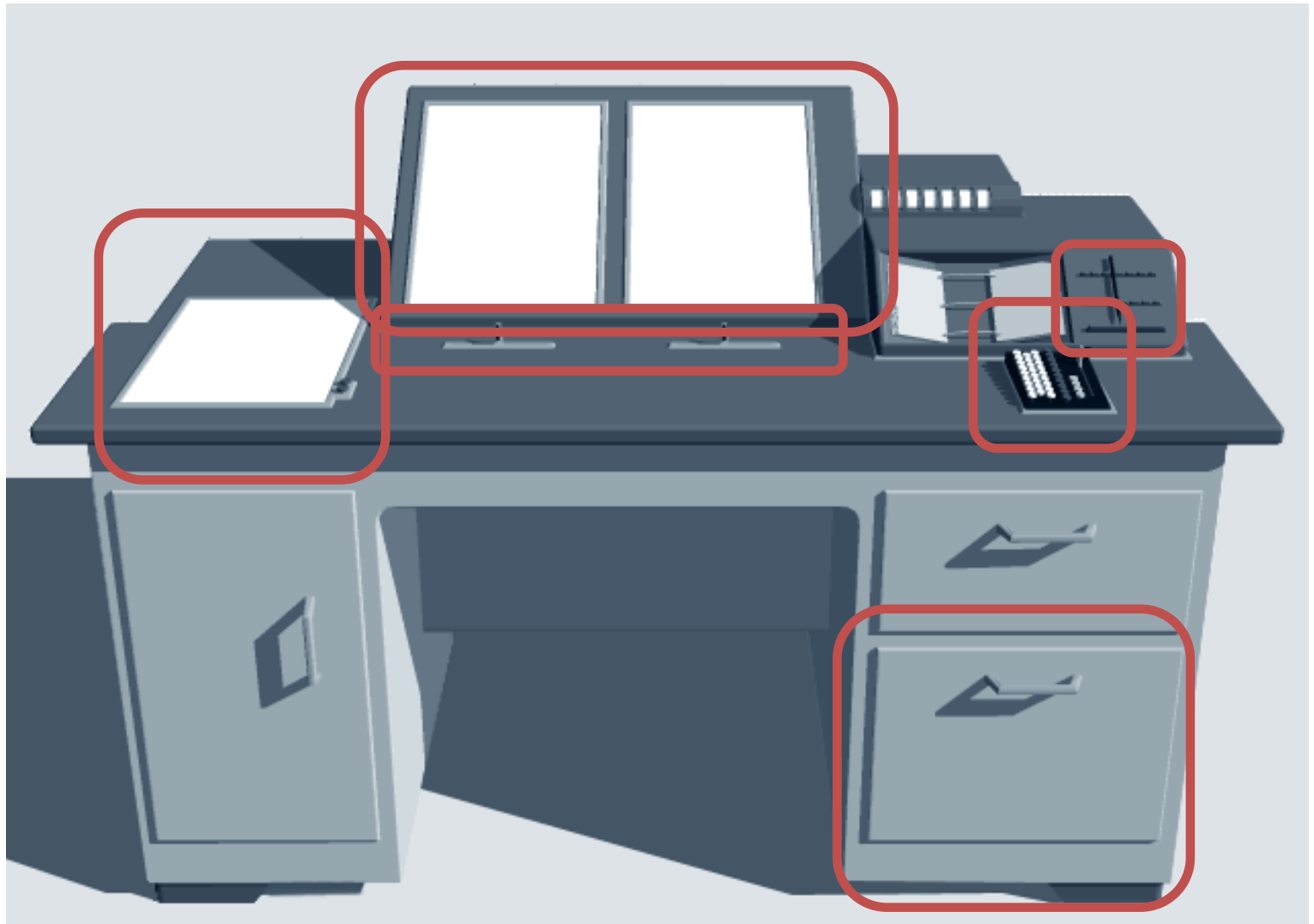
“It would be a brave man who would predict that such a process will always remain clumsy, slow, and faulty in detail.”

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

On January 24th,
Apple Computer will introduce
Macintosh.
And you'll see why 1984
won't be like "1984"

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

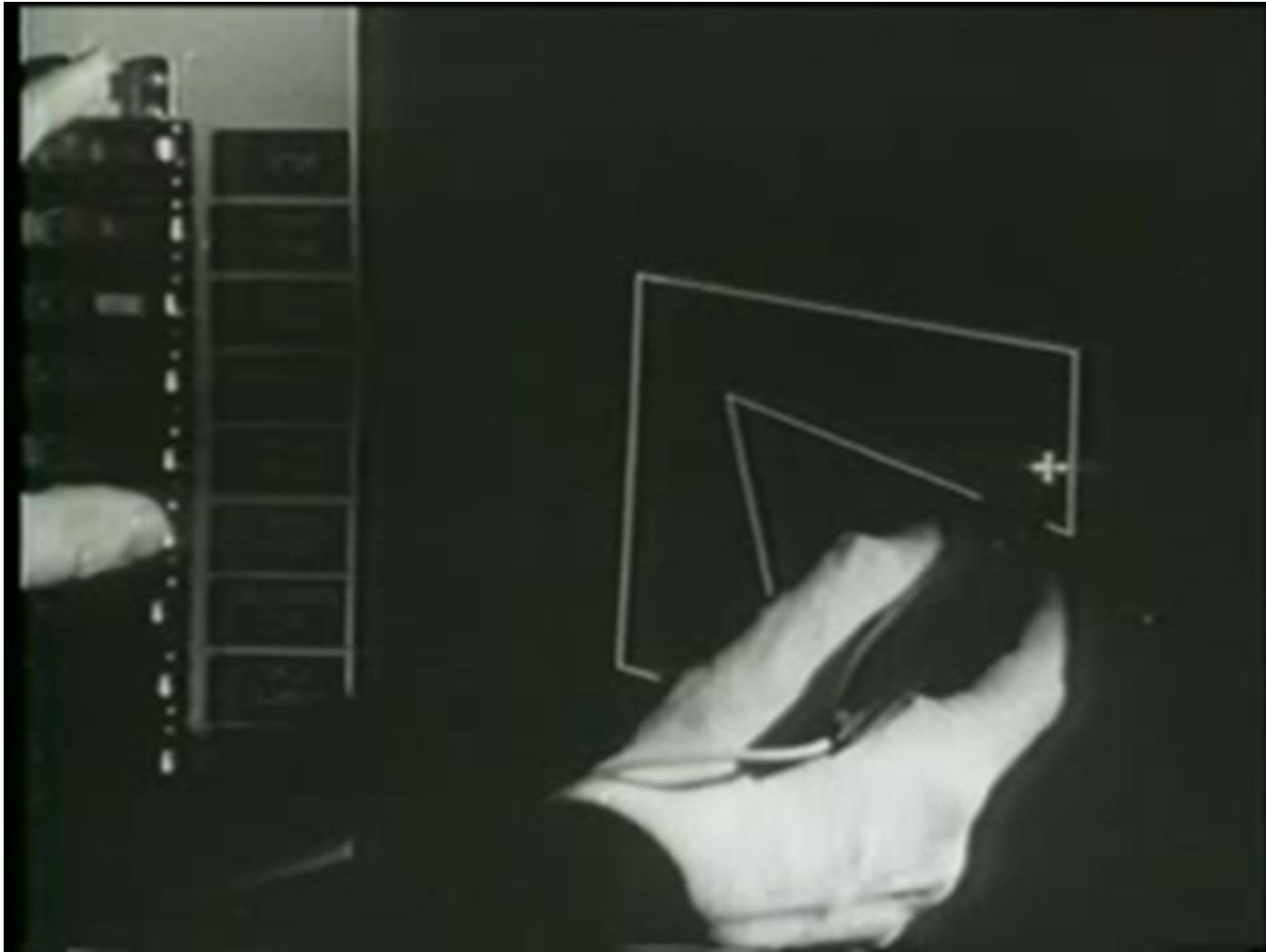
NLS

GRAIL

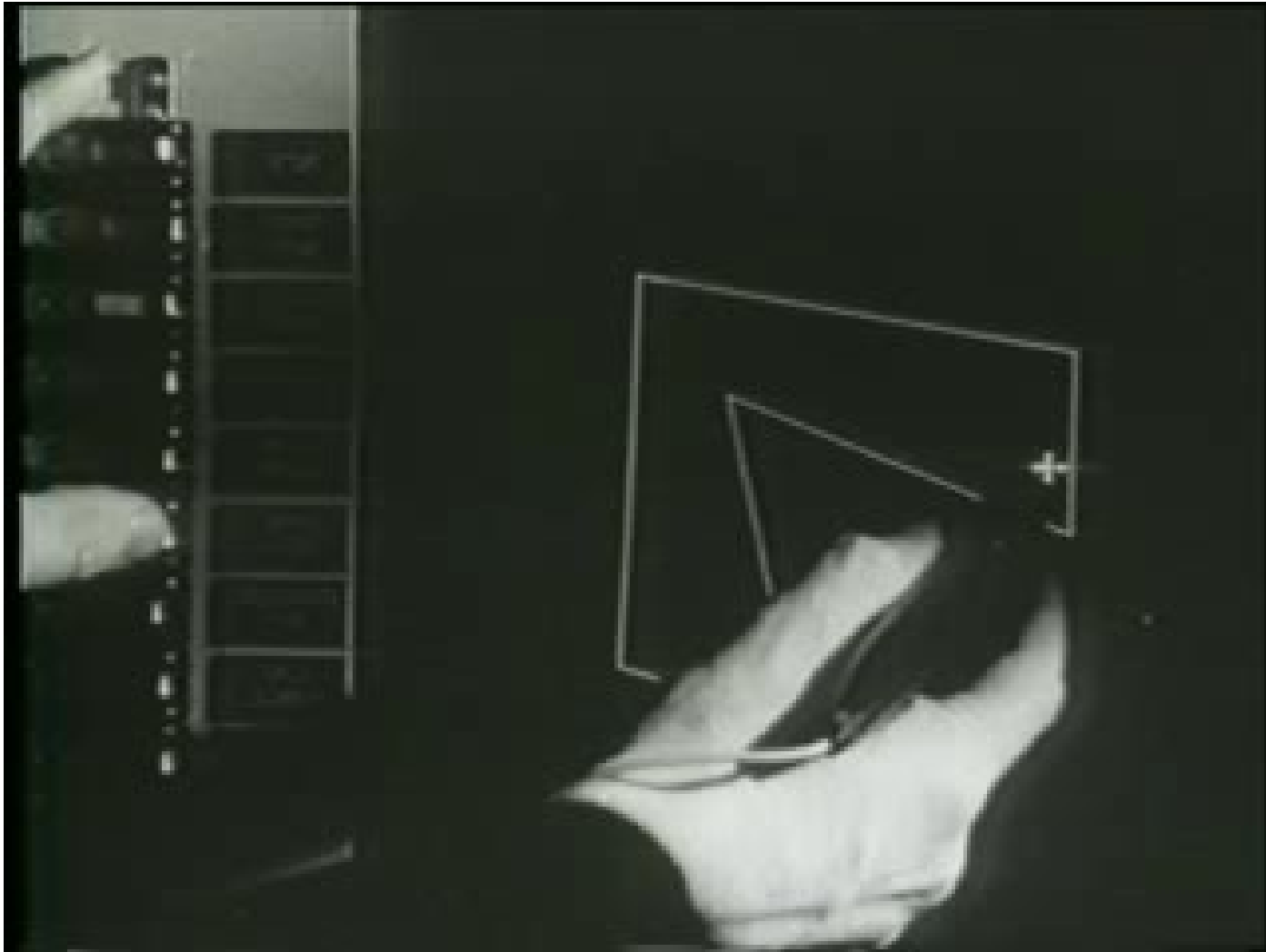
Dynabook

<http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987.m4v>

Ivan Sutherland's Sketchpad



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?



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)

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```

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

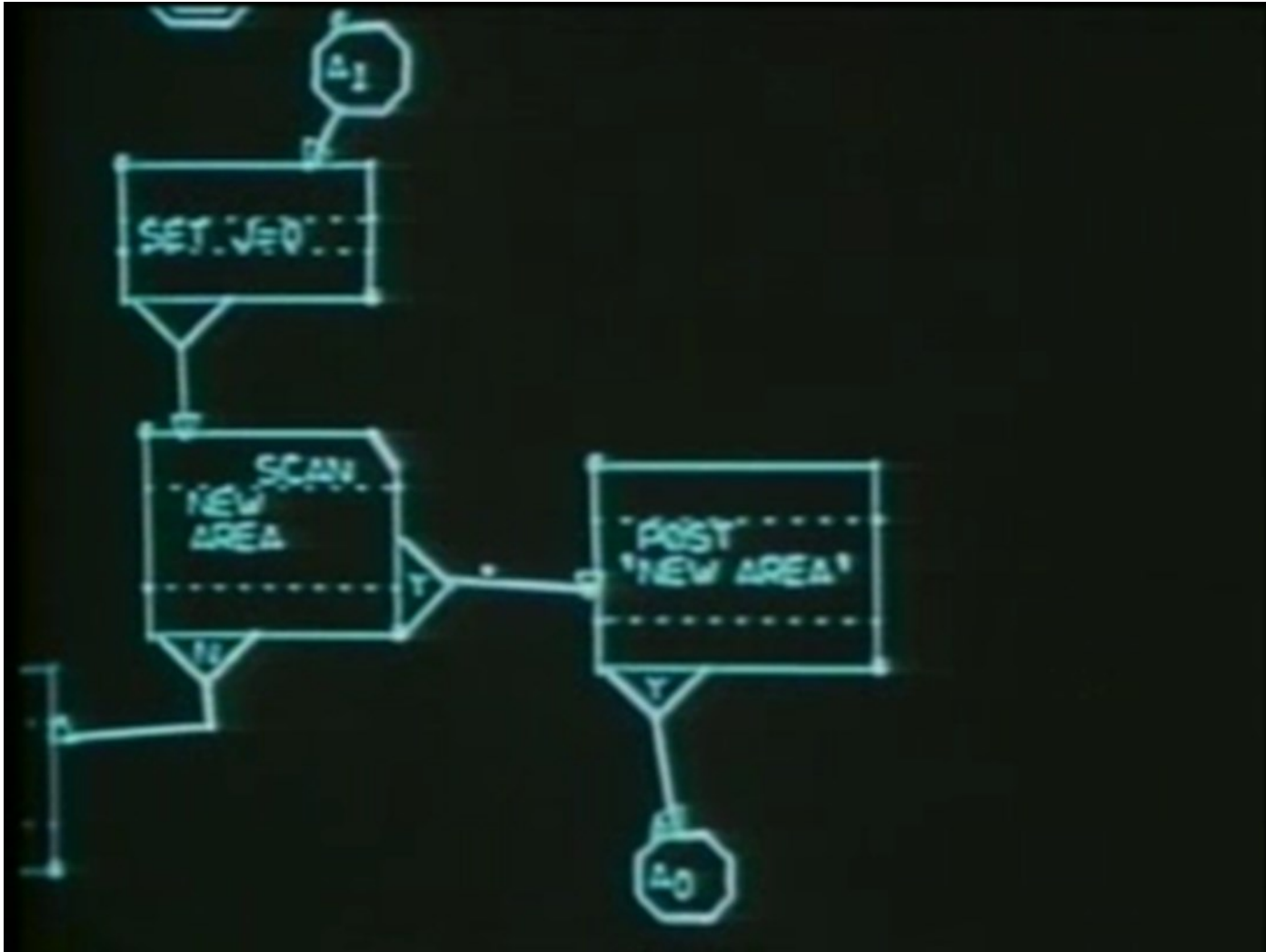
Chording keyboard to reduce hand movement

Remote collaboration

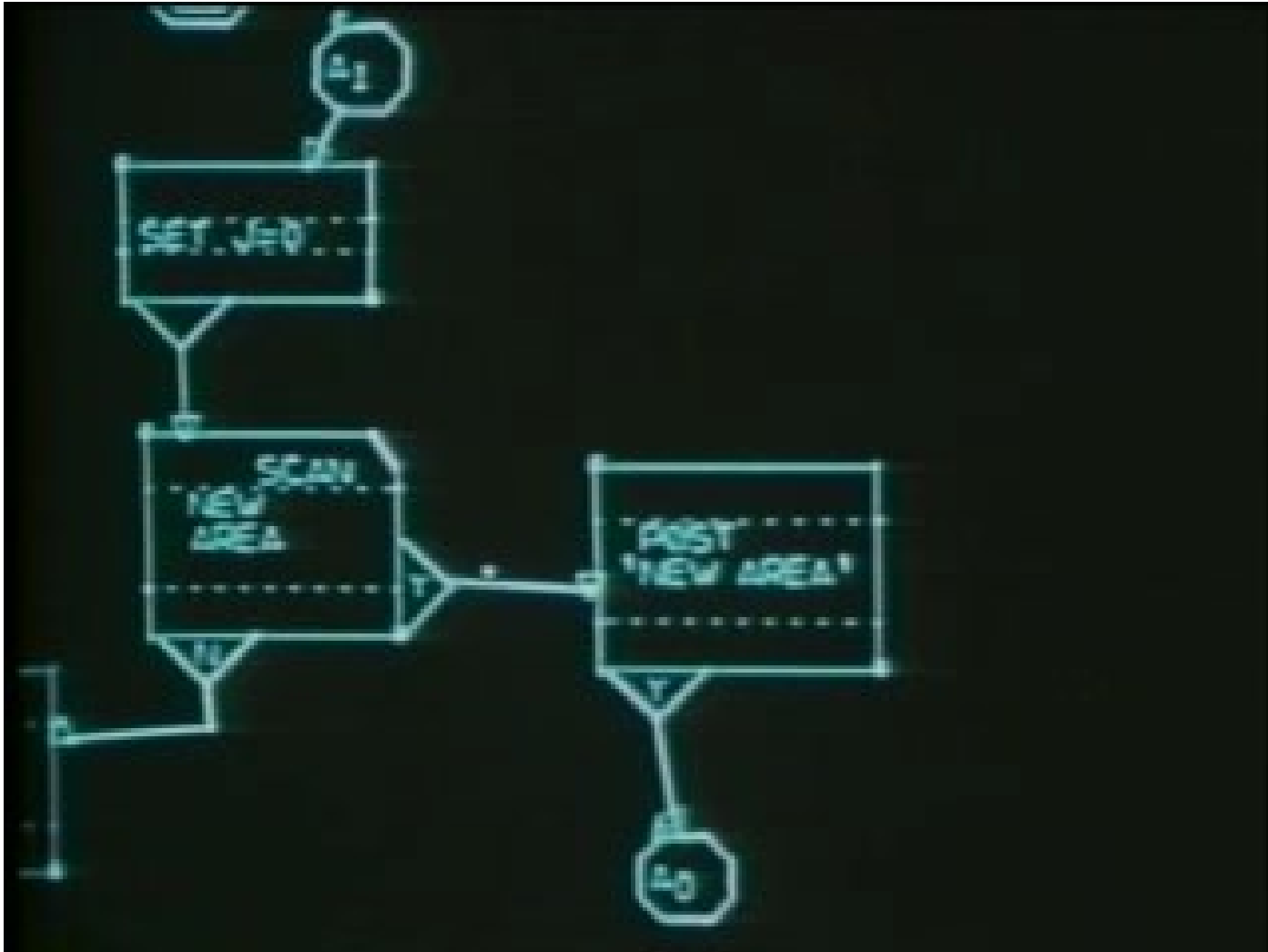
Analog Mouse leads to heavy moding

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

GRAIL



GRAIL



GRAIL

When do we think this was done?

GRAIL

When do we think this was done? 1968

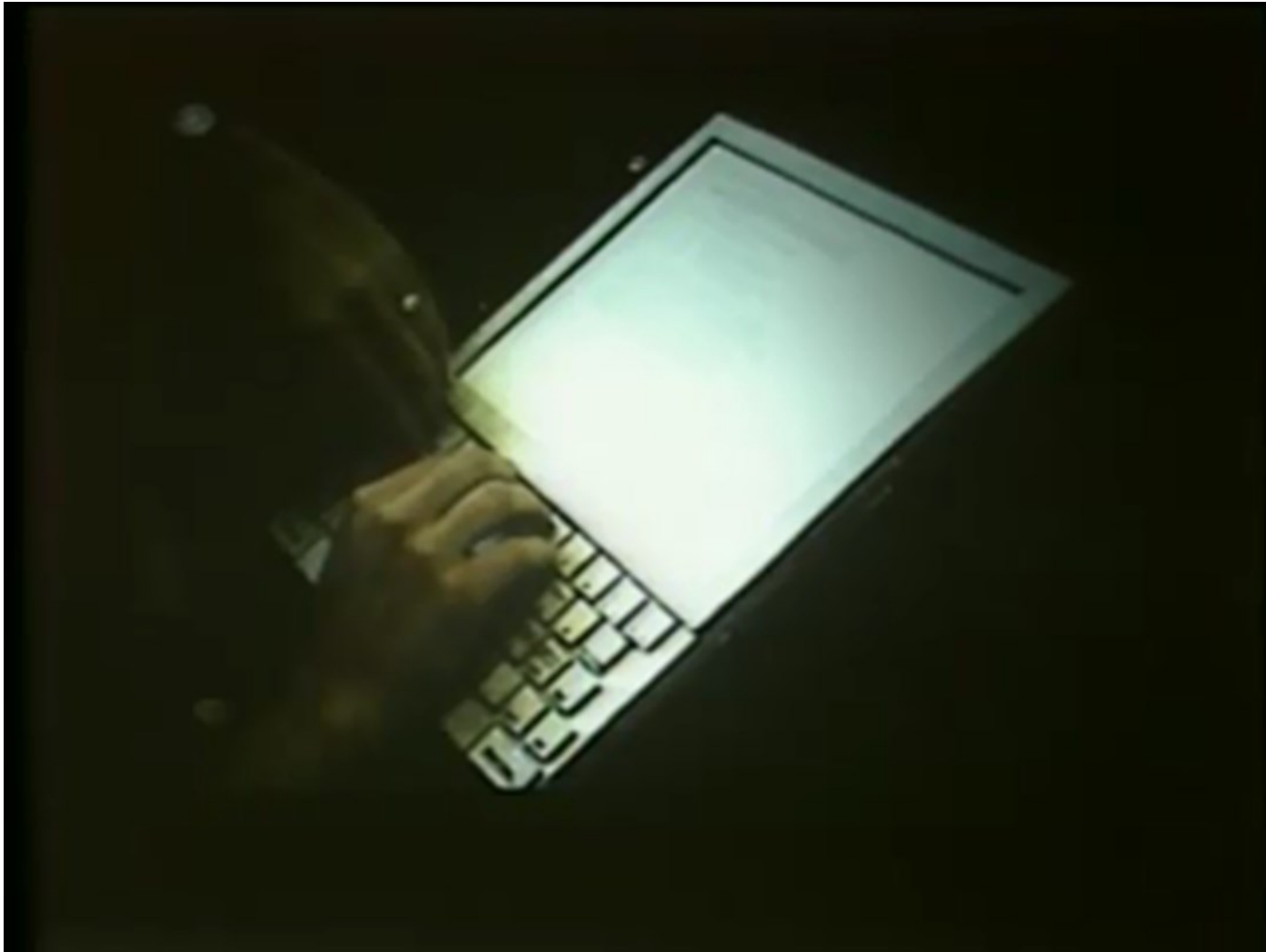
Window handles

Modeless interaction via direct action

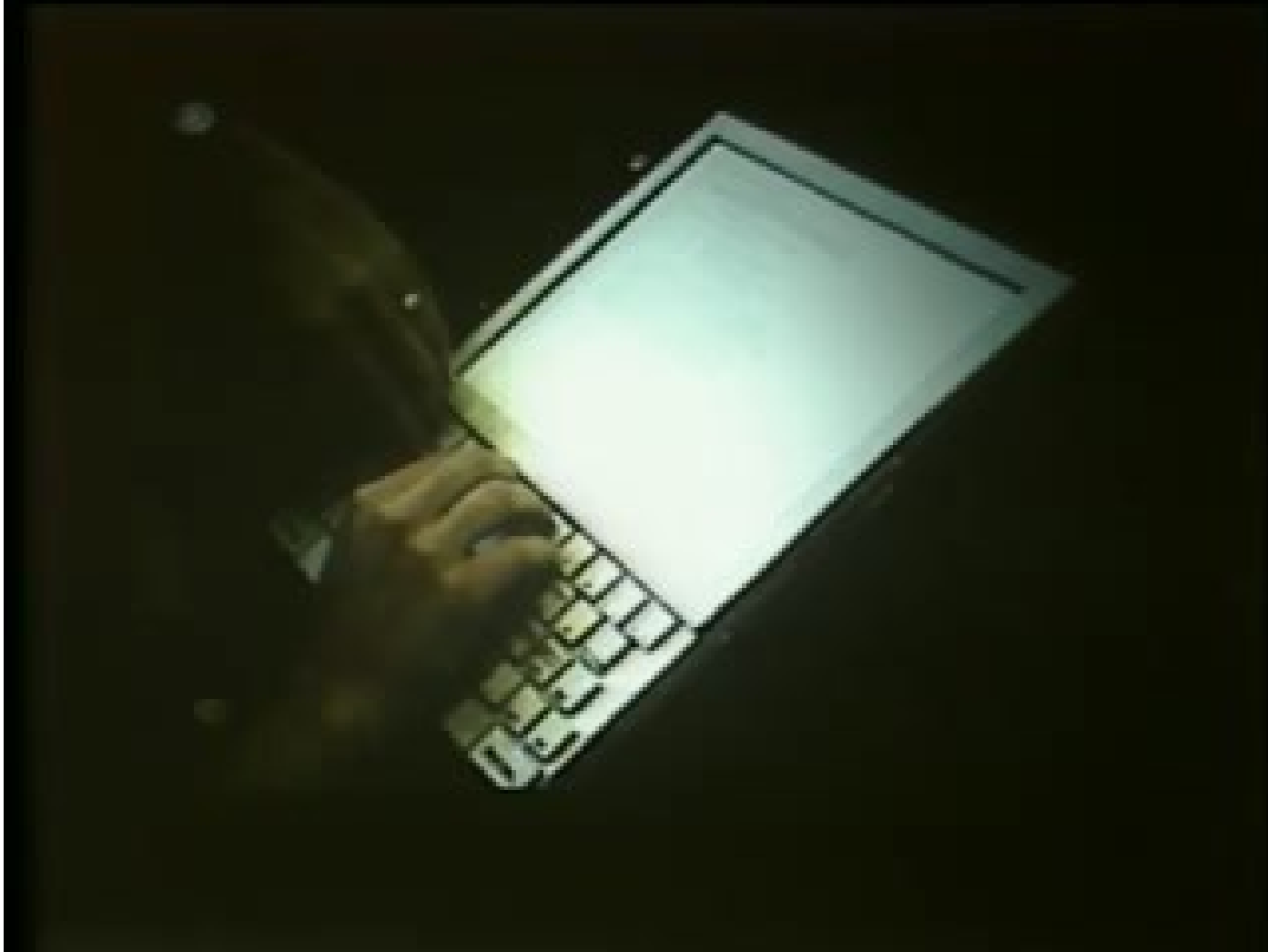
Gesture recognition

Proposed for end-user programming via flow charts

Dynabook



Dynabook



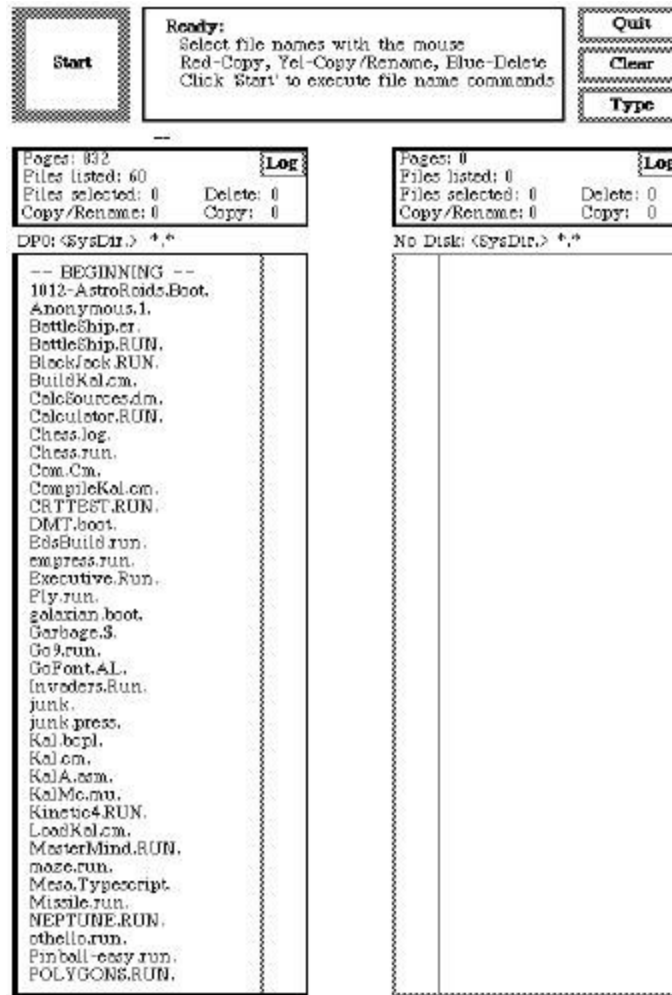
Xerox to Apple and Microsoft

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 errors, as a function of the percentage of use of the workstations. The following equation can be used to express this:

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

Text and Graphics

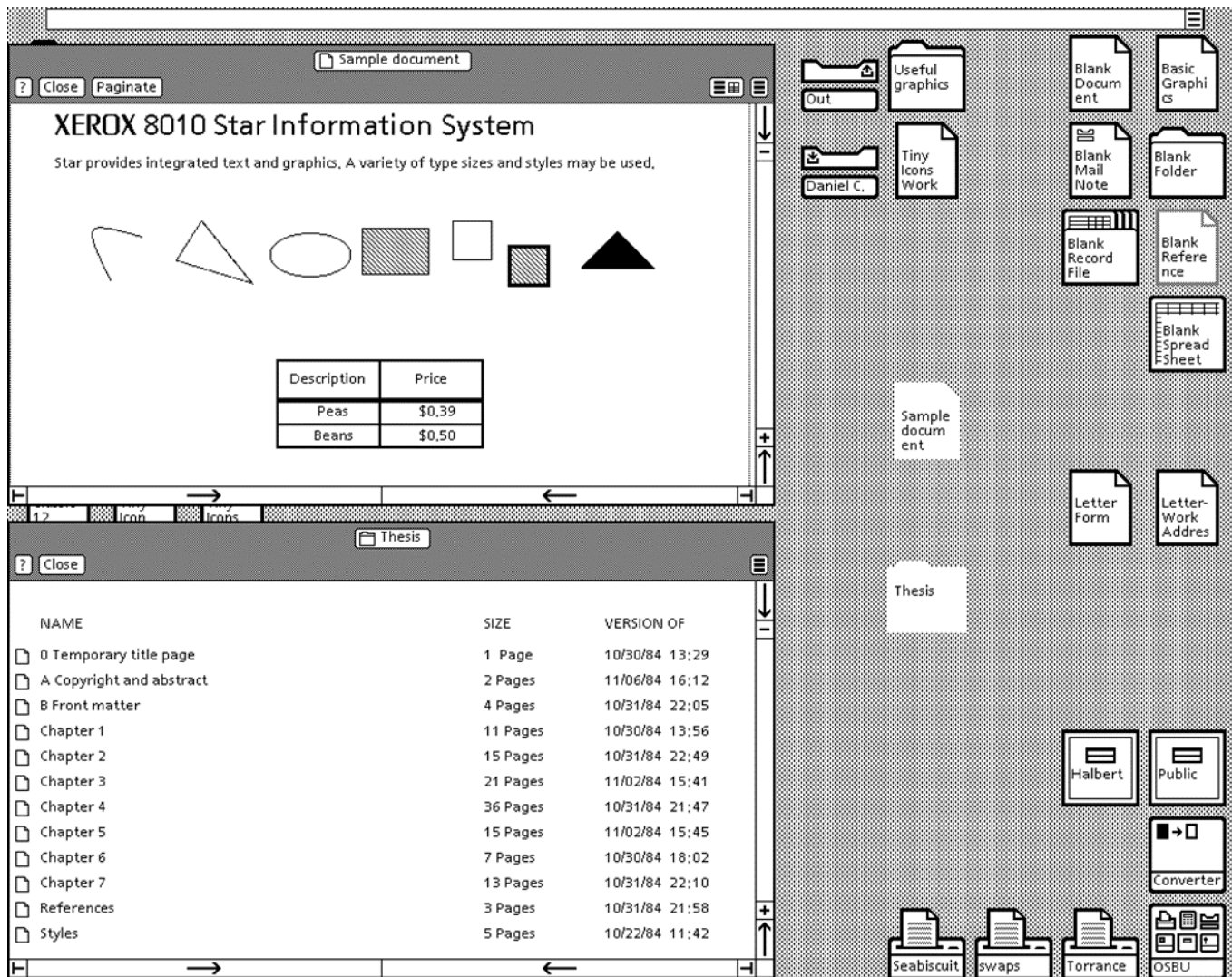
To replace typesetting, the 6085 offers a choice of type faces and sizes, from 6 point to 36 point.

Here is a sample of 12 point text.
 Here is a sample of 18 point text.
 24-point text.
 36-point text.

Year	1985	1985
1978	85.2	15.0
1980	41.1	39.9
1982	45	55
1984	30	73
1986	10	90
1988	5	95

NAME	EXTENSION	SIZE	DATE
COMMAND	COM	32677	15-1
ANSI	SVS	2656	18-1
ASSIGN	COM	864	28-1
ATTEND	EXE	15091	14-1
BACKUP	COM	13024	28-1
CHKDISK	COM	9435	24-1
CHMOD	COM	4528	27-1
COMP	COM	3618	10-1
DEBUG	EXE	45344	15-1

Xerox Star



Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

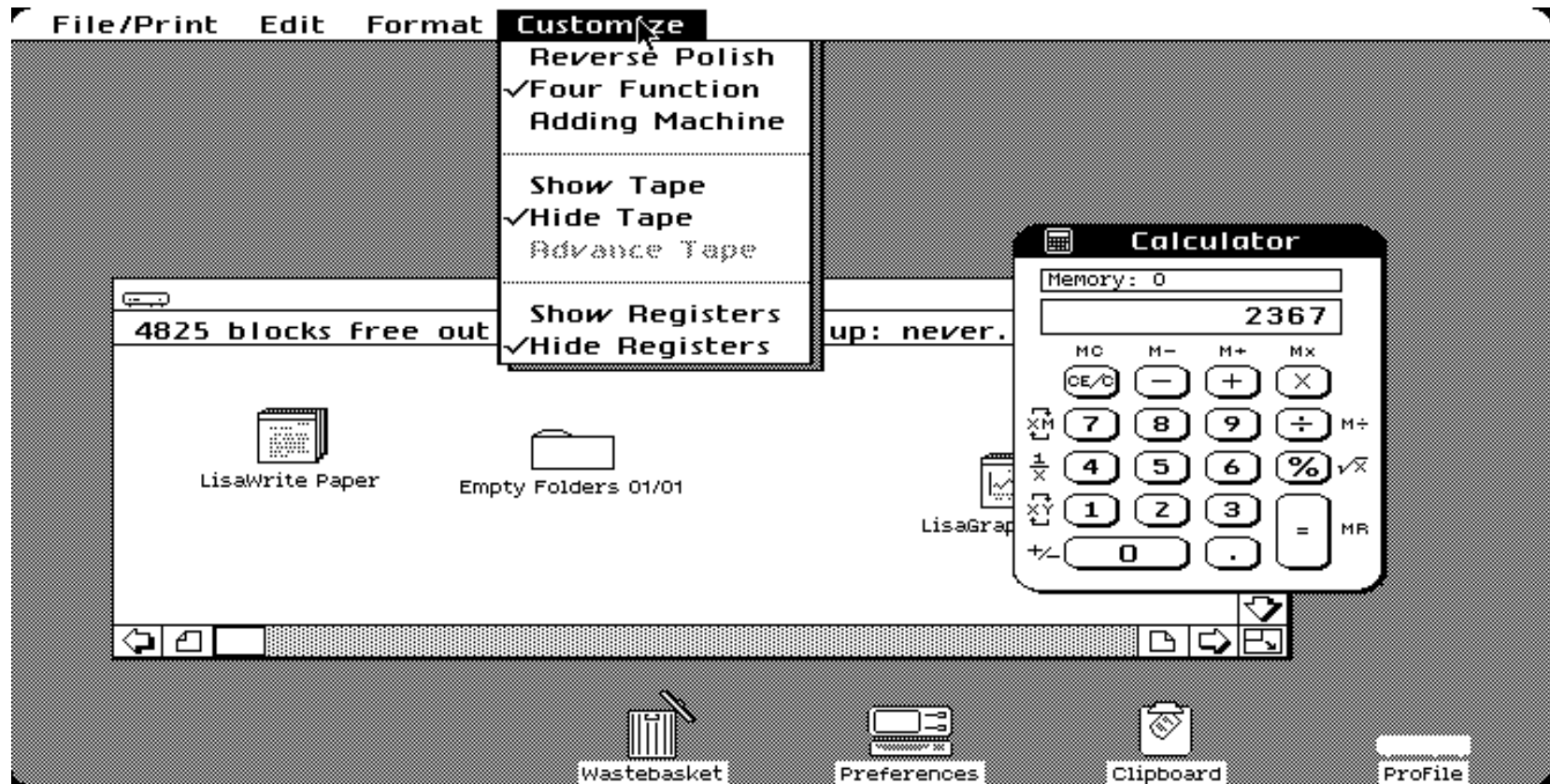
XEROX STAR 1981

Apple Lisa 1981

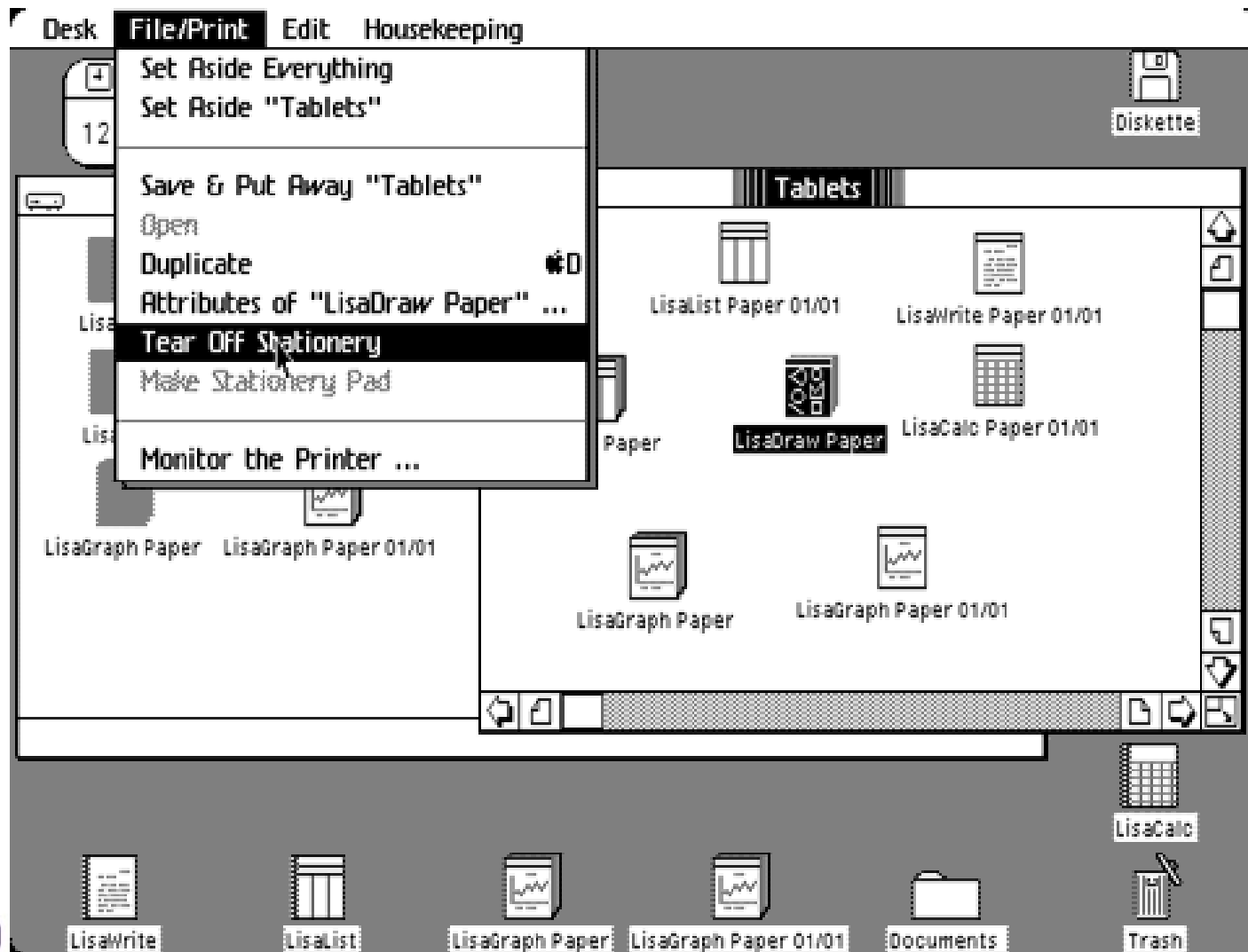
Apple Lisa



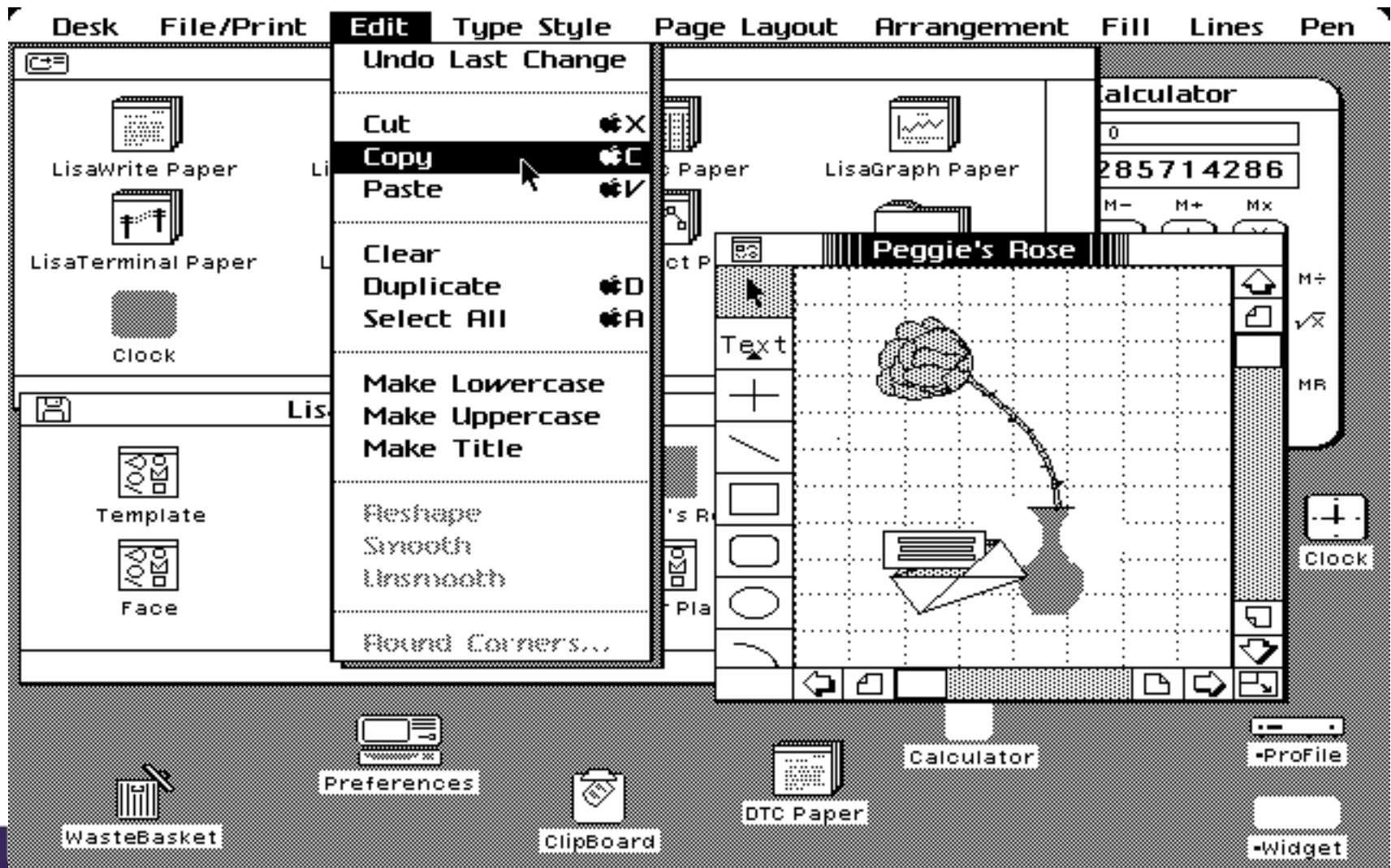
Apple Lisa



Apple Lisa



Apple Lisa



Xerox to Apple and Microsoft

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XEROX STAR 1981

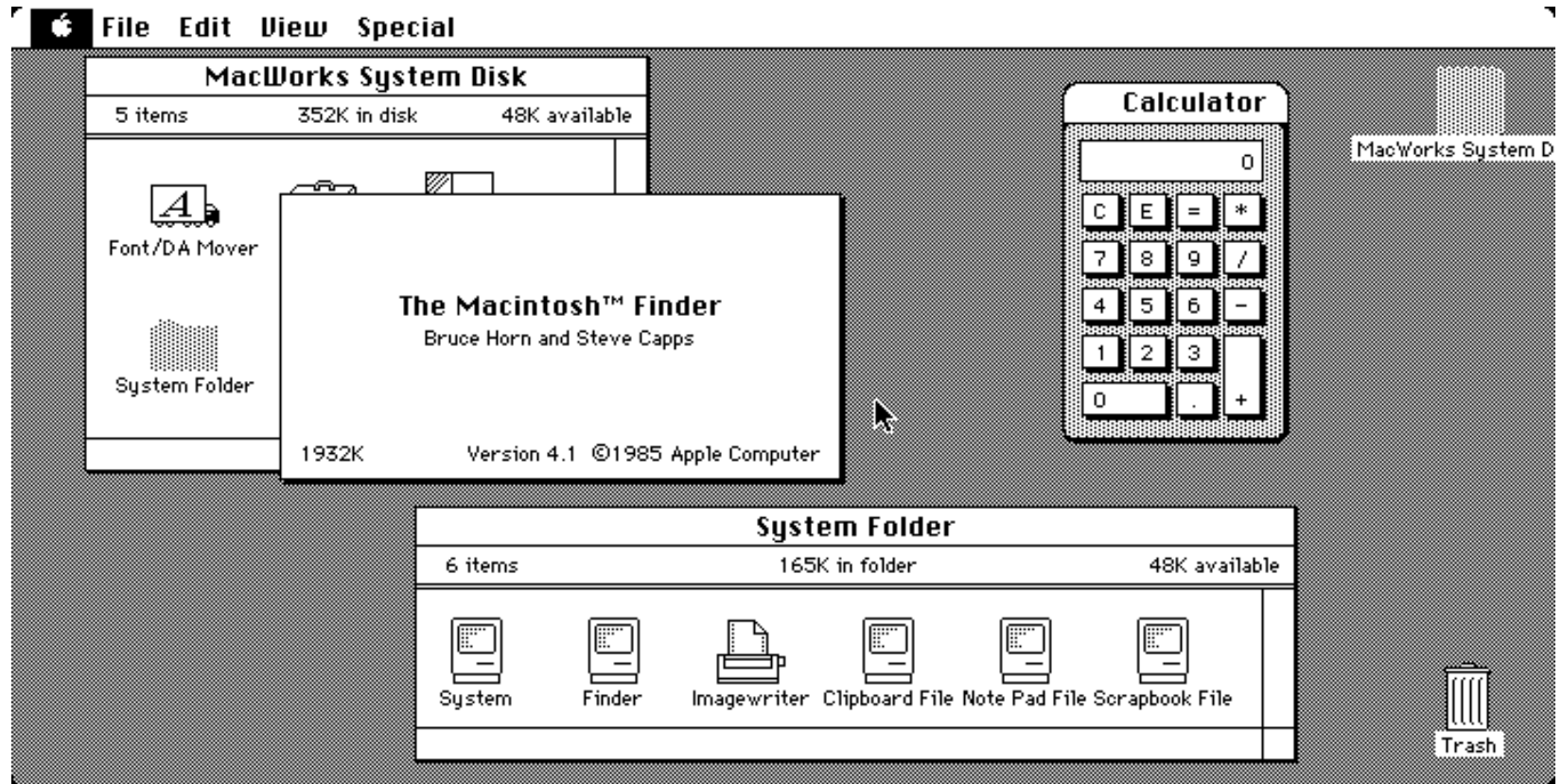
Apple Lisa 1981

Apple Macintosh 1984

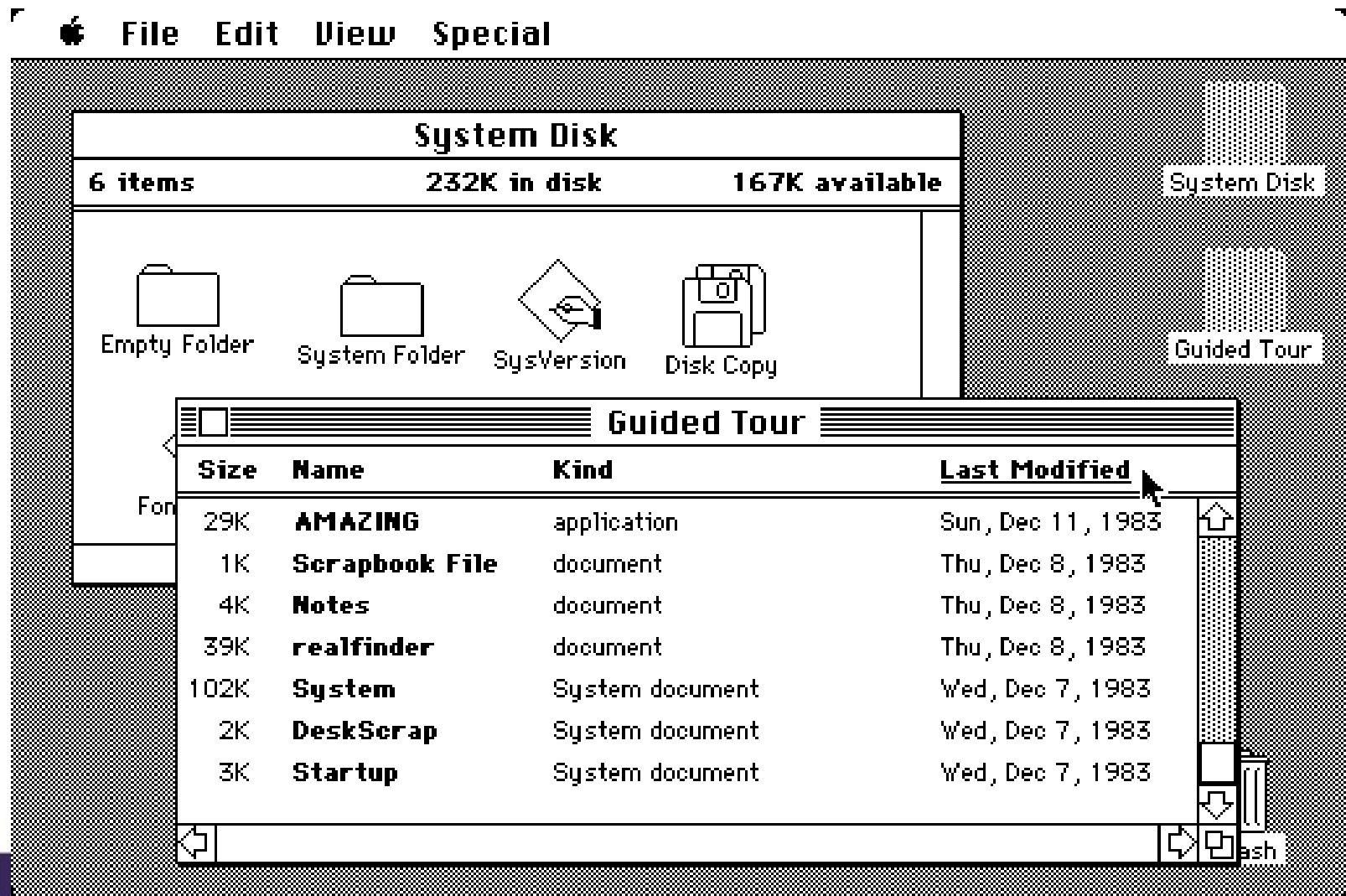
Macintosh



Macintosh



Macintosh



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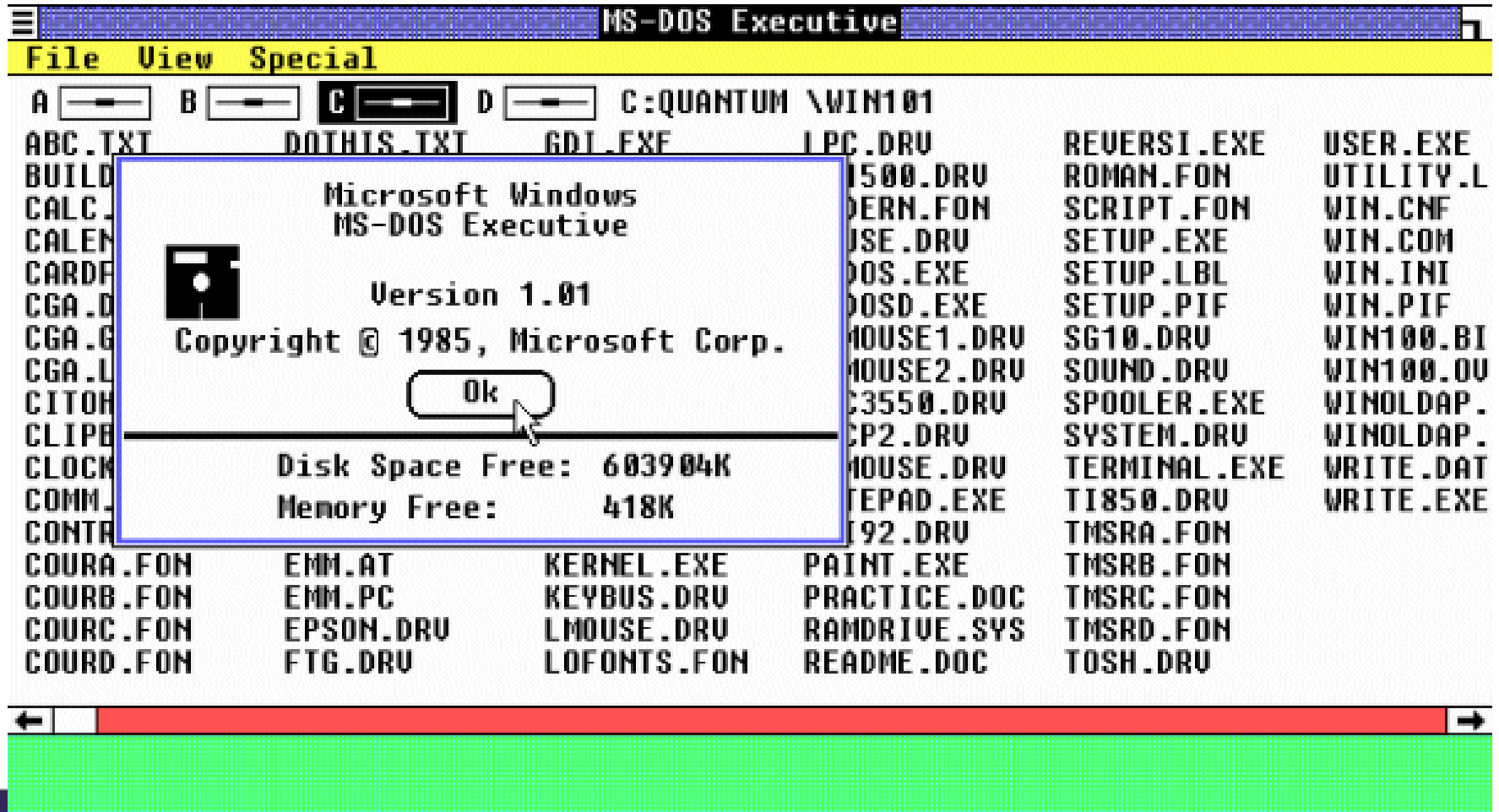
XEROX STAR 1981

Apple Lisa 1981

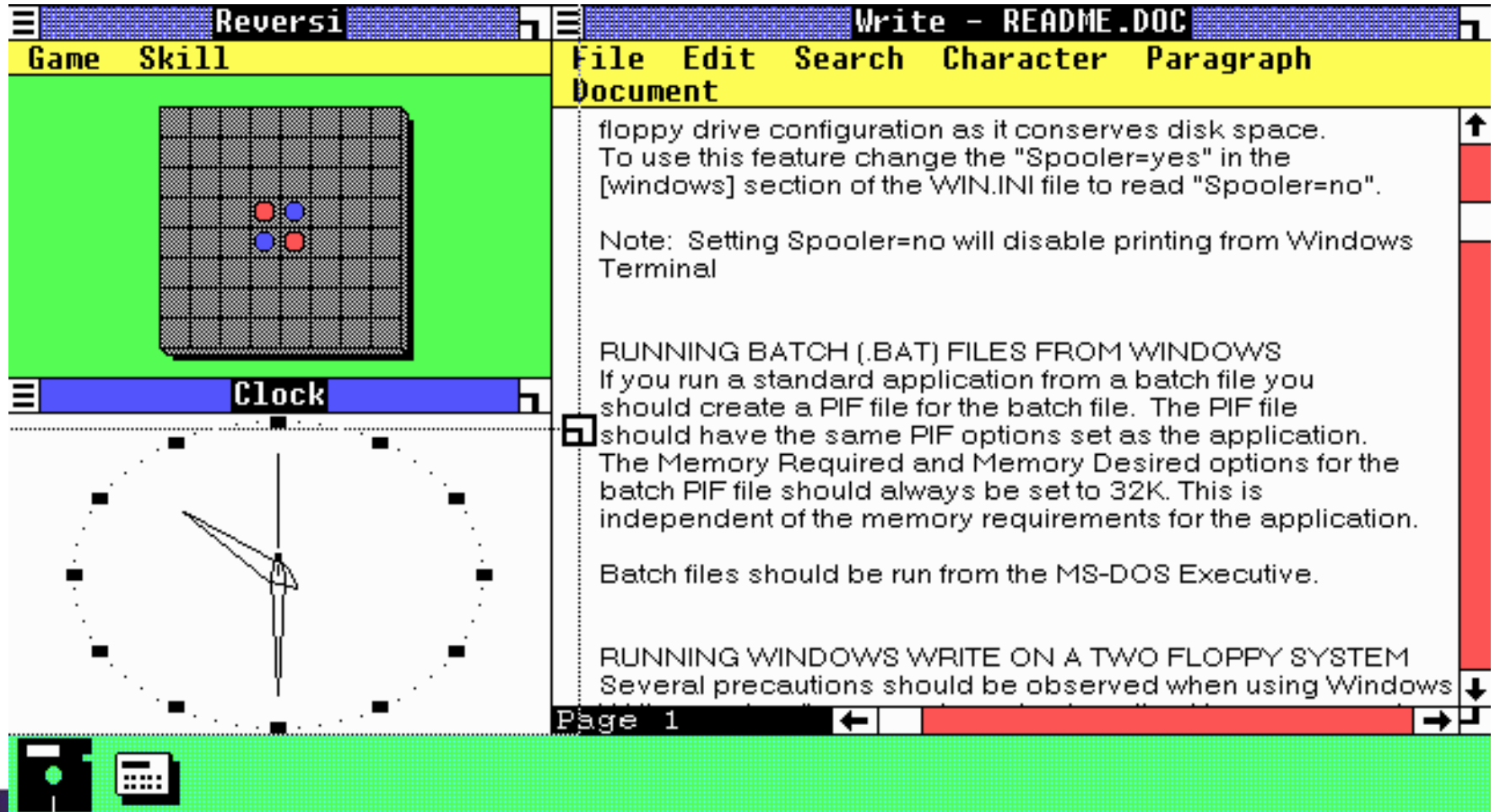
Apple Macintosh 1984

Windows 1.0 1985

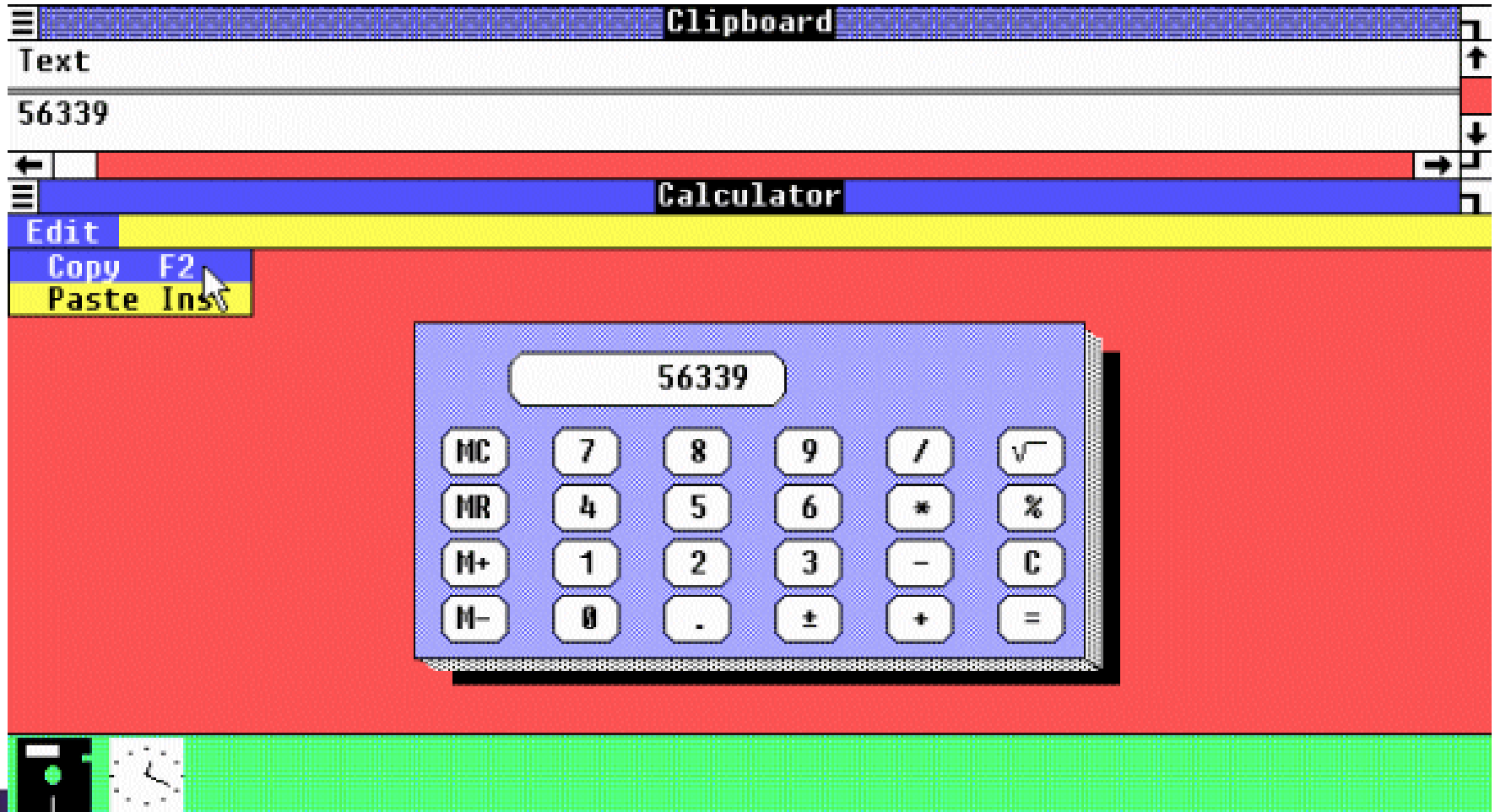
Windows 1.0



Windows 1.0



Windows 1.0



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XEROX STAR 1981

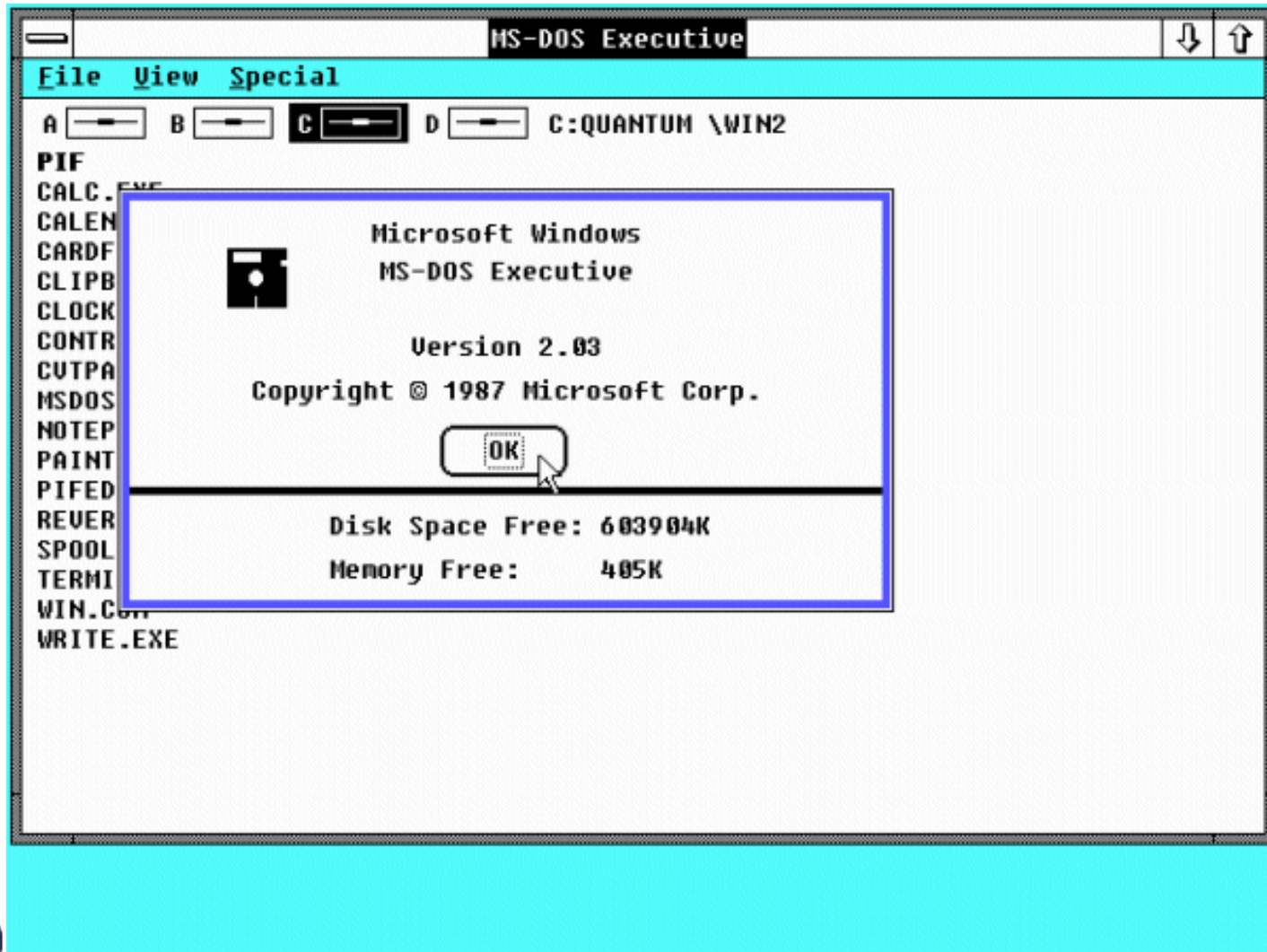
Apple Lisa 1981

Apple Macintosh 1984

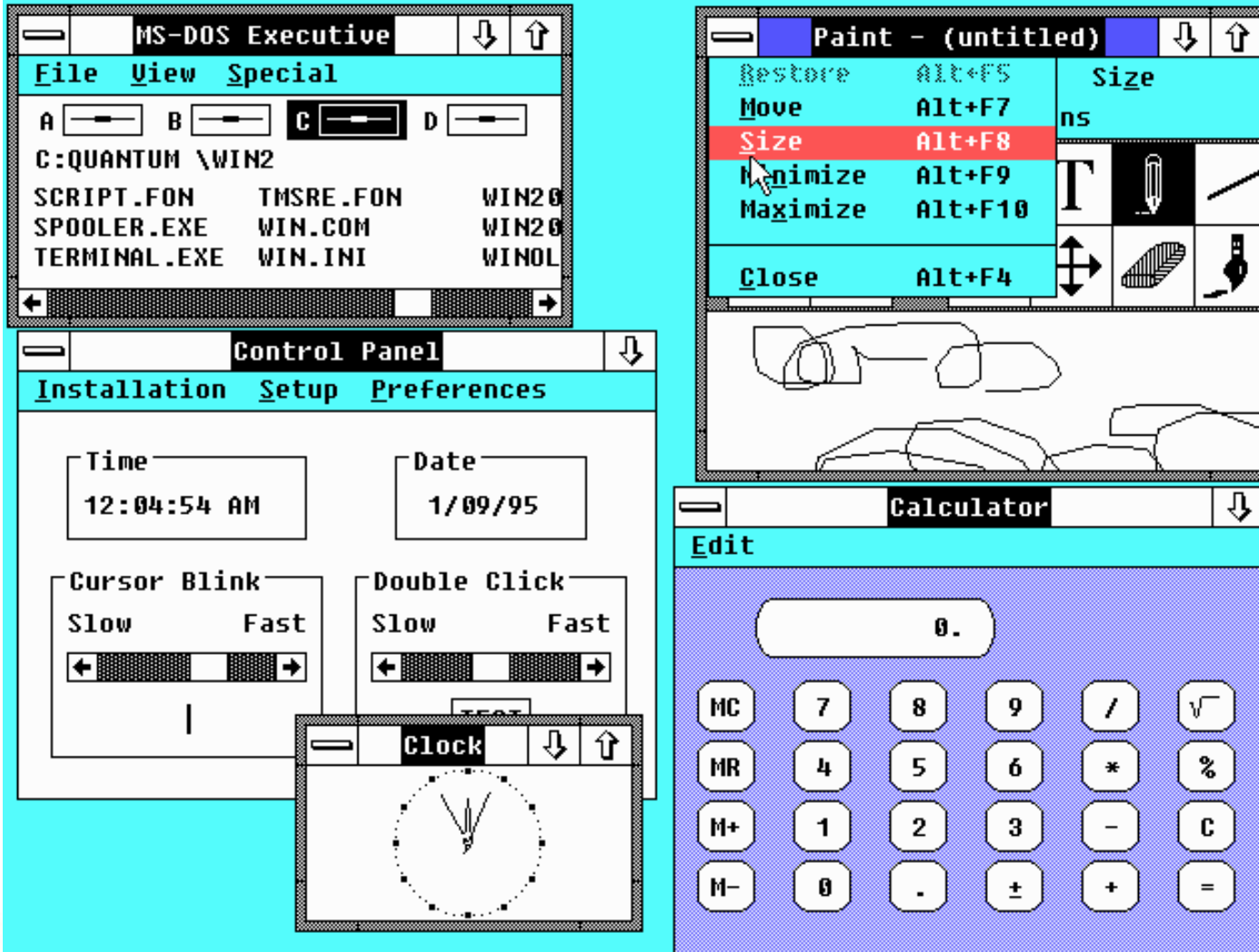
Windows 1.0 1985

Windows 2.0 1987

Windows 2.0 (1987)



Windows 2.0



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XEROX STAR 1981

Apple Lisa 1981

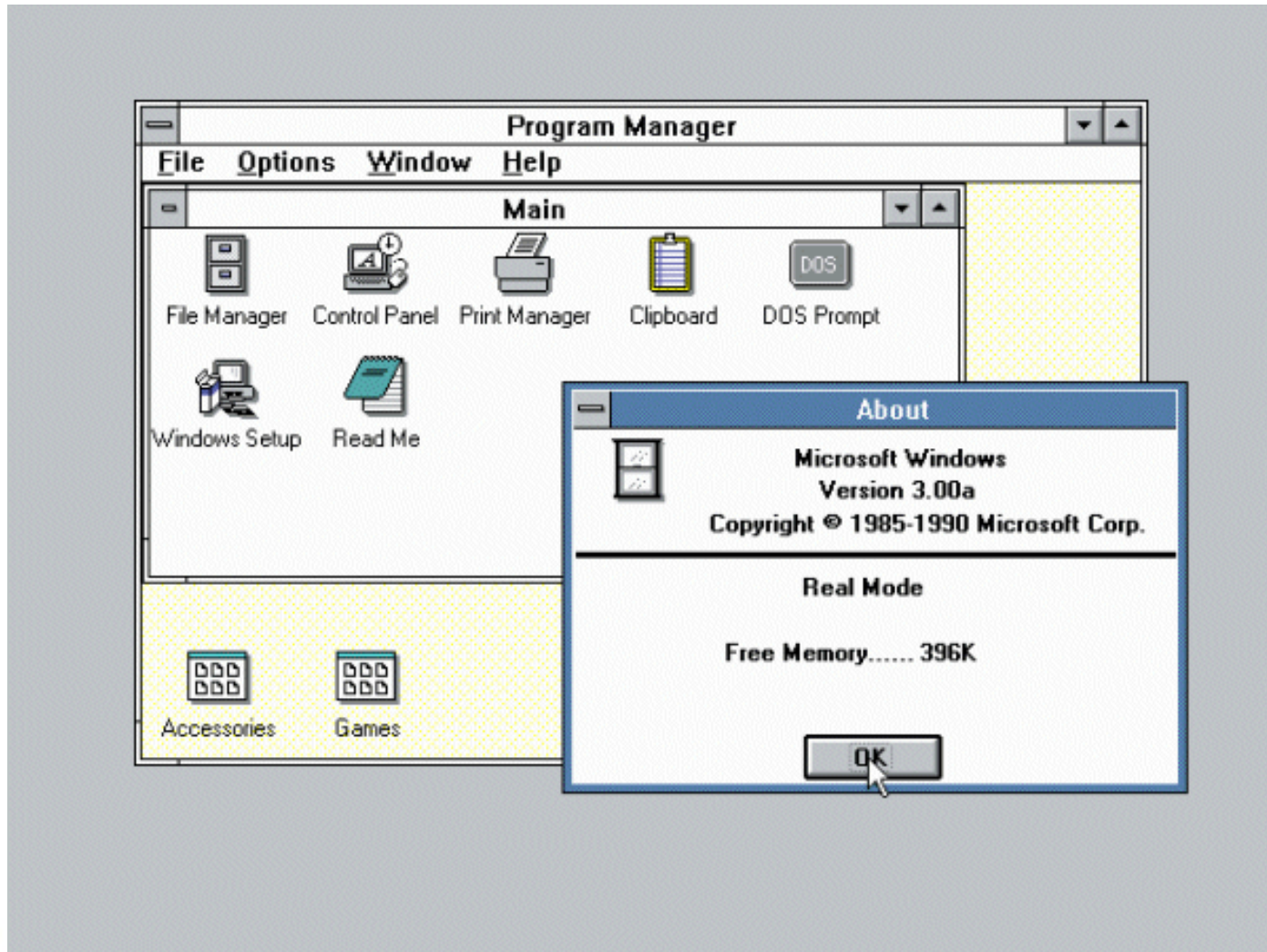
Apple Macintosh 1984

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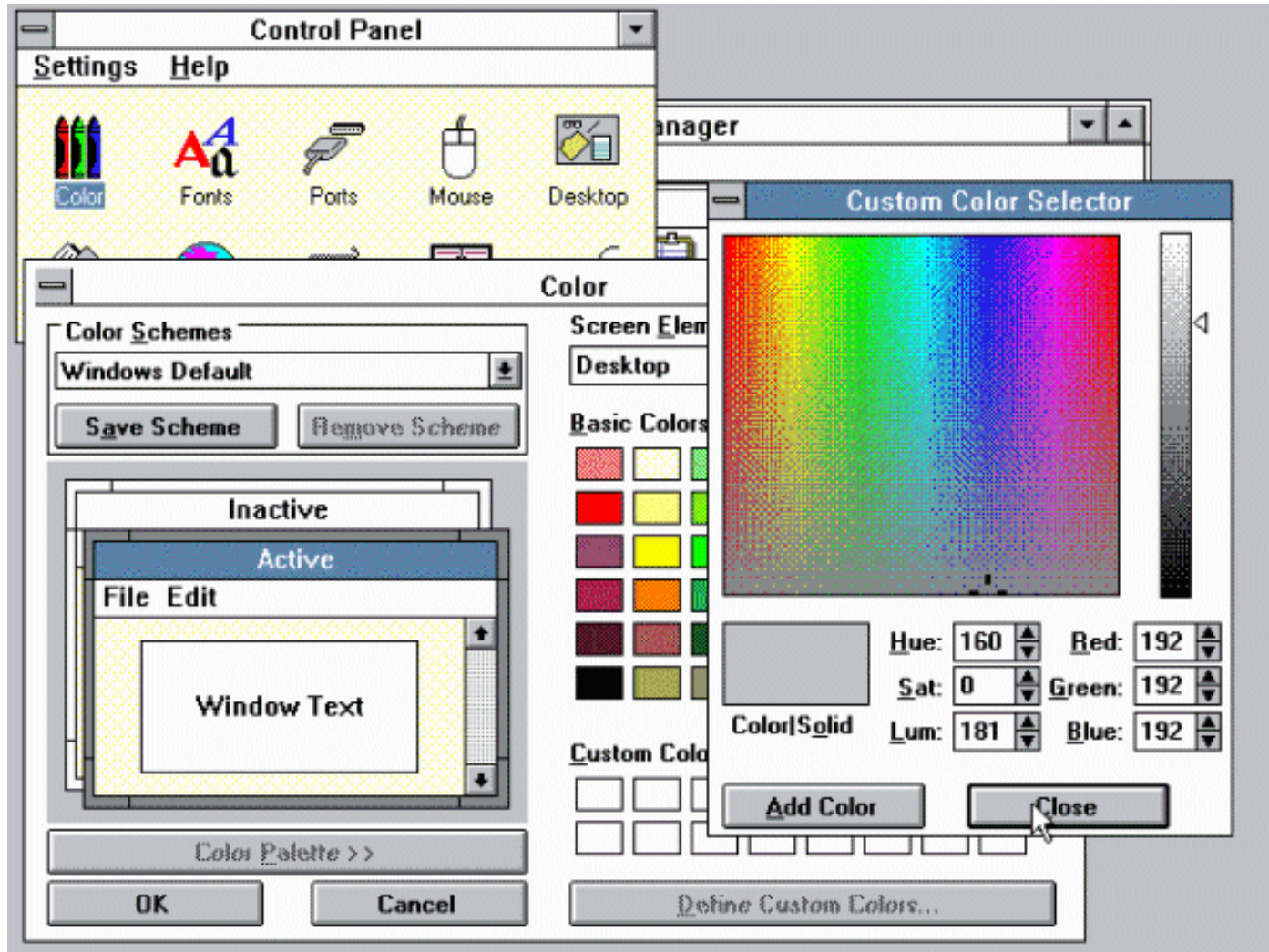
Windows 2.0 1987

Windows 3.0 1990

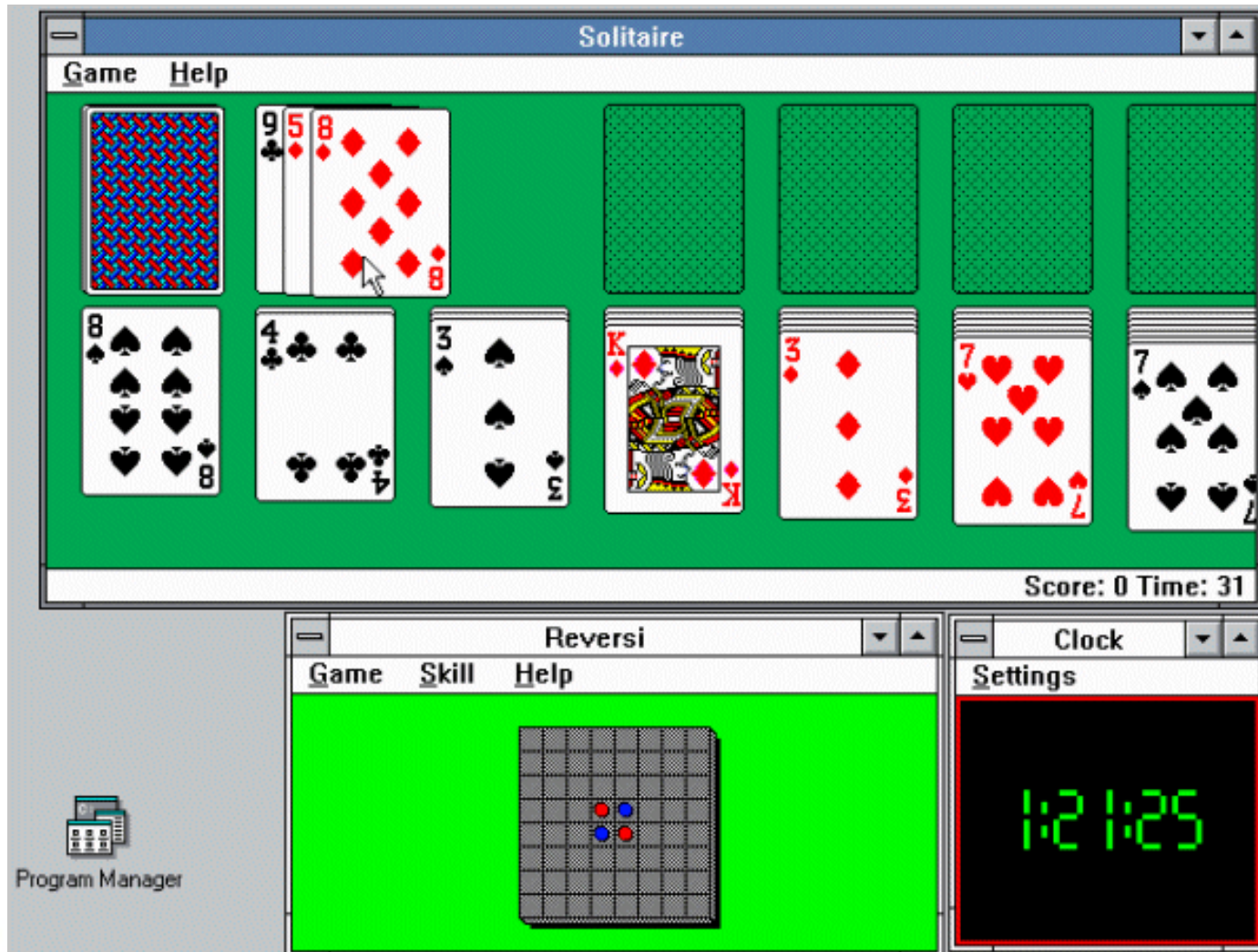
Windows 3.0



Windows 3.0



Windows 3.0



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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

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 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 09:
History

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
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