CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

HCI History

James Fogarty

March 5, 2015

Introduction

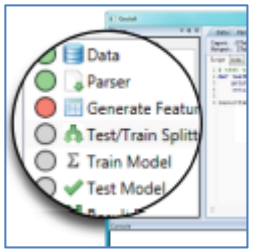
James Fogarty

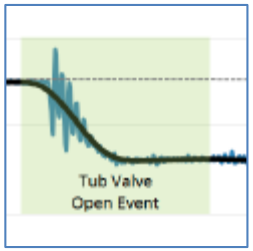
- BS, Virginia Tech, 2000
- PhD, Carnegie Mellon, 2006
- Joined UW CSE, 2006

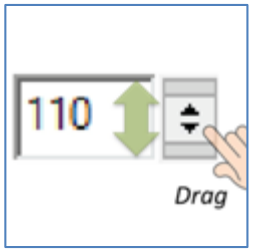
Industrial Stints

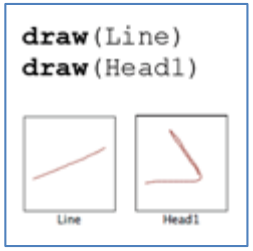
- IBM, 2000
- IBM Research, 2003
- Microsoft Research, 2007

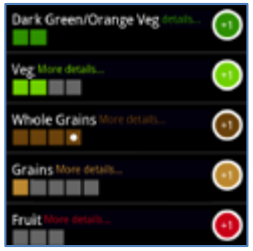
Introduction

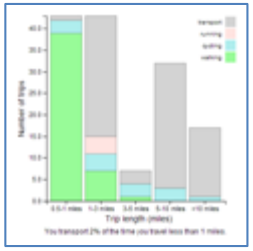


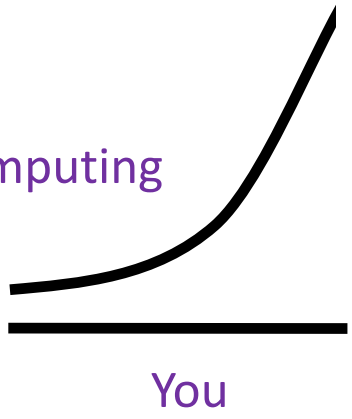












Introduction

Cross-Campus HCI Efforts

- DUB
- MHCID

Teaching

- CSE 332: Data Structures
- CSE 440: Introduction to HCI
- CSE 441: Advanced HCI
- CSE 510: Advanced Topics in HCI
- CSEP 510: Human-Computer Interaction

Today

Milestones

- Matt Check-In on Status and Deadlines

Class Today

- HCI History

Time Remaining

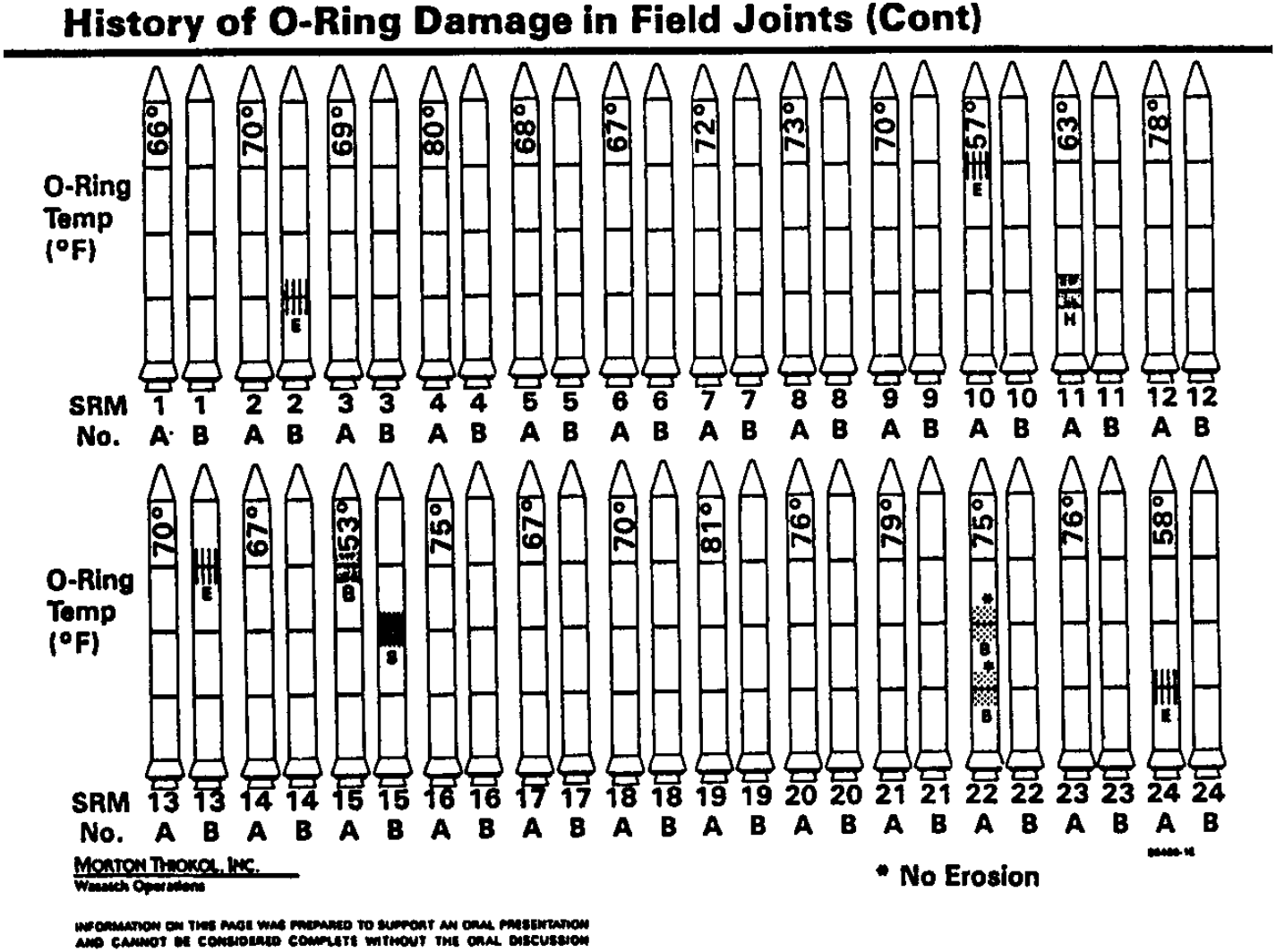
- Project Group Time

Why do we do HCI in CSE?

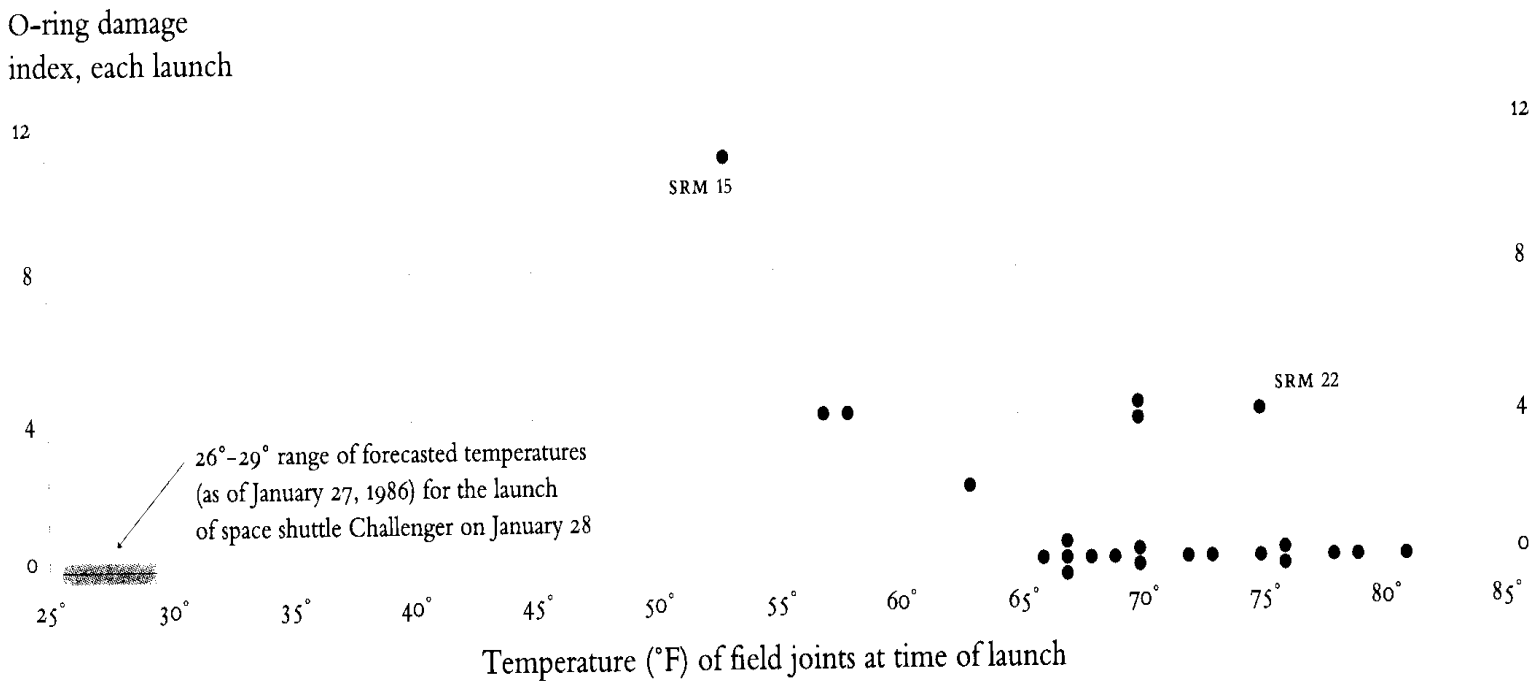
Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns

Tacoma Narrows

O-Rings


History of O-Ring Damage in Field Joints (Cont)
O-Ring Temp (°F)
66° 70° 69° 80° 68° 67° 72° 73° 70° 57° 63° 78°
SRM No. 1 A 1 B 2 A 2 B 3 A 3 B 4 A 4 B 5 A 5 B 6 A 6 B 7 A 7 B 8 A 8 B 9 A 9 B 10 A 10 B 11 A 11 B 12 A 12 B
O-Ring Temp (°F)
70° 67° 53° 75° 67° 70° 81° 76° 79° 75° 76° 58°
SRM No. 13 A 13 B 14 A 14 B 15 A 15 B 16 A 16 B 17 A 17 B 18 A 18 B 19 A 19 B 20 A 20 B 21 A 21 B 22 A 22 B 23 A 23 B 24 A 24 B
MORTON THIOKOL, INC.
Wasatch Operations
* No Erosion
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
12
8
4
0
SRM 15
SRM 22
26°–29° range of forecasted temperatures
(as of January 27, 1986) for the launch
of space shuttle Challenger on January 28
25°
30°
35°
40°
45°
50°
55°
60°
65°
70°
75°
80°
85°
Temperature (°F) of field joints at time of 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

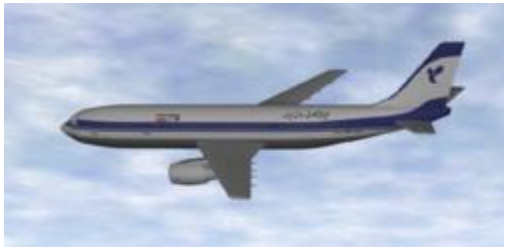
(pilots are crashing planes)

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

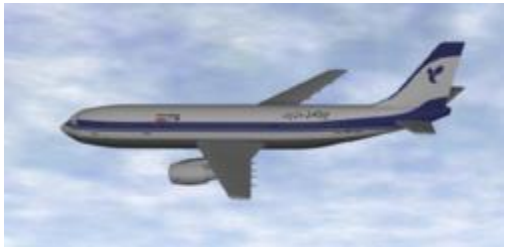
In 1987, *USS Stark* was struck by two missiles launched by an Iraqi Mirage F-1, killing 37 with no weapons fired in self-defense during the attack.



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

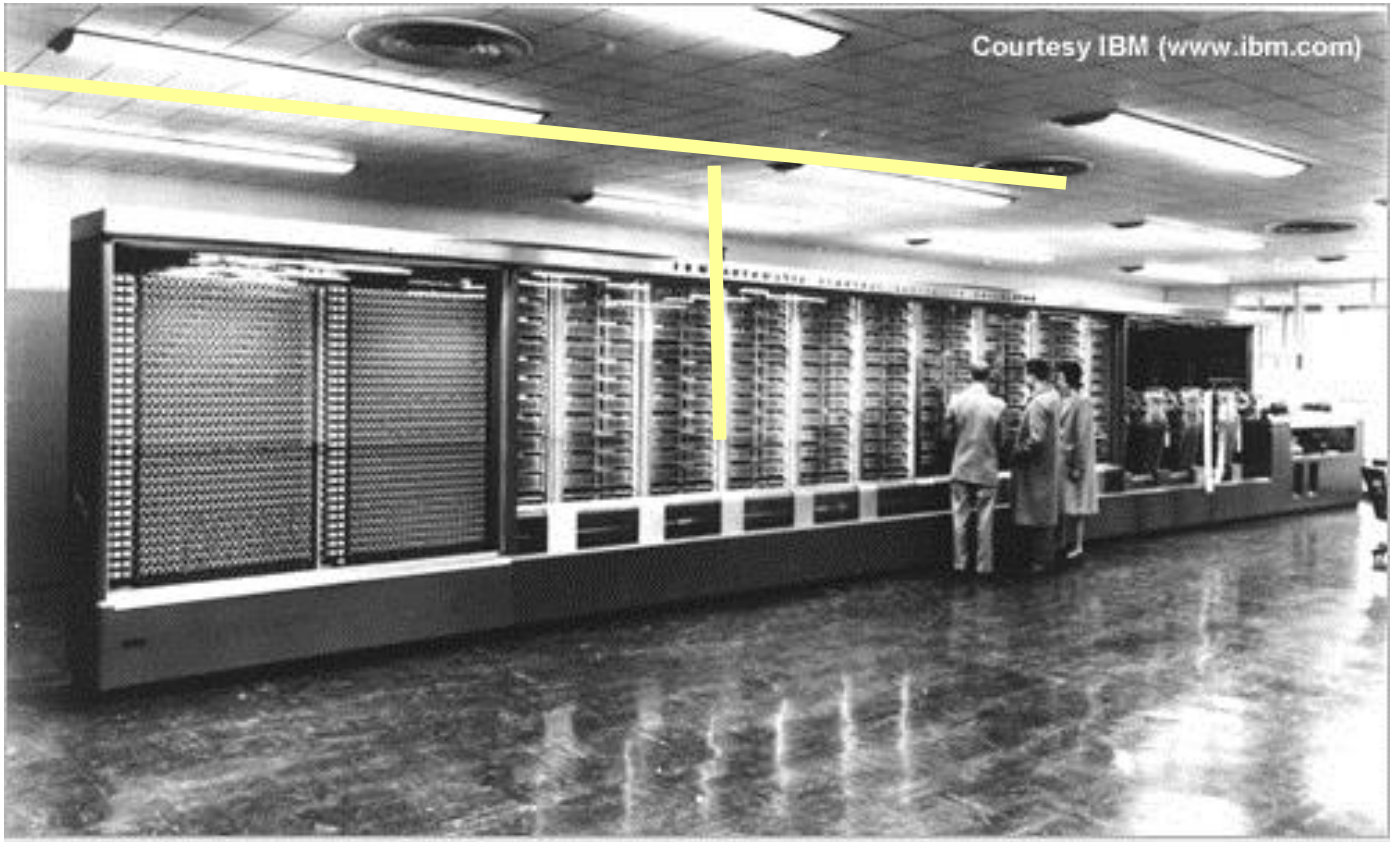
This study must include computer scientists, as we are the ones creating the technology

A History Question

Who invented hypertext? When?

Computing in 1945

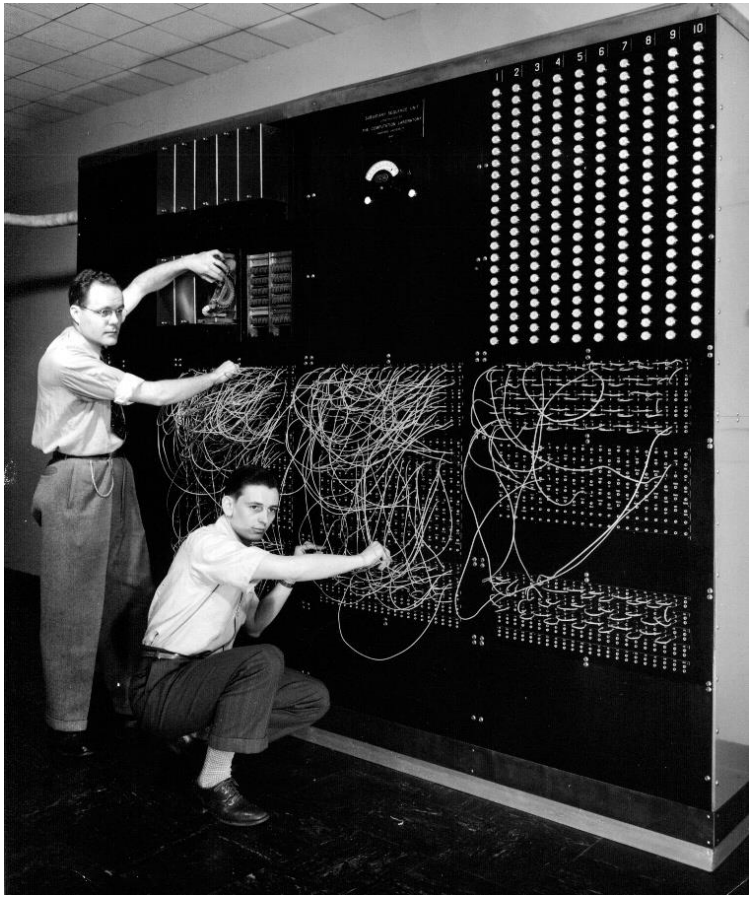
Harvard Mark I, 55 feet long, 8 feet high, 5 tons



The Harvard Mark I

Computing in 1945

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



Computing in 1945

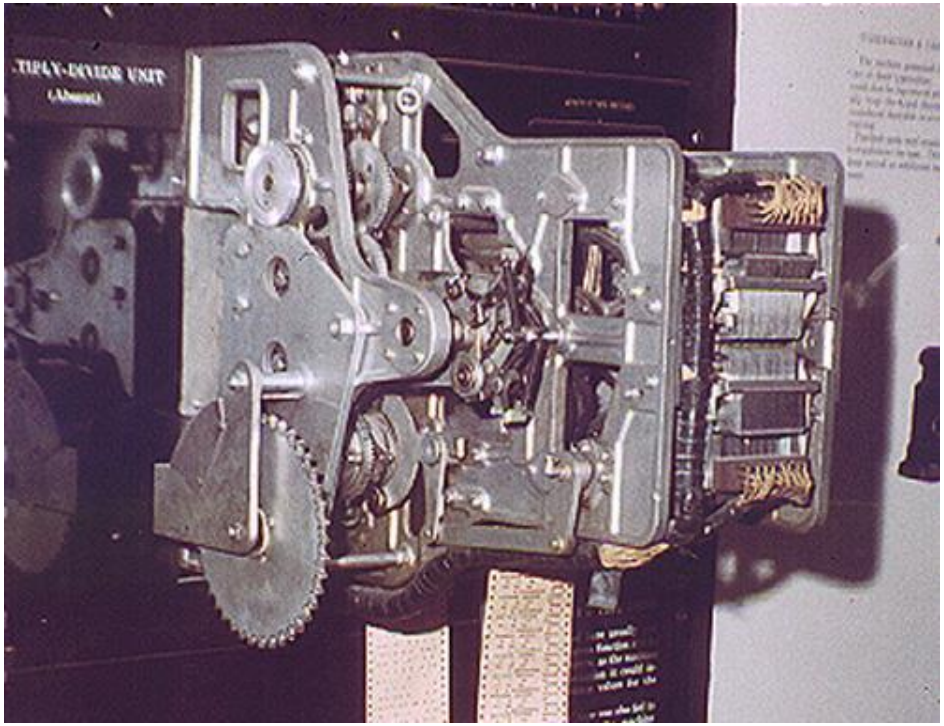
Ballistics calculations

Physical switches
(no microprocessor)

Paper tape

Simple arithmetic
& fixed calculations
(before programs)

3 sec. to multiply



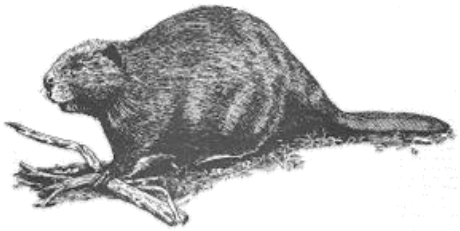
Computing in 1945

First computer bug
(Harvard Mark II)

Adm. Grace Murray Hopper

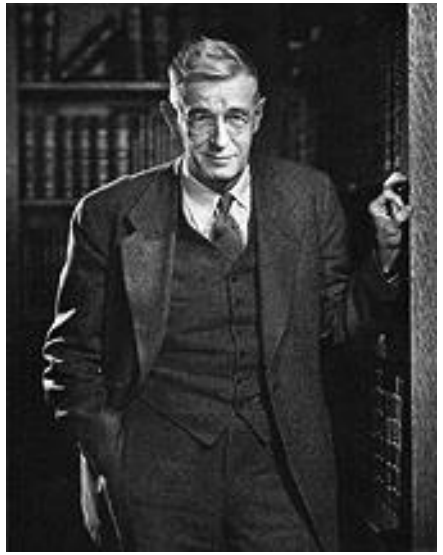
A Little About Vannevar Bush

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

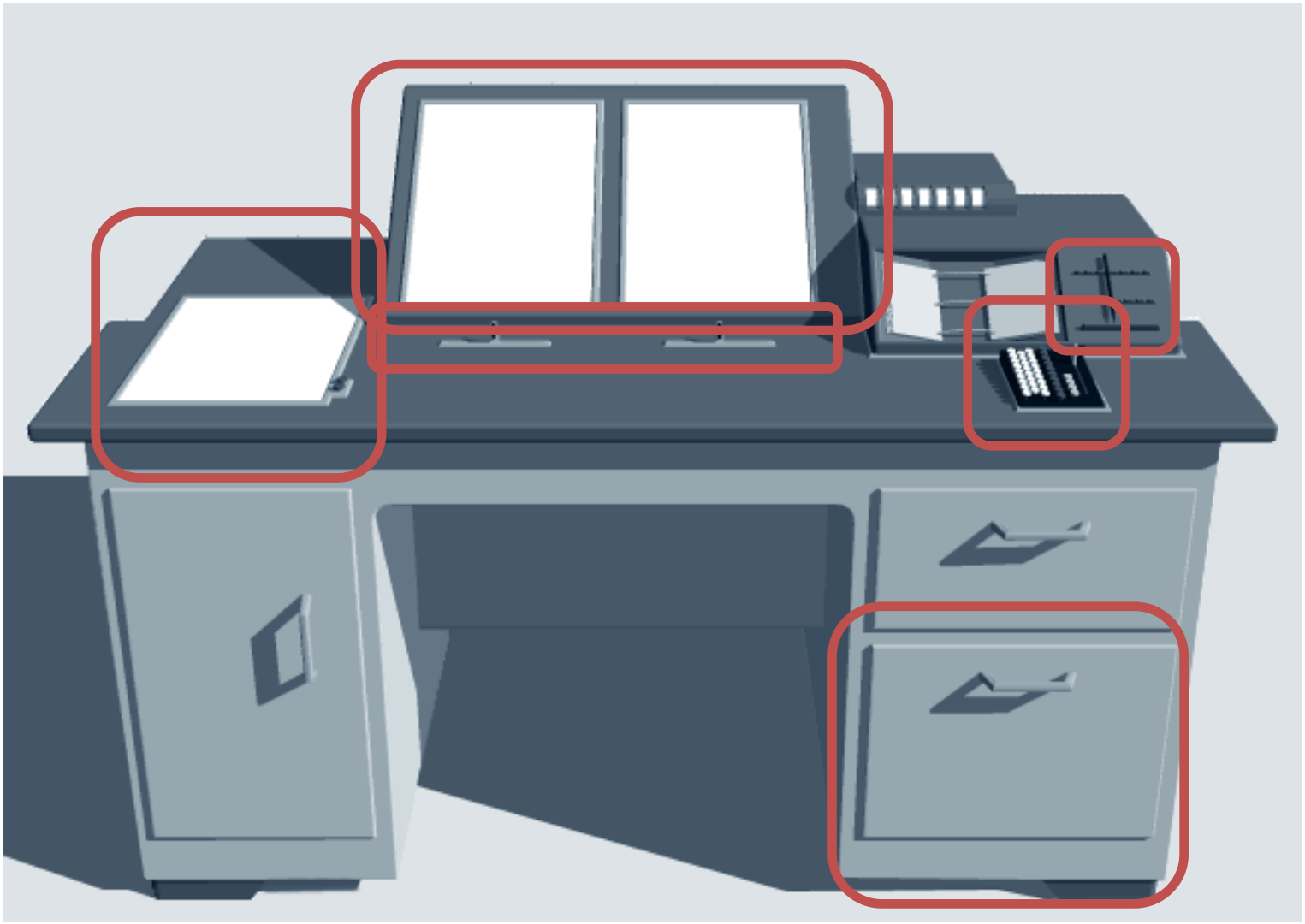
“It would be a brave man who would predict that such a process will always remain clumsy, slow, and faulty in detail.”

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.”

FREE
ENCYCLOPEDIA
CD
ROM
plus 100
FREE
HOURS
See Back for Details.
AMERICA
Online
GROLIER
Multimedia Encyclopedia
SPECIAL EDITION
Complete
from A to Z
#1 in Schools
GOOD
CALCIUM
KRAFT
Singles
MADE FROM WHOLESOME MILK
AMERICAN

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

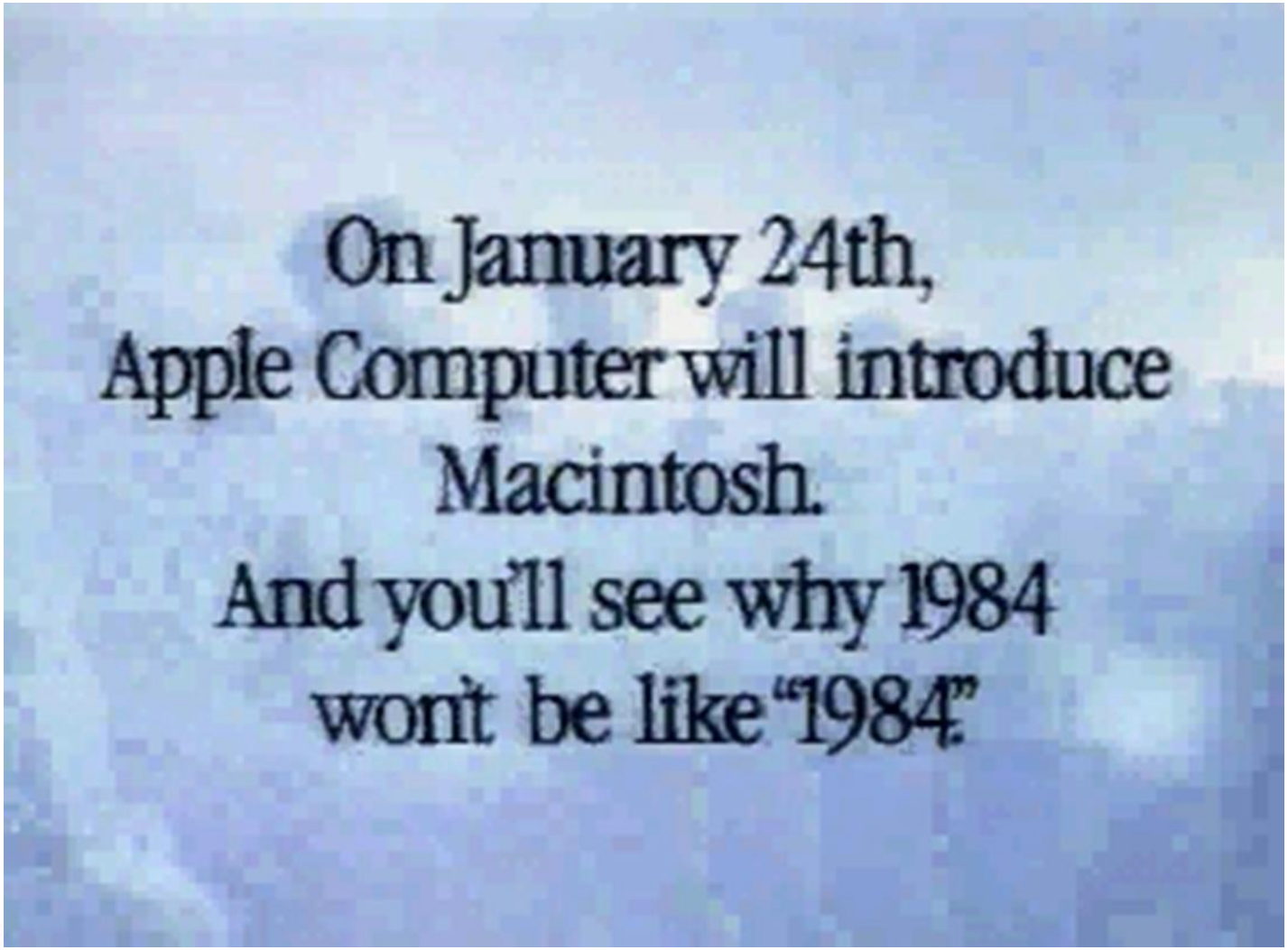
"Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified."

Memex is the first proposed hypertext system

A History Question

Who invented desktop computing? When?

Macintosh in 1984 is well known



http://courses.cs.washington.edu/courses/cse440/videos/history/Apple1984.mp4

Macintosh in 1984 is well known

http://courses.cs.washington.edu/courses/cse440/videos/history/Apple1984.mp4

Alan Kay on Early Interface Work

Narrator is Alan Kay, speaking in 1987

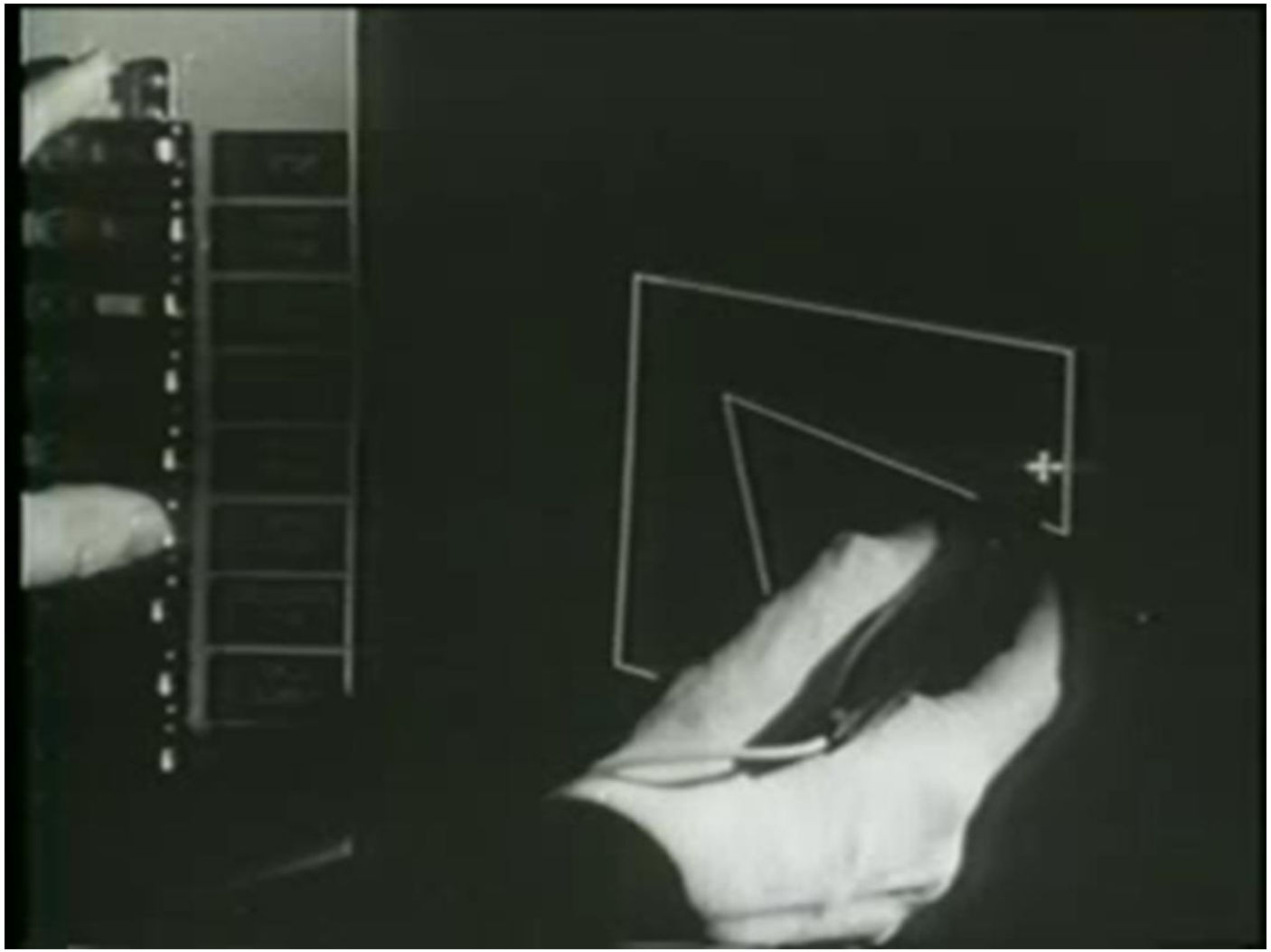
- This video is almost 20 years old
- It was a historical account when it was filmed

Speaks to four sytems

- Sketchpad
- NLS
- GRAIL
- Dynabook

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

Ivan Sutherland's Sketchpad



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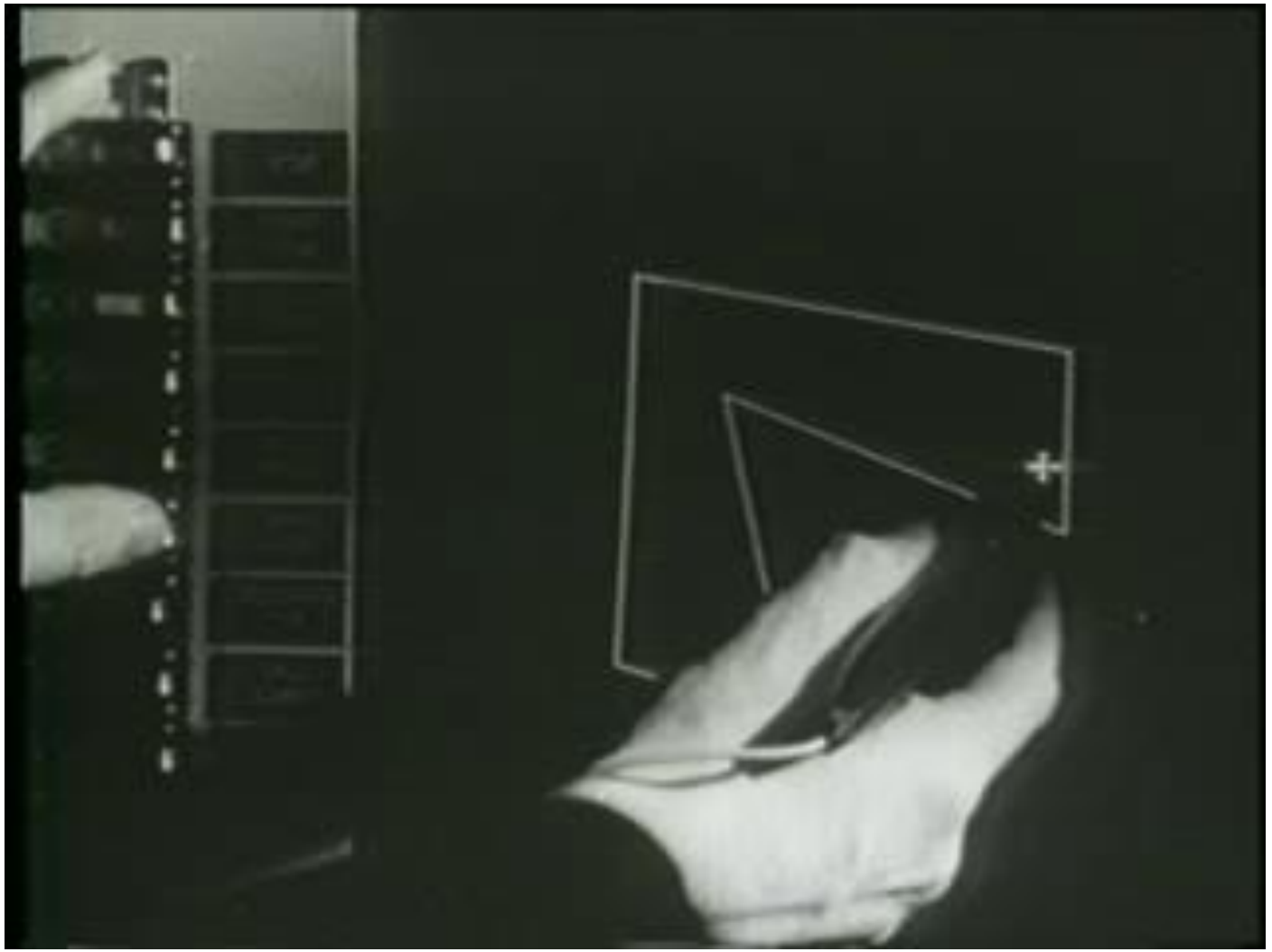
Ivan Sutherland's Sketchpad



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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?

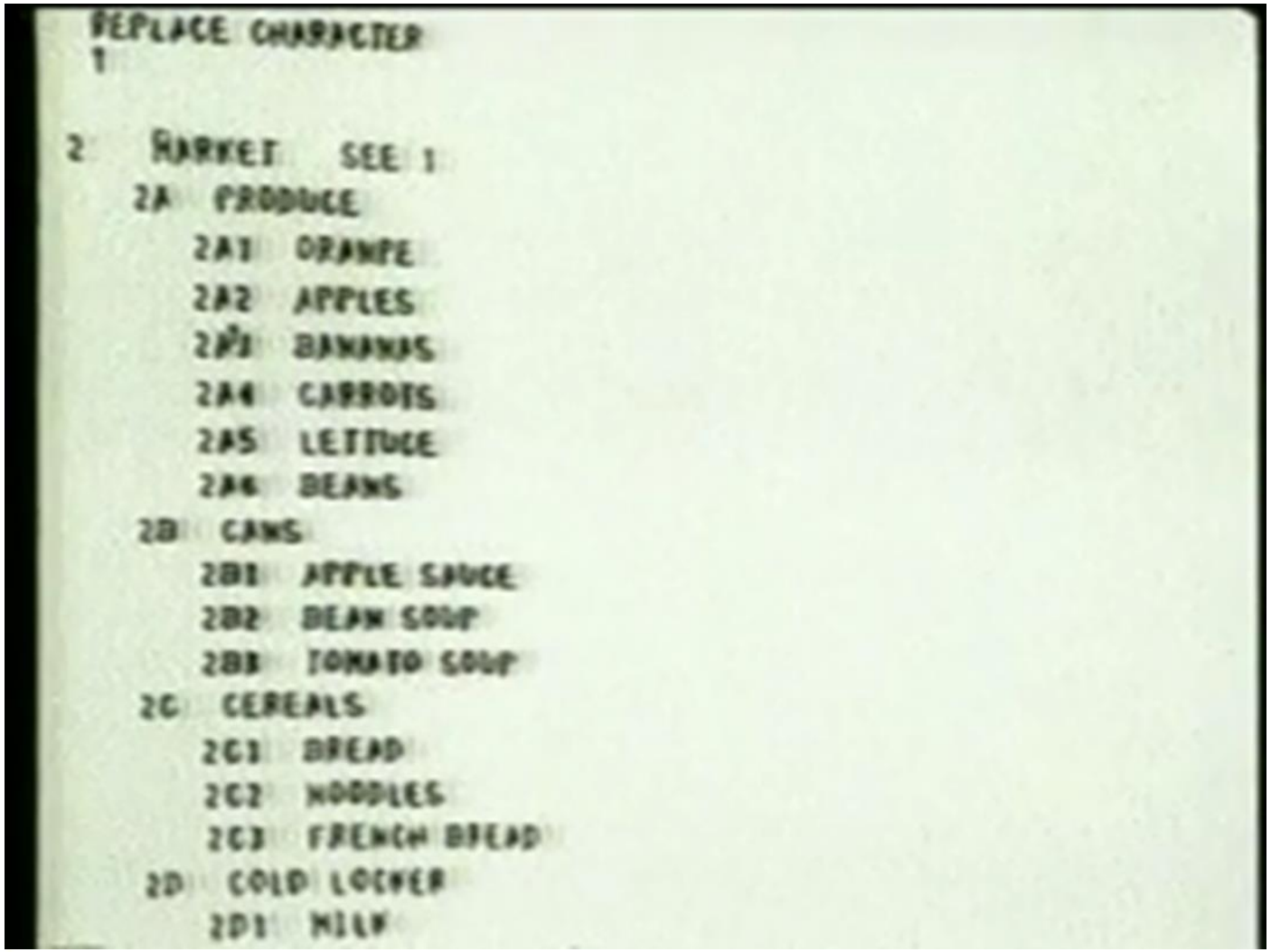
1962

Windows

Constraints
(i.e., non-procedural)

Prototype/Instance Inheritance
(i.e., object-oriented)

Doug Engelbart's NLS (Online System)



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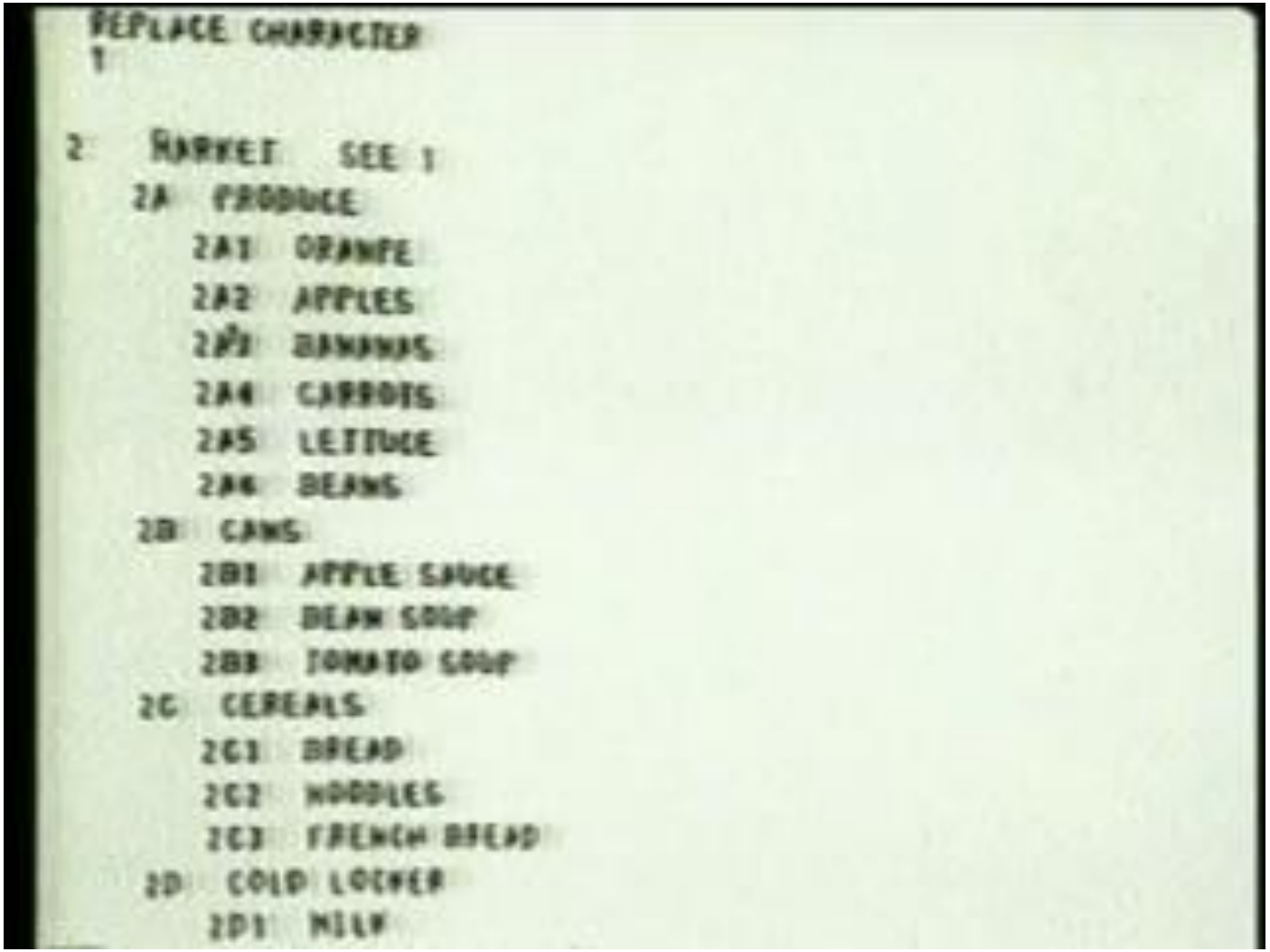
Doug Engelbart's NLS (Online System)



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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

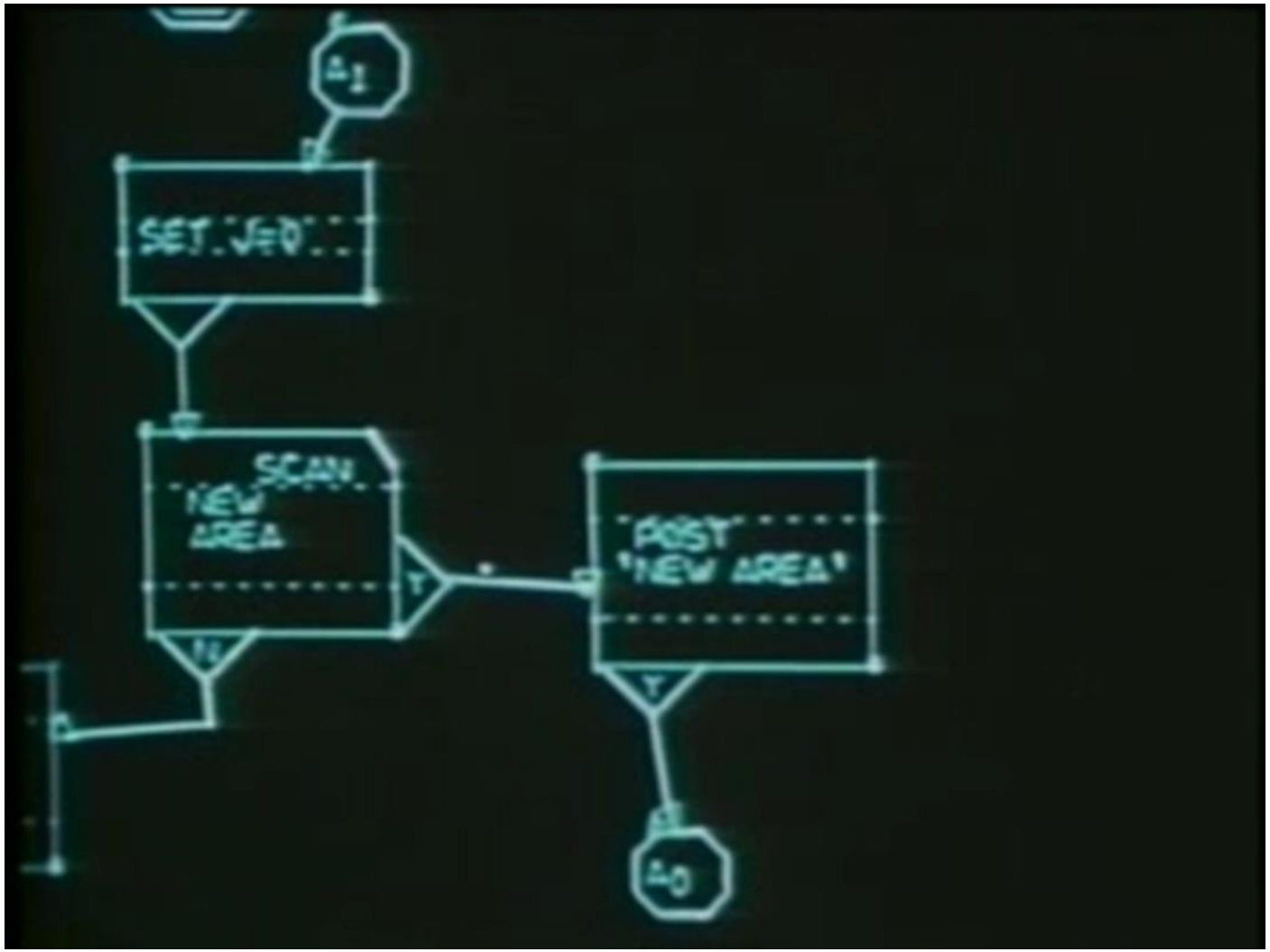
Chording keyboard to reduce hand movement

Remote collaboration

Analog Mouse leads to heavy moding

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

GRAIL



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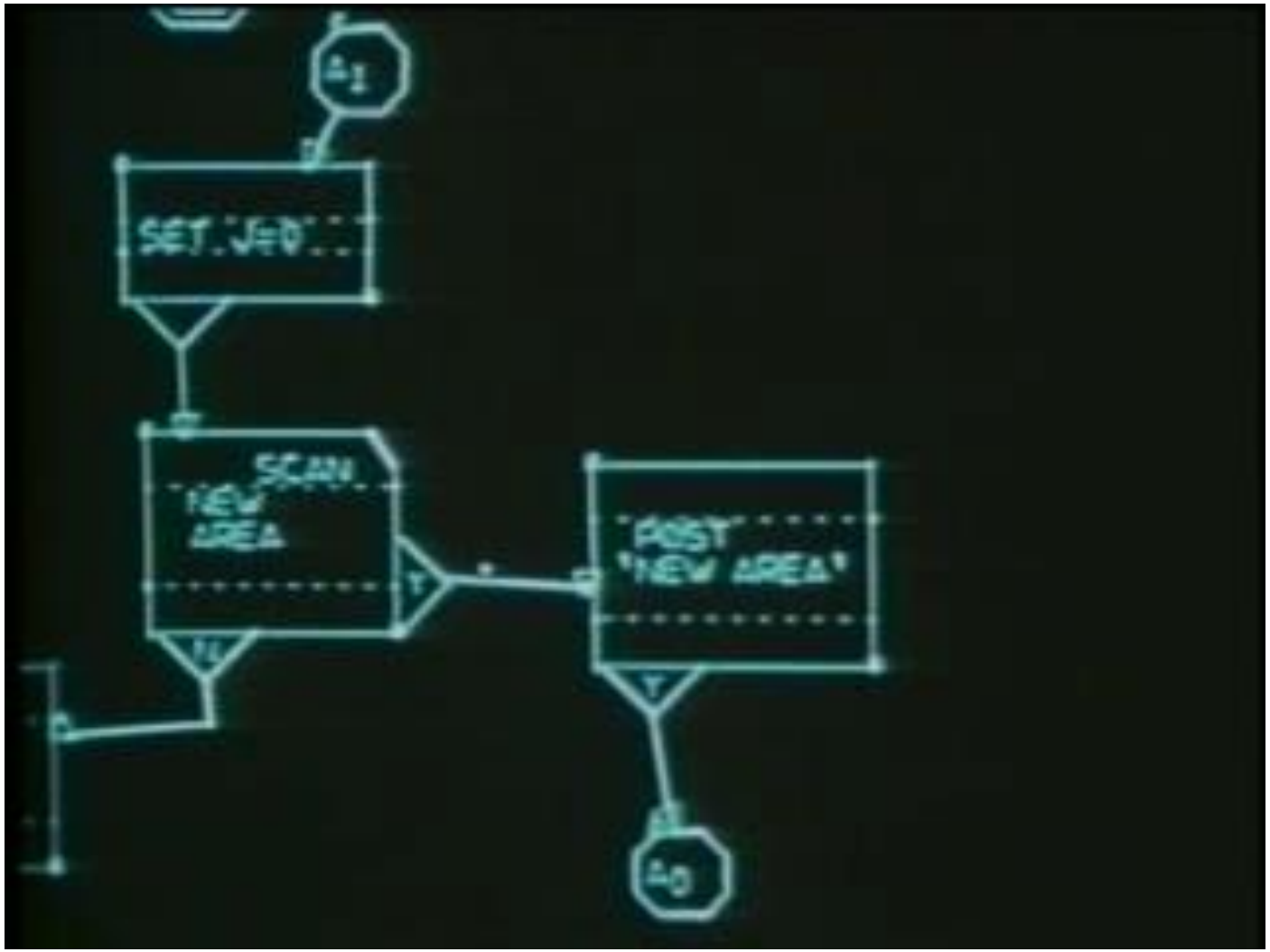
GRAIL



http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-GRAIL.m4v

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

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-Dynabook.m4v

Dynabook

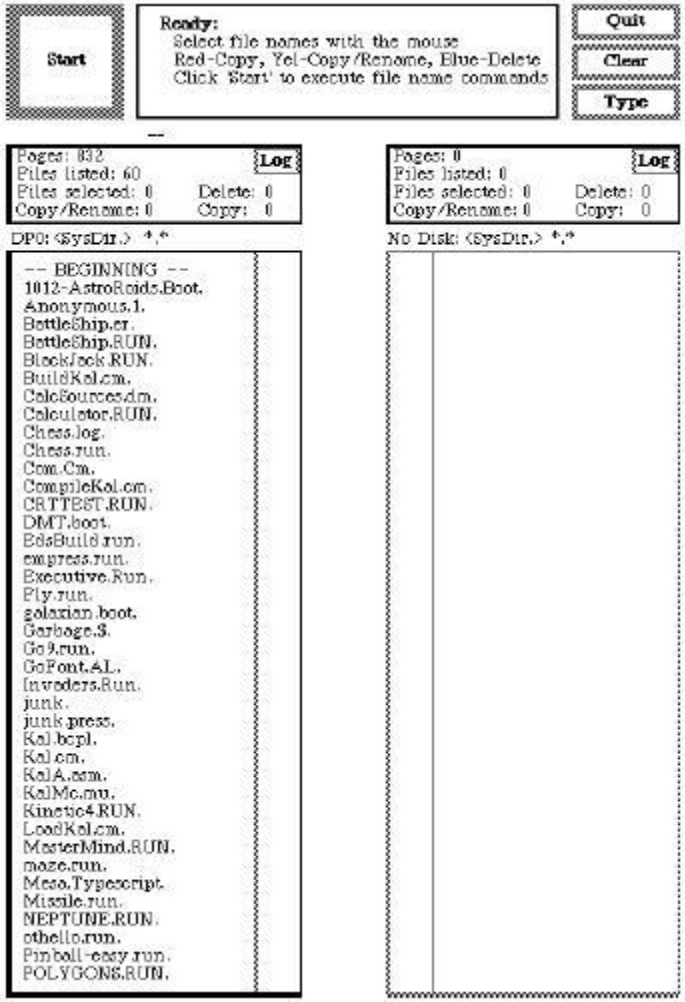
http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-Dynabook.m4v

Xerox to Apple and Microsoft

XEROX Alto 1973

Xerox Alto

Xerox Alto


Start
Ready:
Select file names with the mouse
Red-Copy, Yel-Copy/Rename, Blue-Delete
Click 'Start' to execute file name commands
Quit
Clear
Type
Pages: 832
Files listed: 60
Files selected: 0
Copy/Rename: 0
Delete: 0
Copy: 0
Log
DP0: <SysDir.> *.*
-- BEGINNING --
1012-AstroRoids.Boot.
Anonymous.1.
BattleShip.cr.
BattleShip.RUN.
BlackJack.RUN.
BuildKal.cm.
CalcSources.dm.
Calculator.RUN.
Chess.log.
Chess.run.
Com.Cm.
CompileKal.cm.
CRTTEST.RUN.
DMT.boot.
EdsBuild.run.
empress.run.
Executive.Run.
Fly.run.
galaxian.boot.
Garboge.$.
Go9.run.
GoFont.AL.
Invaders.Run.
junk.
junk.press.
Kal.bcpl.
Kal.cm.
KalA.cm.
KalMc.mu.
Kinetic4.RUN.
LoadKal.cm.
MasterMind.RUN.
maze.run.
Meso.Typescript.
Missile.run.
NEPTUNE.RUN.
othello.run.
Pinball-easy.run.
POLYGONS.RUN.
Pages: 0
Files listed: 0
Files selected: 0
Copy/Rename: 0
Delete: 0
Copy: 0
Log
No Disk: <SysDir.> *.*

Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

Xerox to Apple and Microsoft

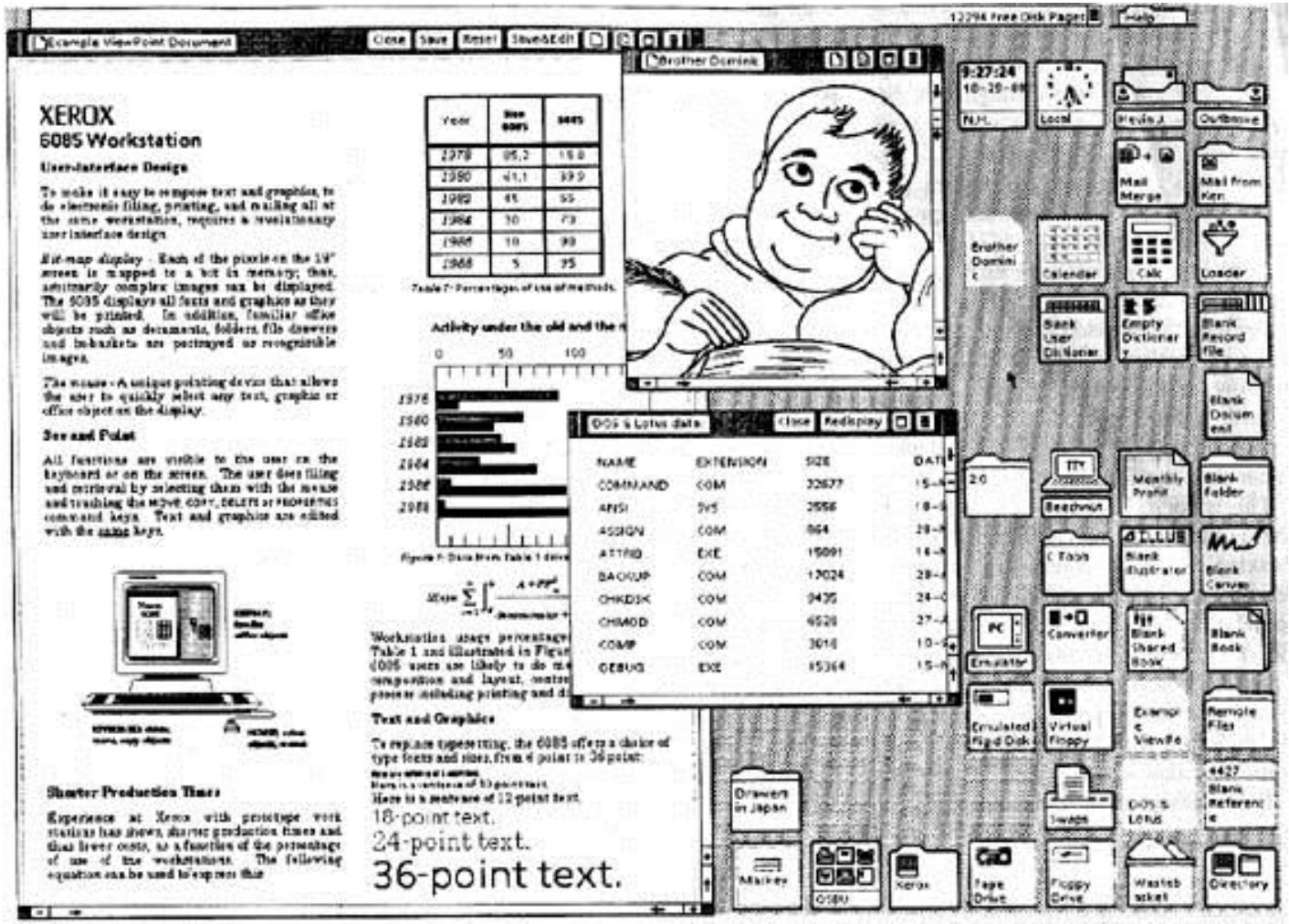
XEROX Alto 1973

Steve Jobs visits PARC in 1979

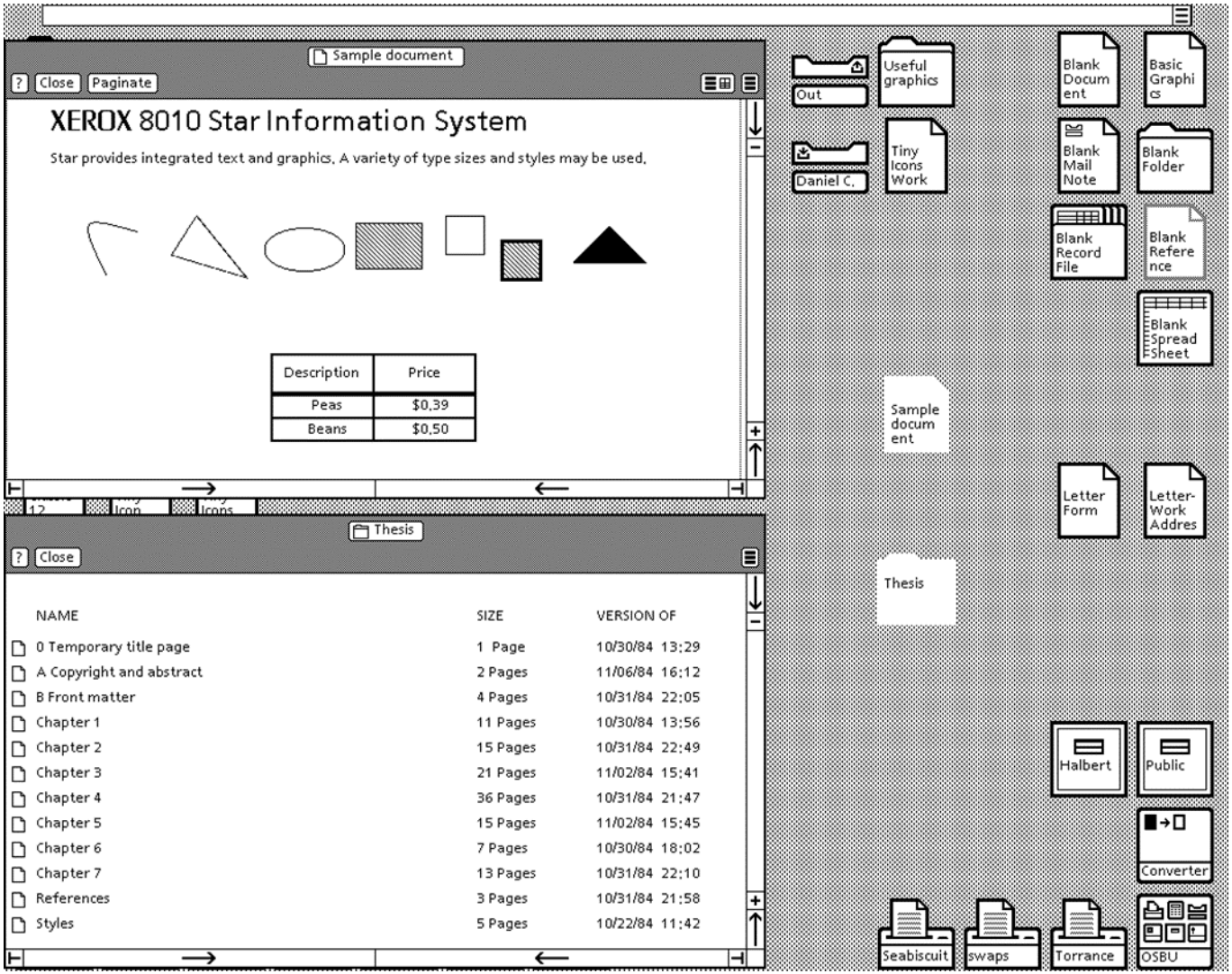
XEROX STAR 1981

Xerox Star

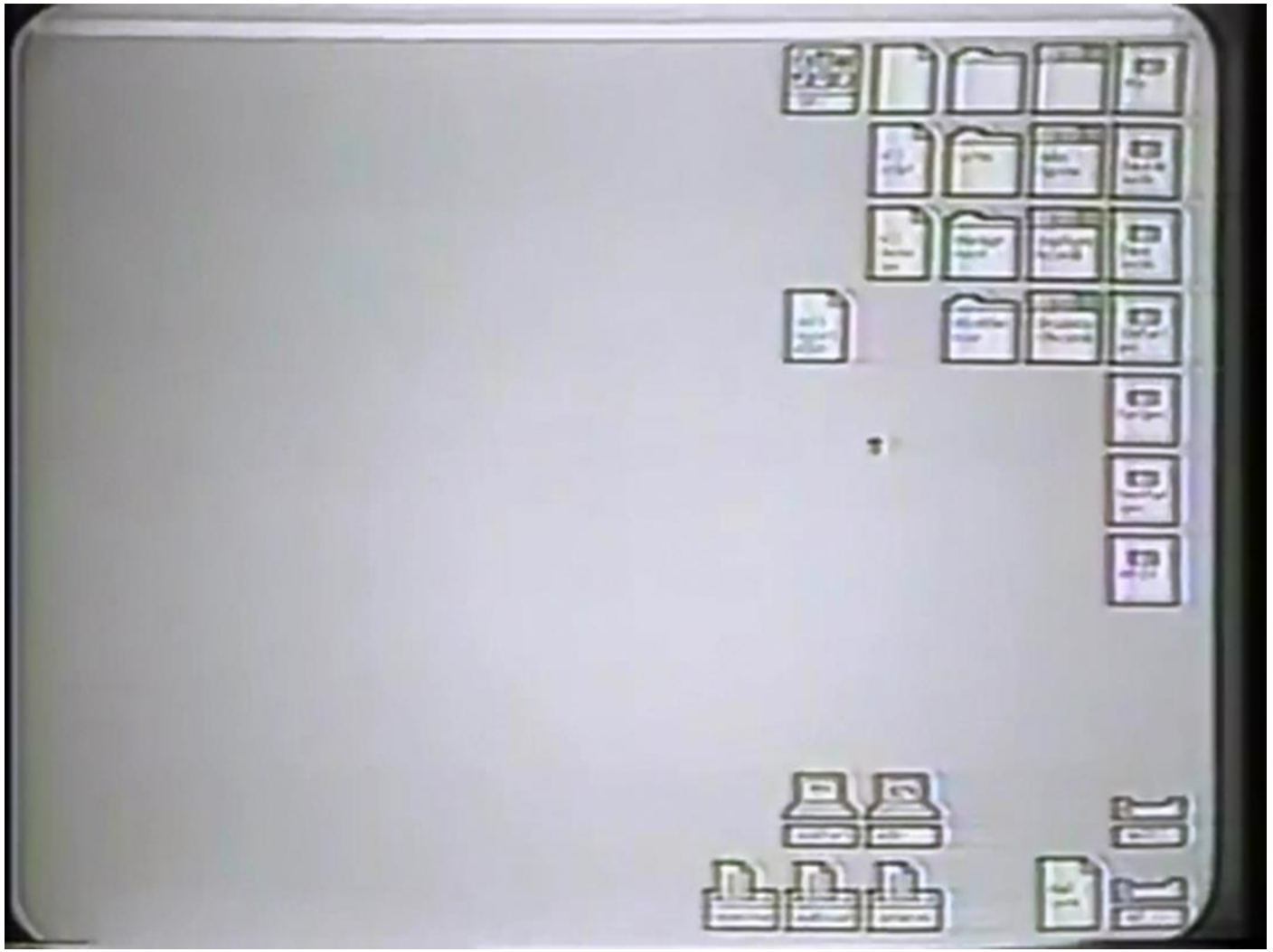
Xerox Star


XEROX
6085 Workstation
User-Interface Design
See and Point
Shorter Production Times
Text and Graphics
18-point text.
24-point text.
36-point text.

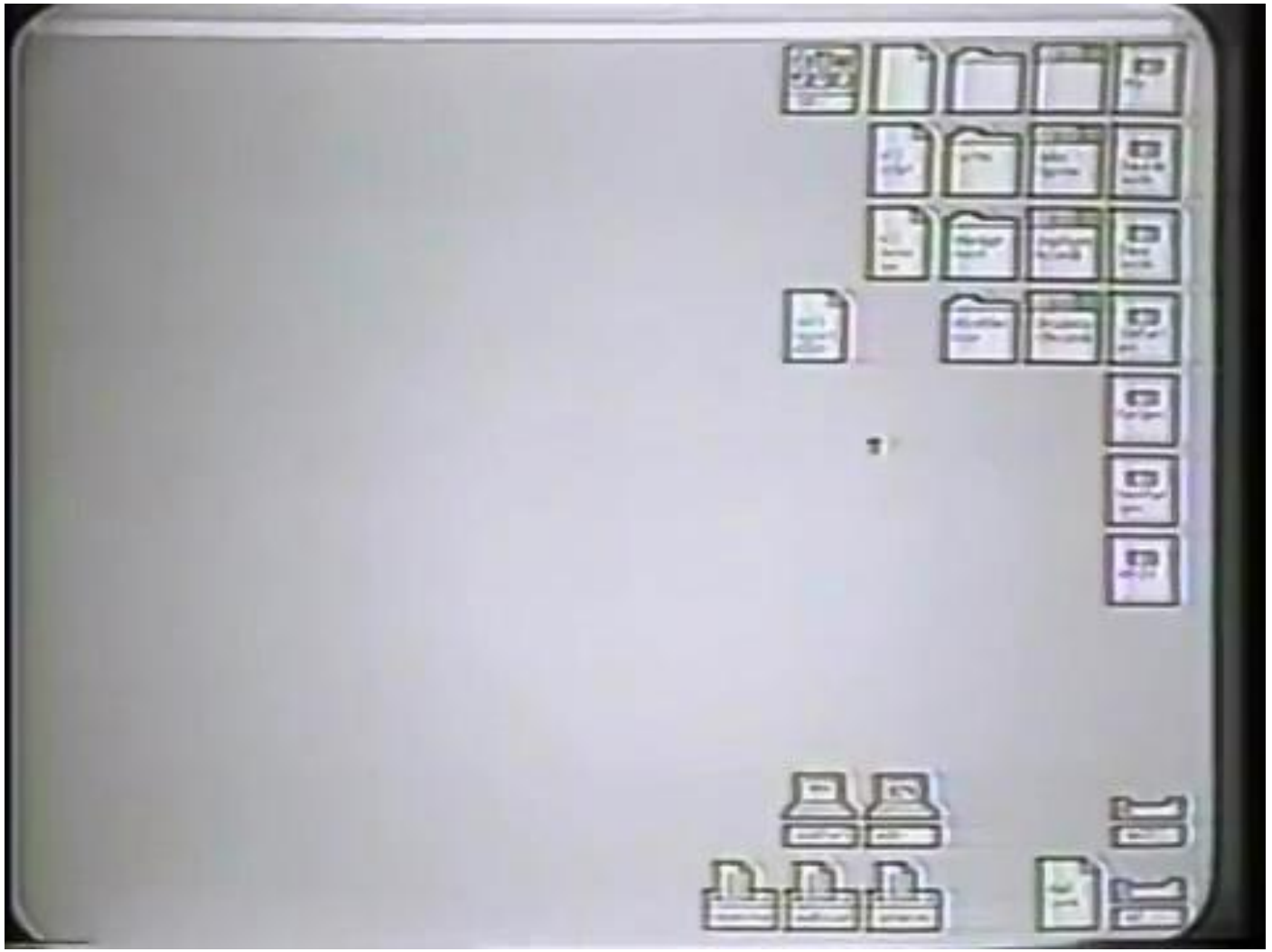
Xerox Star


Sample document
Close
Paginate
XEROX 8010 Star Information System
Star provides integrated text and graphics. A variety of type sizes and styles may be used.
Description
Price
Peas
$0,39
Beans
$0,50
Thesis
Close
NAME
SIZE
VERSION OF
0 Temporary title page
1 Page
10/30/84 13:29
A Copyright and abstract
2 Pages
11/06/84 16:12
B Front matter
4 Pages
10/31/84 22:05
Chapter 1
11 Pages
10/30/84 13:56
Chapter 2
15 Pages
10/31/84 22:49
Chapter 3
21 Pages
11/02/84 15:41
Chapter 4
36 Pages
10/31/84 21:47
Chapter 5
15 Pages
11/02/84 15:45
Chapter 6
7 Pages
10/30/84 18:02
Chapter 7
13 Pages
10/31/84 22:10
References
3 Pages
10/31/84 21:58
Styles
5 Pages
10/22/84 11:42
Out
Useful graphics
Daniel C.
Tiny Icons Work
Blank Document
Basic Graphics
Blank Mail Note
Blank Folder
Blank Record File
Blank Reference
Blank Spread Sheet
Sample document
Letter Form
Letter-Work Addres
Thesis
Halbert
Public
Converter
Seabiscuit
swaps
Torrance
OSBU

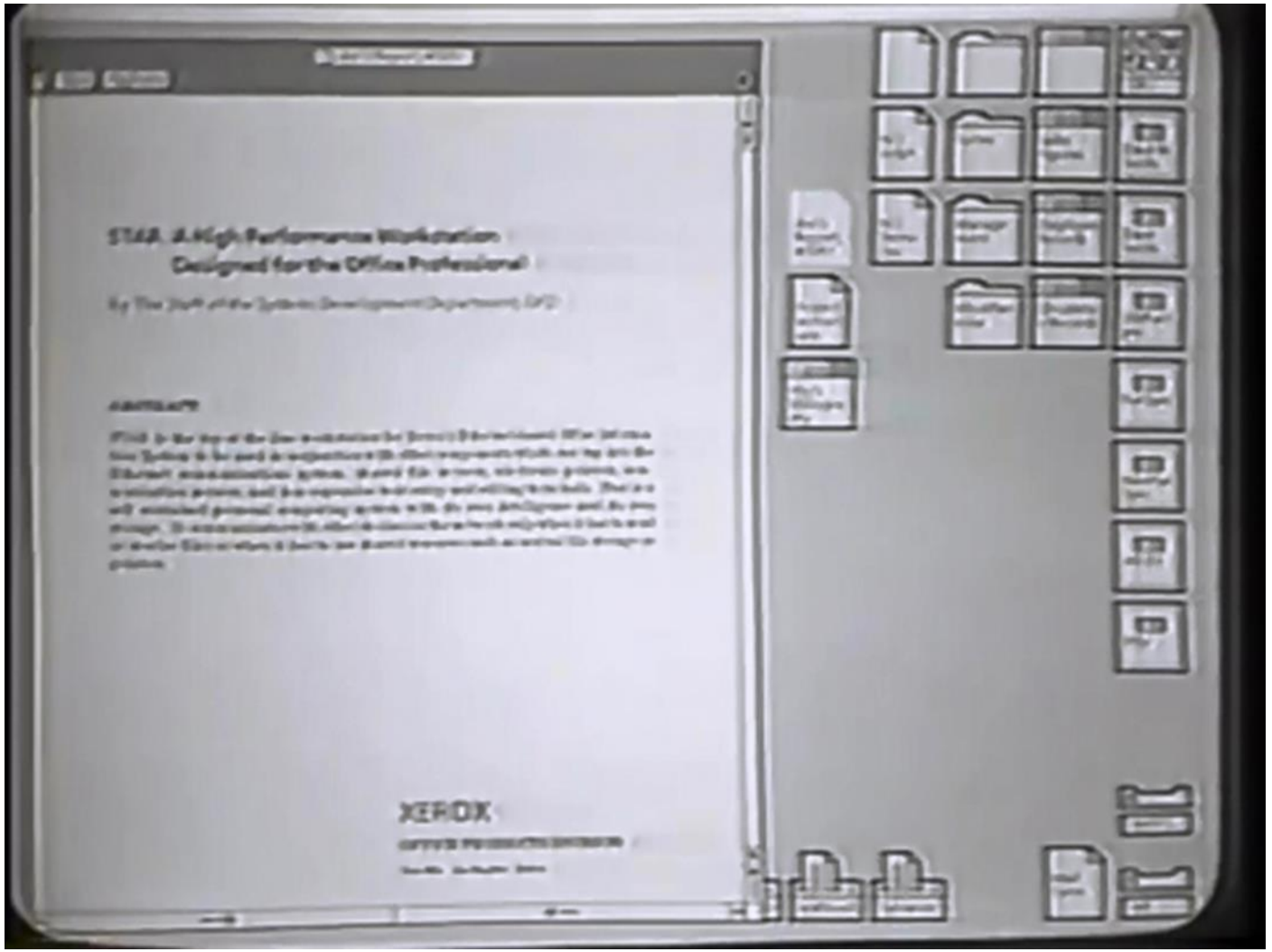
Xerox Star



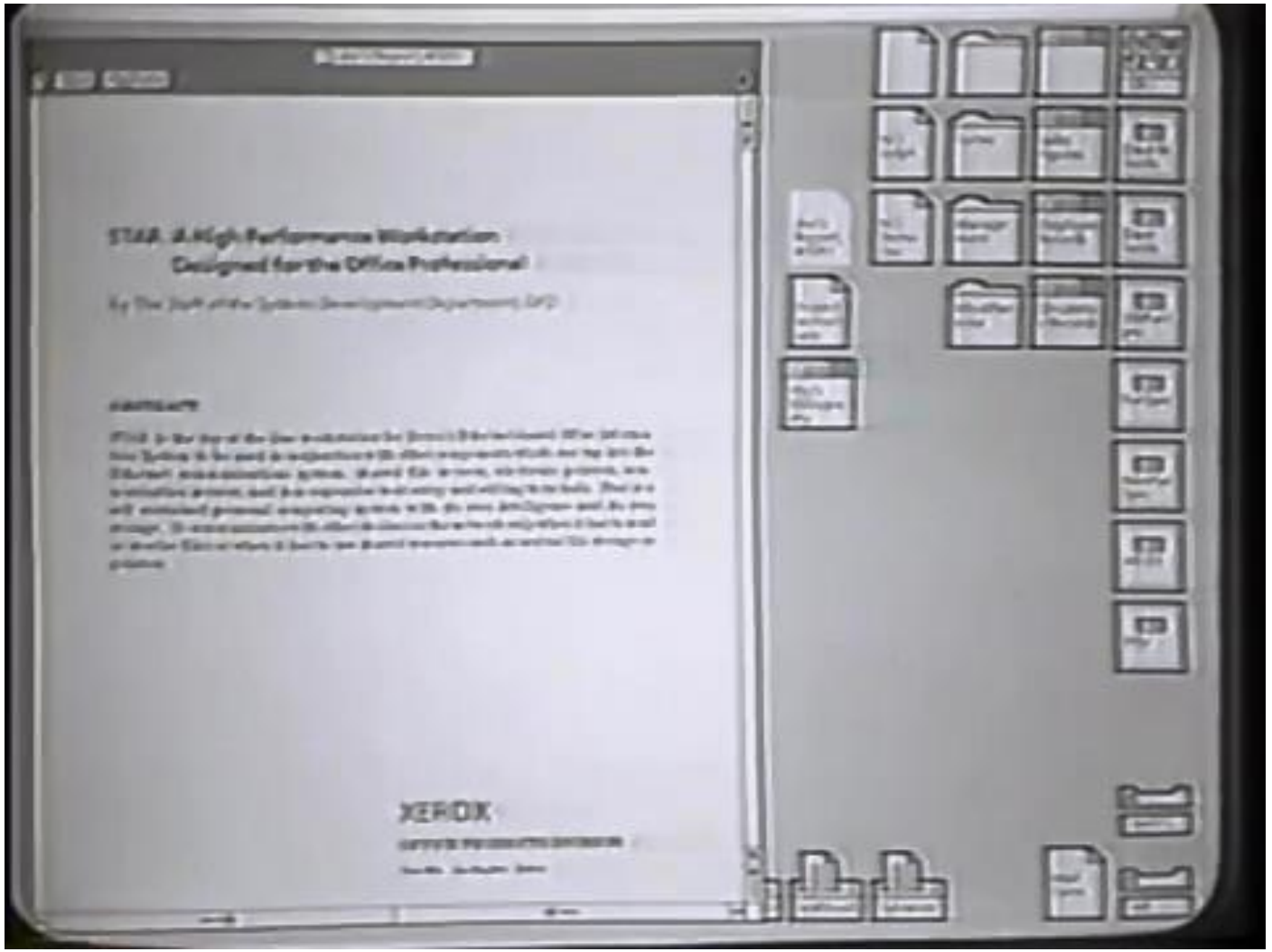
Xerox Star



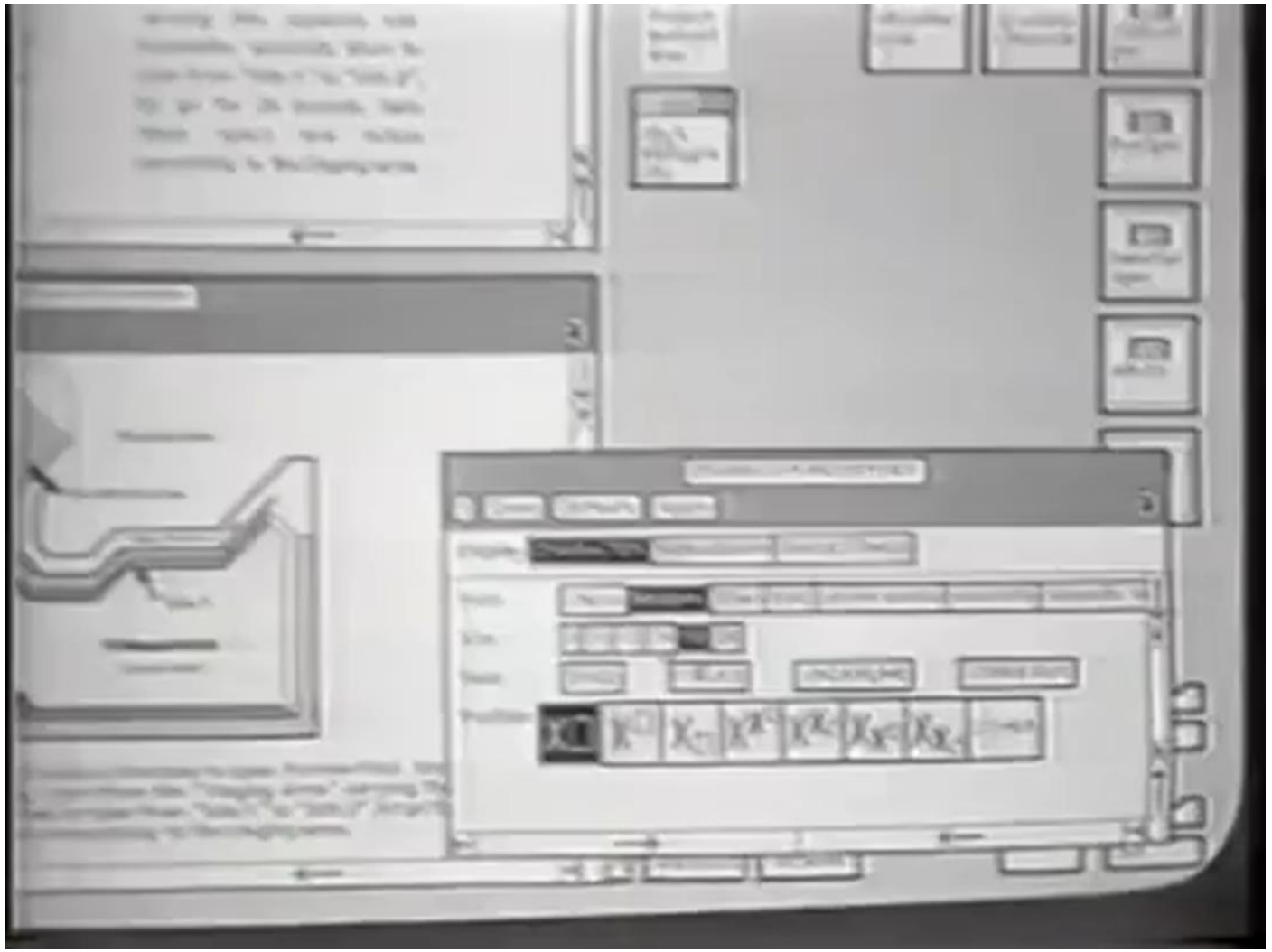
Xerox Star



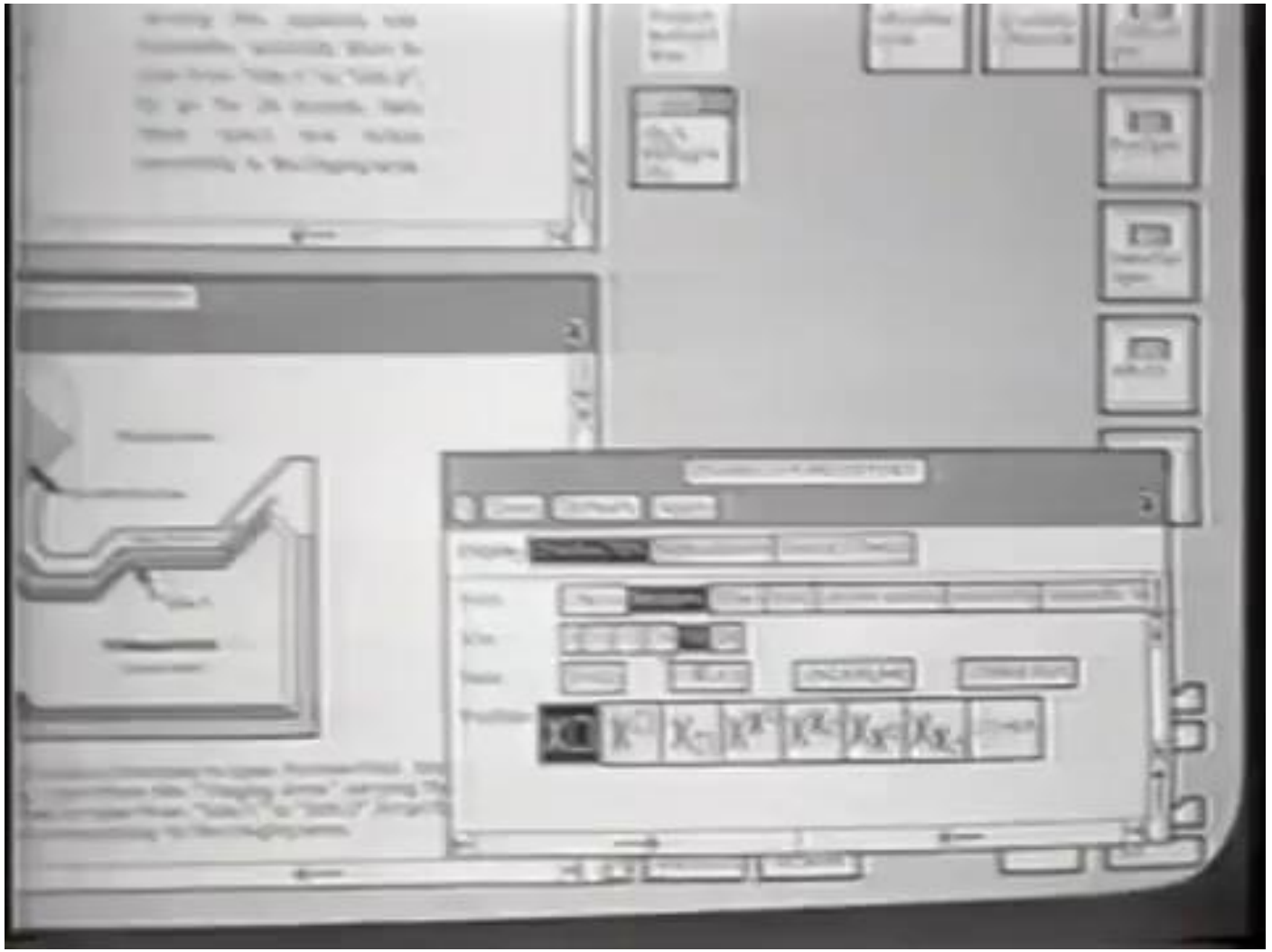
Xerox Star



Xerox Star



Xerox Star



Xerox to Apple and Microsoft

XEROX Alto 1973

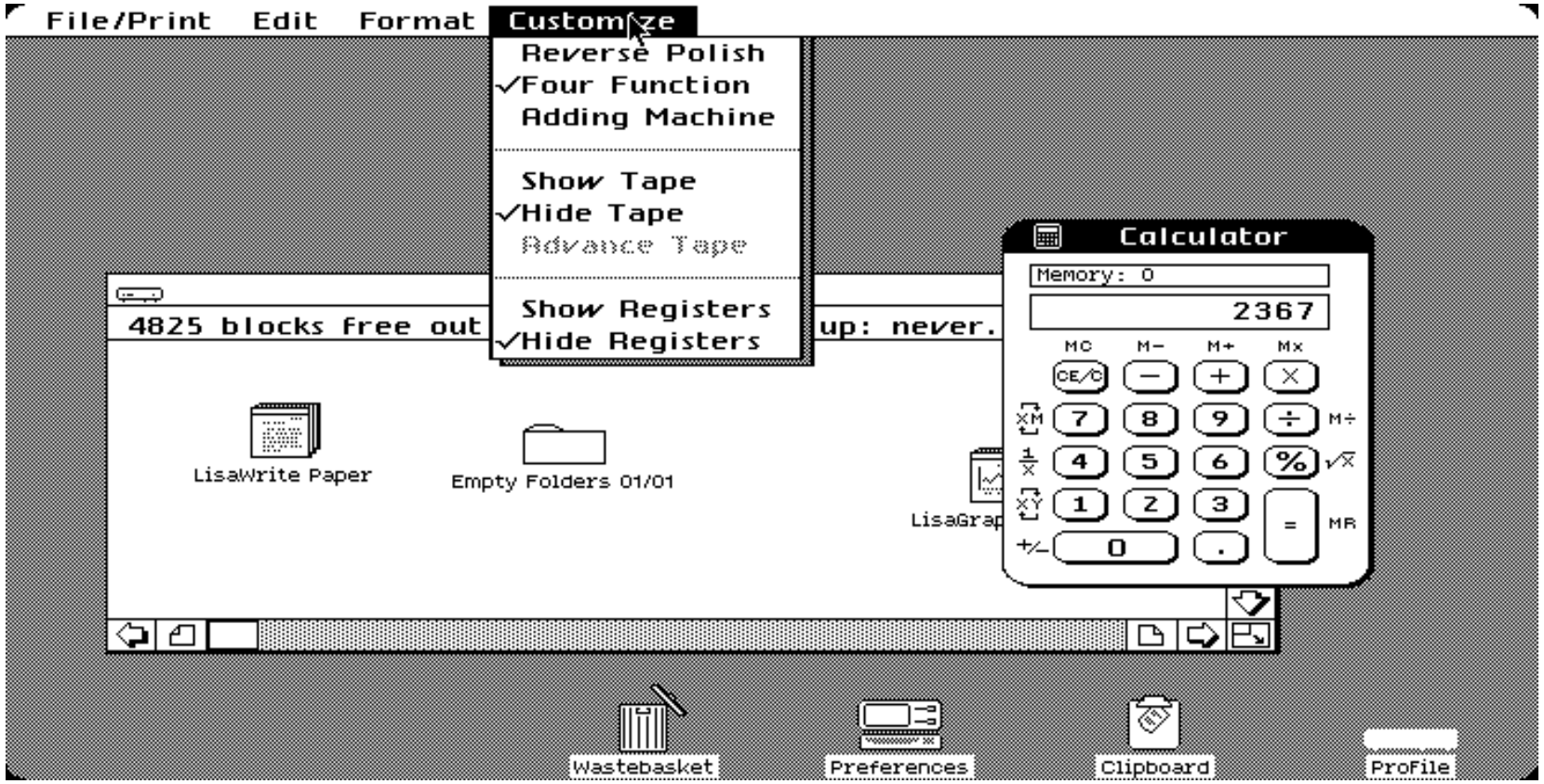
Steve Jobs visits PARC in 1979

XEROX STAR 1981

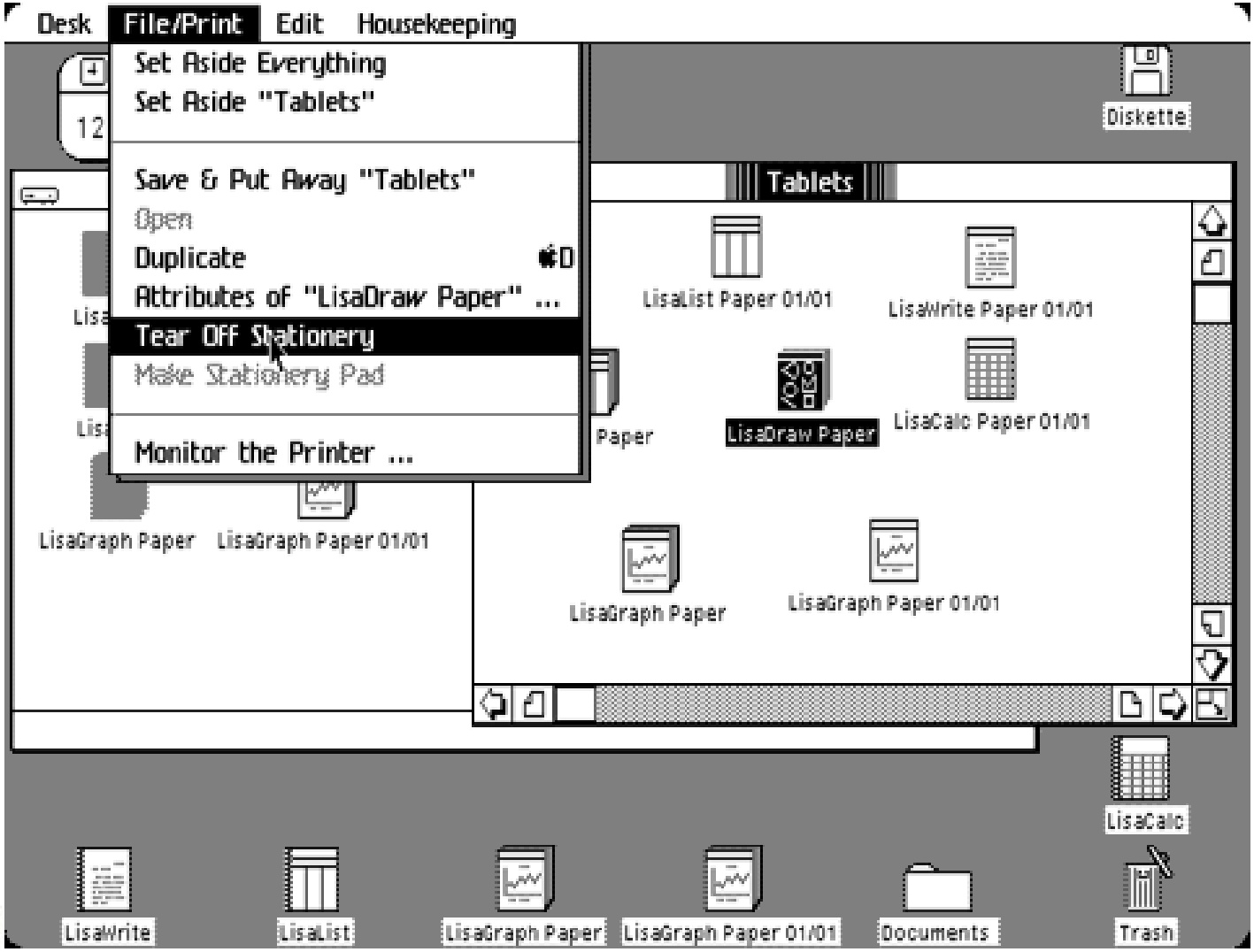
Apple Lisa 1981

Apple Lisa

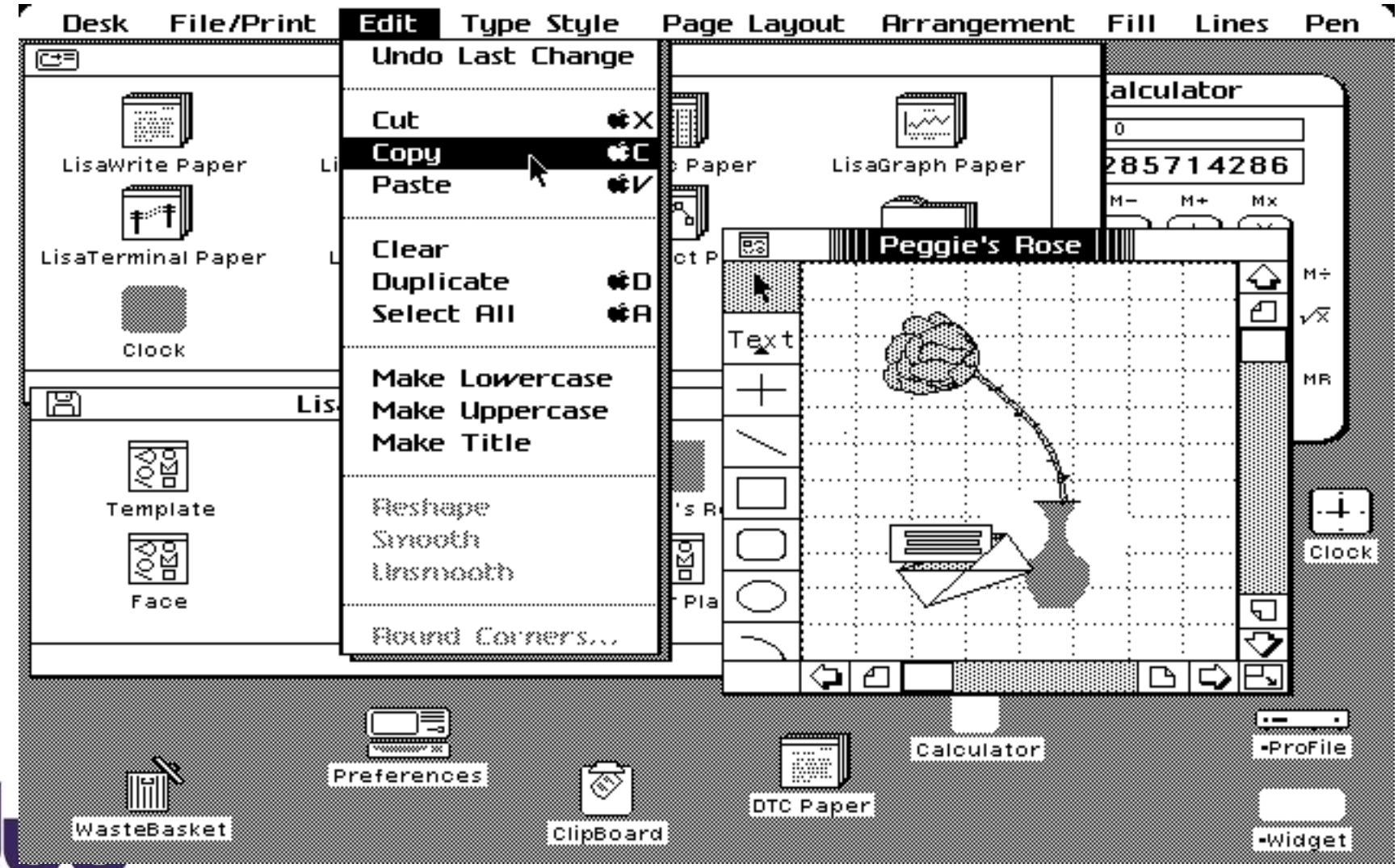
Apple Lisa


File/Print
Edit
Format
Customize
Reverse Polish
✓Four Function
Adding Machine
Show Tape
✓Hide Tape
Advance Tape
Show Registers
✓Hide Registers
4825 blocks free out
up: never.
LisaWrite Paper
Empty Folders 01/01
LisaGrap
Calculator
Memory: 0
2367
MC
M−
M+
Mx
CE/C
M÷
MR
Wastebasket
Preferences
Clipboard
ProFile

Apple Lisa


Desk
File/Print
Edit
Housekeeping
Set Aside Everything
Set Aside "Tablets"
Save & Put Away "Tablets"
Open
Duplicate ⌘D
Attributes of "LisaDraw Paper" ...
Tear Off Stationery
Make Stationery Pad
Monitor the Printer ...
Diskette
Tablets
LisaList Paper 01/01
LisaWrite Paper 01/01
LisaDraw Paper
LisaCalc Paper 01/01
Paper
LisaGraph Paper
LisaGraph Paper 01/01
LisaGraph Paper
LisaGraph Paper 01/01
LisaCalc
LisaWrite
LisaList
LisaGraph Paper
LisaGraph Paper 01/01
Documents
Trash

Apple Lisa


Desk
File/Print
Edit
Type Style
Page Layout
Arrangement
Fill
Lines
Pen
Undo Last Change
Cut ⌘X
Copy ⌘C
Paste ⌘V
Clear
Duplicate ⌘D
Select All ⌘A
Make Lowercase
Make Uppercase
Make Title
Reshape
Smooth
Unsmooth
Round Corners...
LisaWrite Paper
LisaTerminal Paper
Clock
Template
Face
LisaGraph Paper
Peggie's Rose
Text
Calculator
Clock
WasteBasket
Preferences
ClipBoard
DTC Paper
Calculator
ProFile
Widget

Xerox to Apple and Microsoft

XEROX Alto 1973

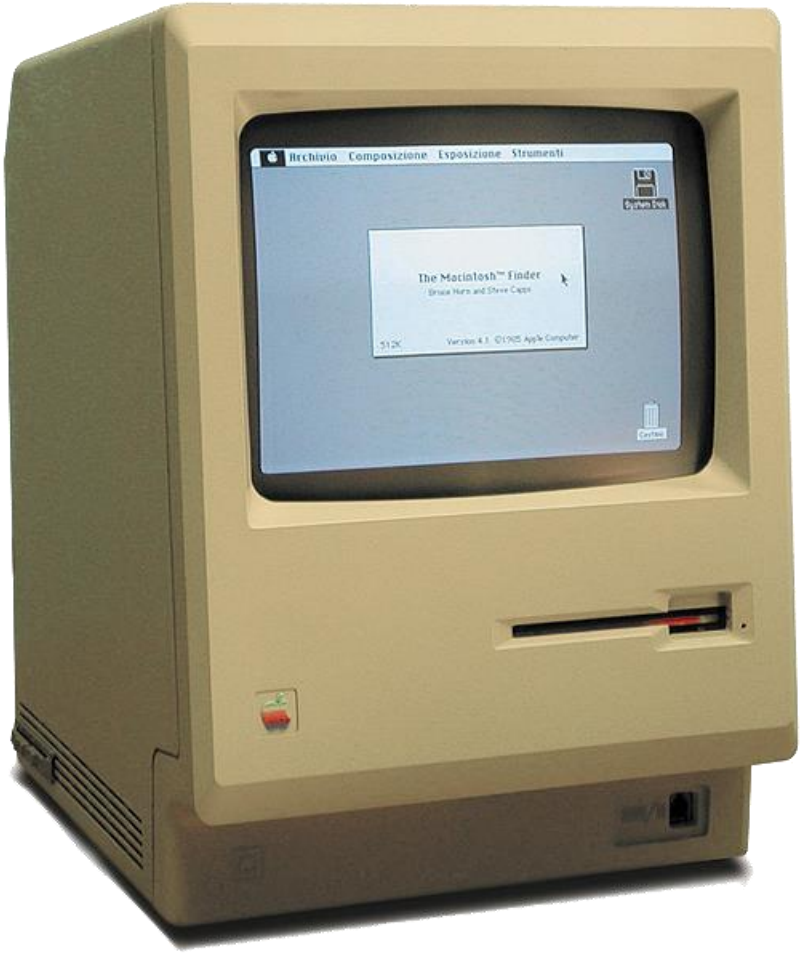
Steve Jobs visits PARC in 1979

XEROX STAR 1981

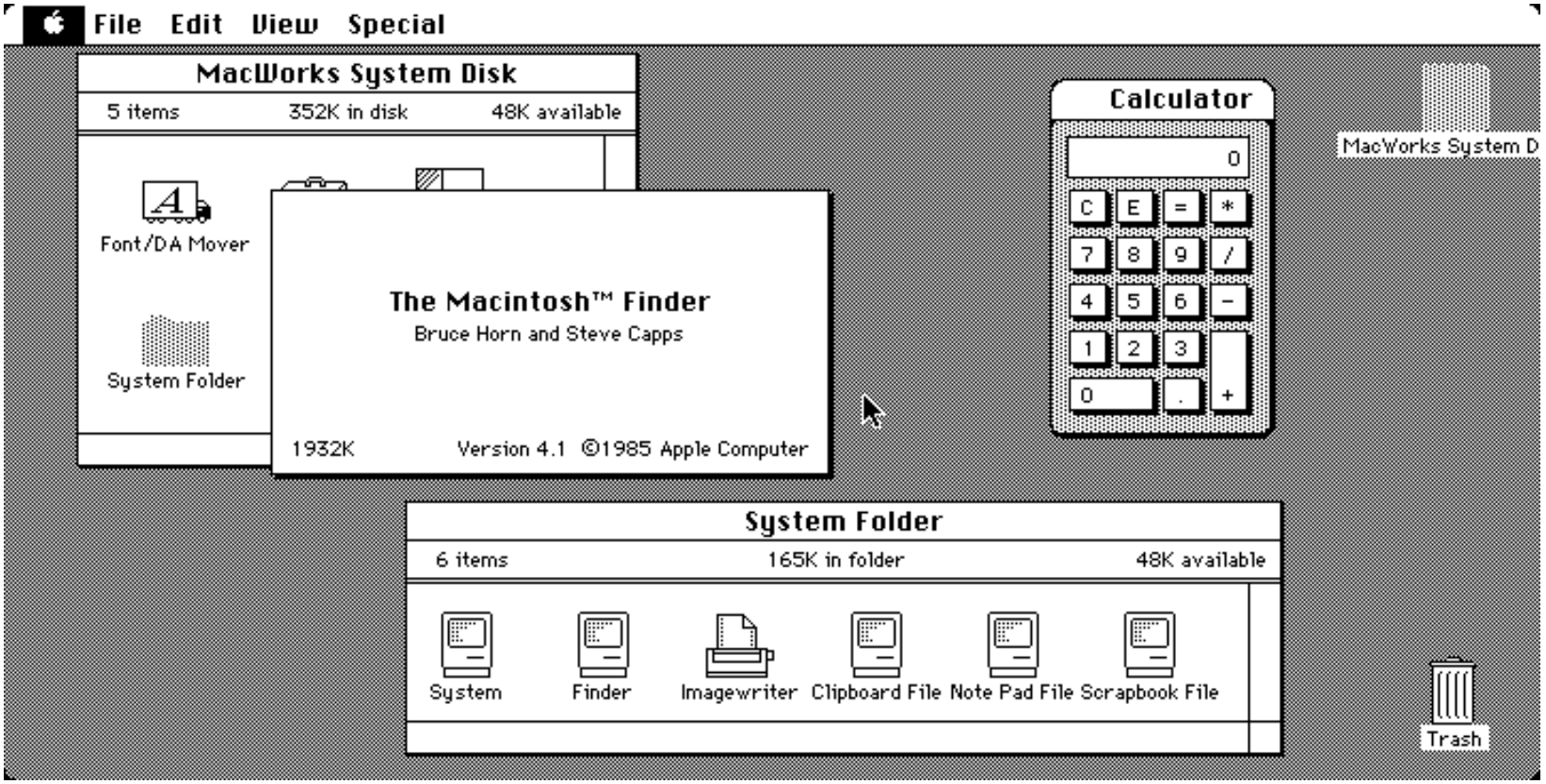
Apple Lisa 1981

Apple Macintosh 1984

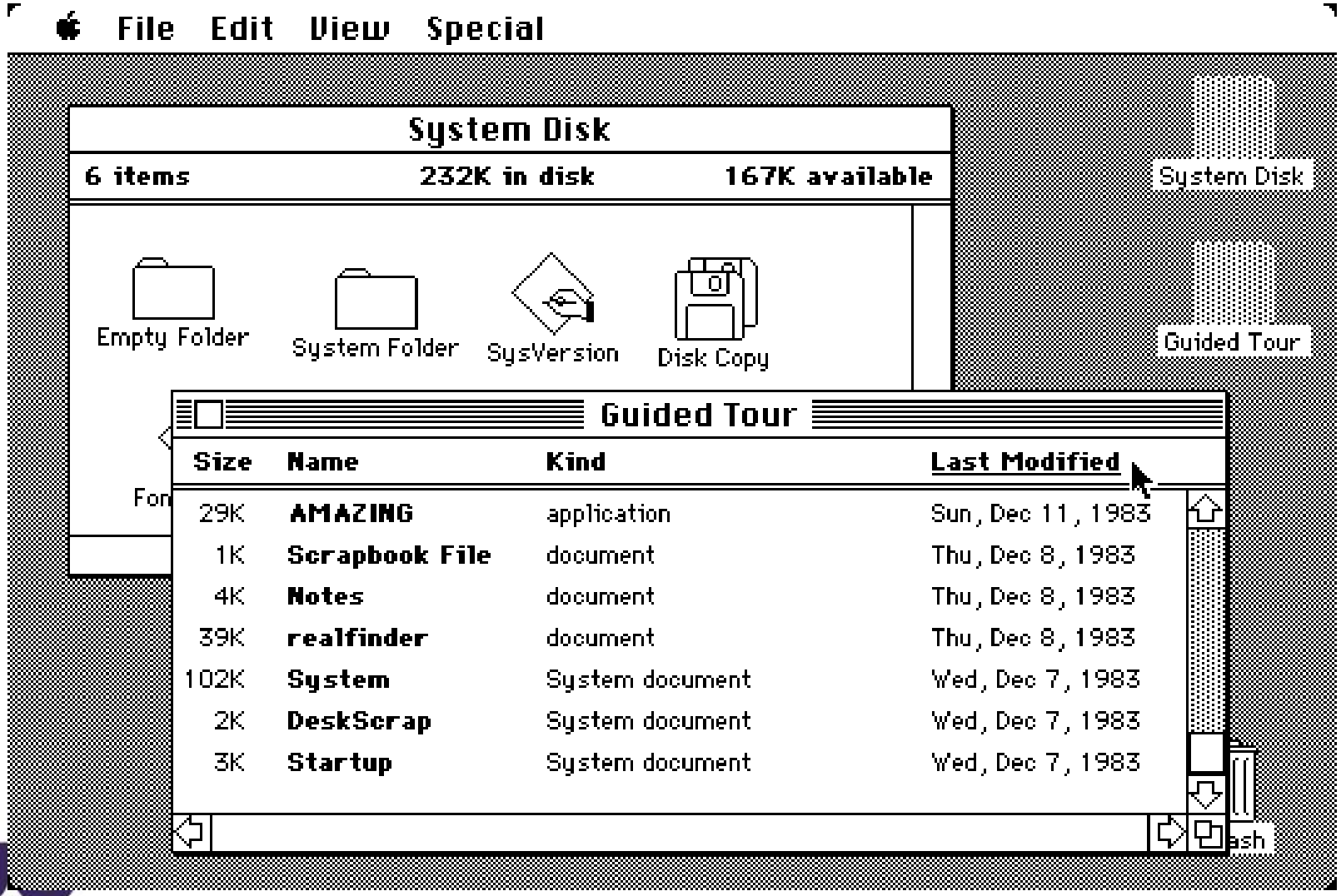
Macintosh


Archivio Composizione Esposizione Strumenti
The Macintosh™ Finder

Macintosh


File Edit View Special
MacWorks System Disk
5 items
352K in disk
48K available
Font/DA Mover
System Folder
The Macintosh™ Finder
Bruce Horn and Steve Capps
1932K
Version 4.1 ©1985 Apple Computer
Calculator
0
C E = *
7 8 9 /
4 5 6 -
1 2 3
0 . +
MacWorks System D
System Folder
6 items
165K in folder
48K available
System
Finder
Imagewriter
Clipboard File
Note Pad File
Scrapbook File
Trash

Macintosh


File Edit View Special
System Disk
6 items
232K in disk
167K available
Empty Folder
System Folder
SysVersion
Disk Copy
System Disk
Guided Tour
Guided Tour
Size Name Kind Last Modified
29K AMAZING application Sun, Dec 11, 1983
1K Scrapbook File document Thu, Dec 8, 1983
4K Notes document Thu, Dec 8, 1983
39K realfinder document Thu, Dec 8, 1983
102K System System document Wed, Dec 7, 1983
2K DeskScrap System document Wed, Dec 7, 1983
3K Startup System document Wed, Dec 7, 1983

Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

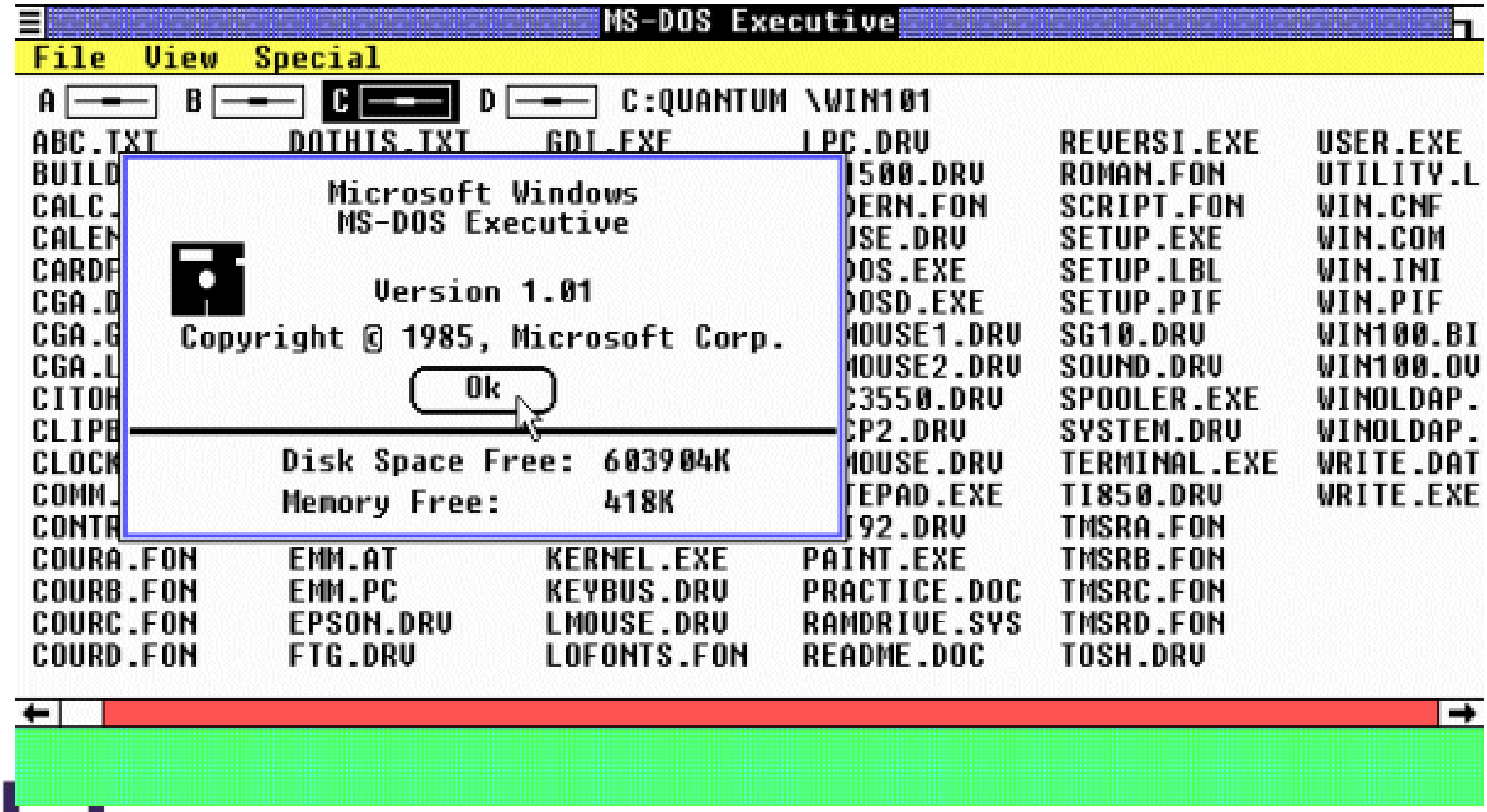
XEROX STAR 1981

Apple Lisa 1981

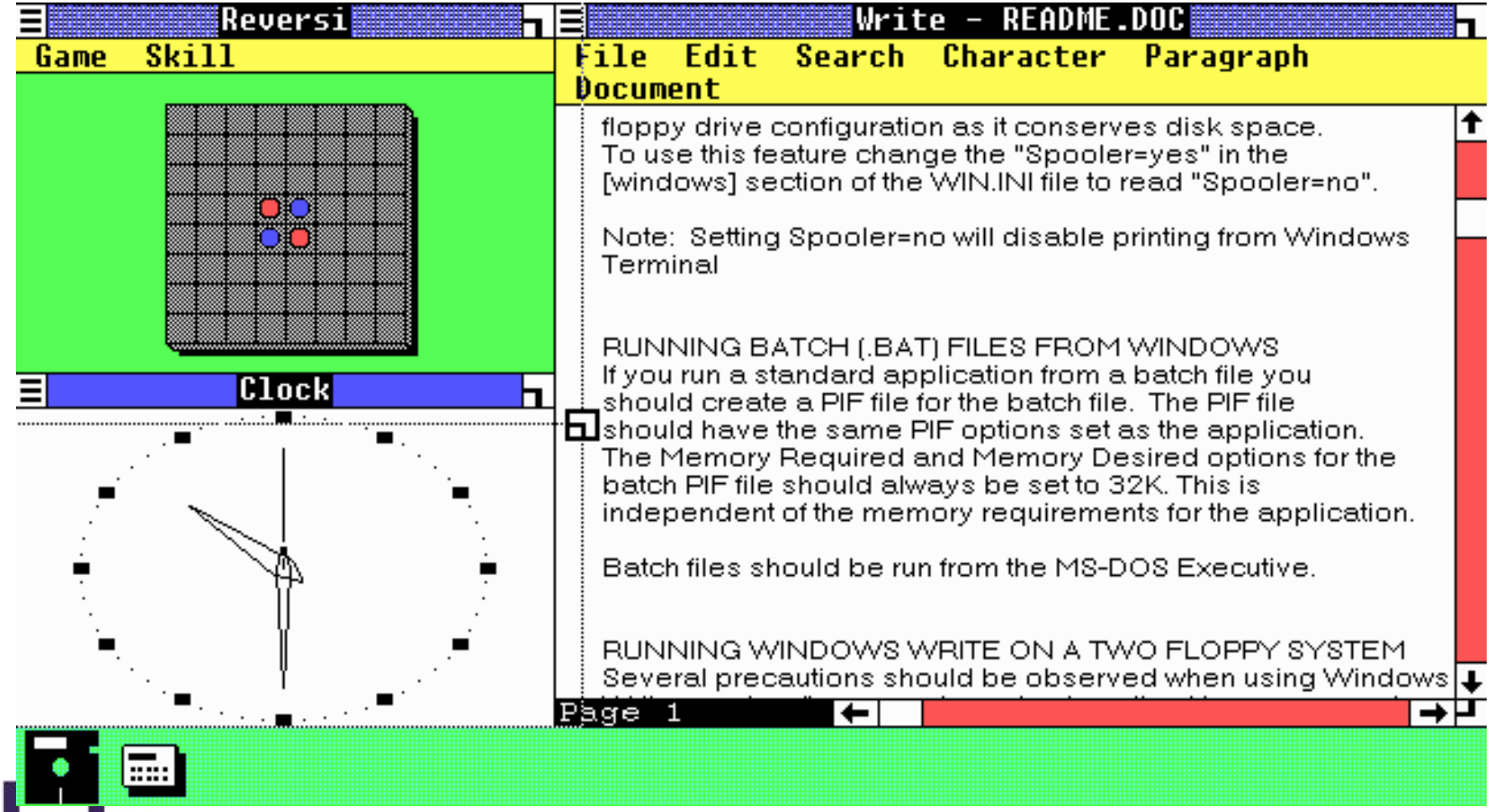
Apple Macintosh 1984

Windows 1.0 1985

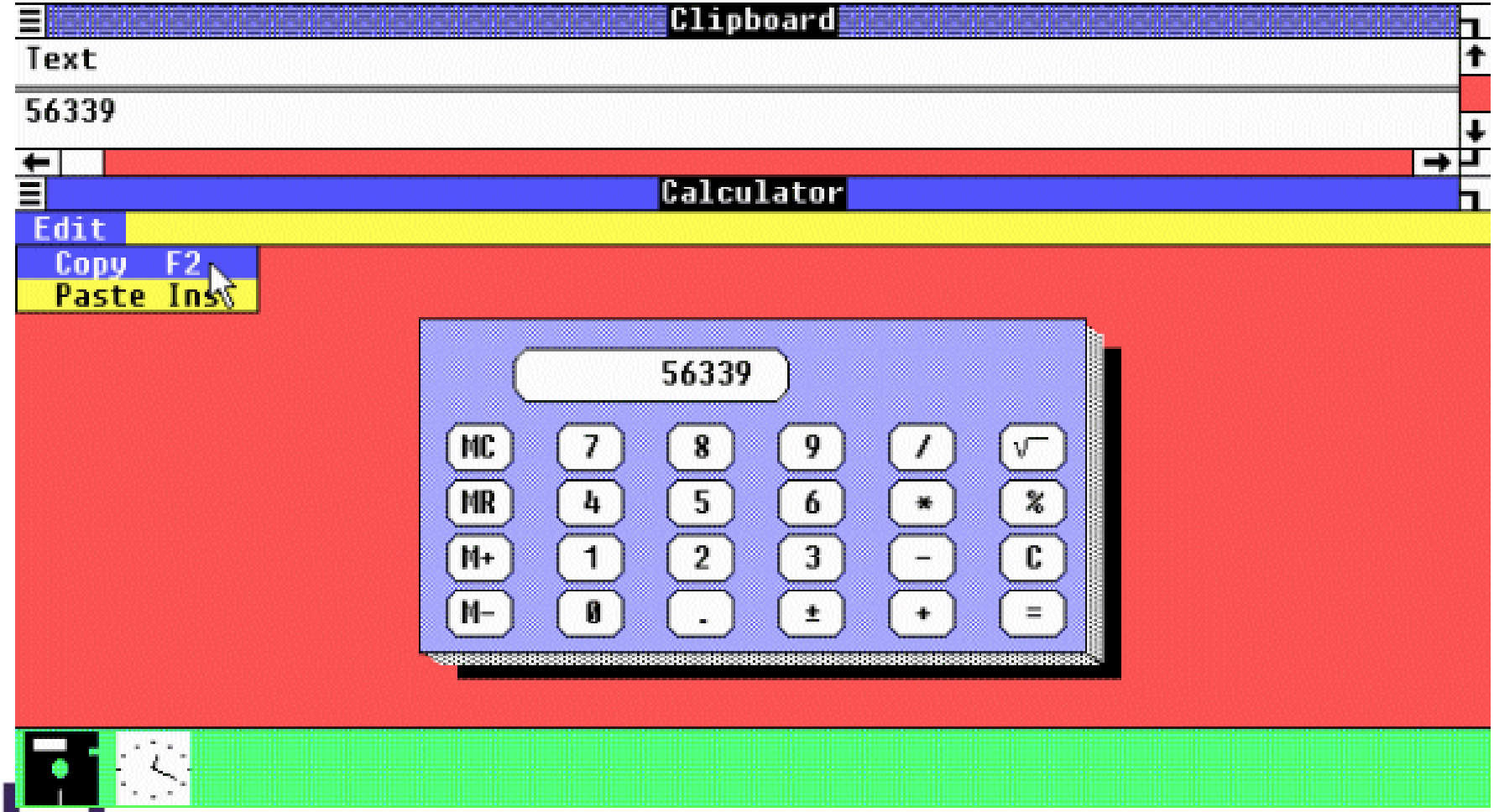
Windows 1.0


MS-DOS Executive
File View Special
A B C D C:QUANTUM \WIN101
ABC.TXT DOTHIS.TXT GDI.EXE LPC.DRV REVERSI.EXE USER.EXE
1500.DRV ROMAN.FON UTILITY.L
ERN.FON SCRIPT.FON WIN.CNF
SE.DRV SETUP.EXE WIN.COM
OS.EXE SETUP.LBL WIN.INI
OSD.EXE SETUP.PIF WIN.PIF
MOUSE1.DRV SG10.DRV WIN100.BI
MOUSE2.DRV SOUND.DRV WIN100.OV
C3550.DRV SPOOLER.EXE WINOLDAP.
CP2.DRV SYSTEM.DRV WINOLDAP.
MOUSE.DRV TERMINAL.EXE WRITE.DAT
TEPAD.EXE TI850.DRV WRITE.EXE
I92.DRV TMSRA.FON
COURA.FON EMM.AT KERNEL.EXE PAINT.EXE TMSRB.FON
COURB.FON EMM.PC KEYBUS.DRV PRACTICE.DOC TMSRC.FON
COURC.FON EPSON.DRV LMOUSE.DRV RAMDRIVE.SYS TMSRD.FON
COURD.FON FTG.DRV LOFONTS.FON README.DOC TOSH.DRV
Microsoft Windows
MS-DOS Executive
Version 1.01
Copyright © 1985, Microsoft Corp.
Ok
Disk Space Free: 603904K
Memory Free: 418K

Windows 1.0


Reversi
Game Skill
Clock
Write - README.DOC
File Edit Search Character Paragraph
Document
floppy drive configuration as it conserves disk space.
To use this feature change the "Spooler=yes" in the
[windows] section of the WIN.INI file to read "Spooler=no".
Note: Setting Spooler=no will disable printing from Windows
Terminal
RUNNING BATCH (.BAT) FILES FROM WINDOWS
If you run a standard application from a batch file you
should create a PIF file for the batch file. The PIF file
should have the same PIF options set as the application.
The Memory Required and Memory Desired options for the
batch PIF file should always be set to 32K. This is
independent of the memory requirements for the application.
Batch files should be run from the MS-DOS Executive.
RUNNING WINDOWS WRITE ON A TWO FLOPPY SYSTEM
Several precautions should be observed when using Windows
Page 1

Windows 1.0


Clipboard
Text
56339
Calculator
Edit
Copy F2
Paste Ins
56339
MC 7 8 9 / √
MR 4 5 6 * %
M+ 1 2 3 - C
M- 0 . ± + =

Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

XEROX STAR 1981

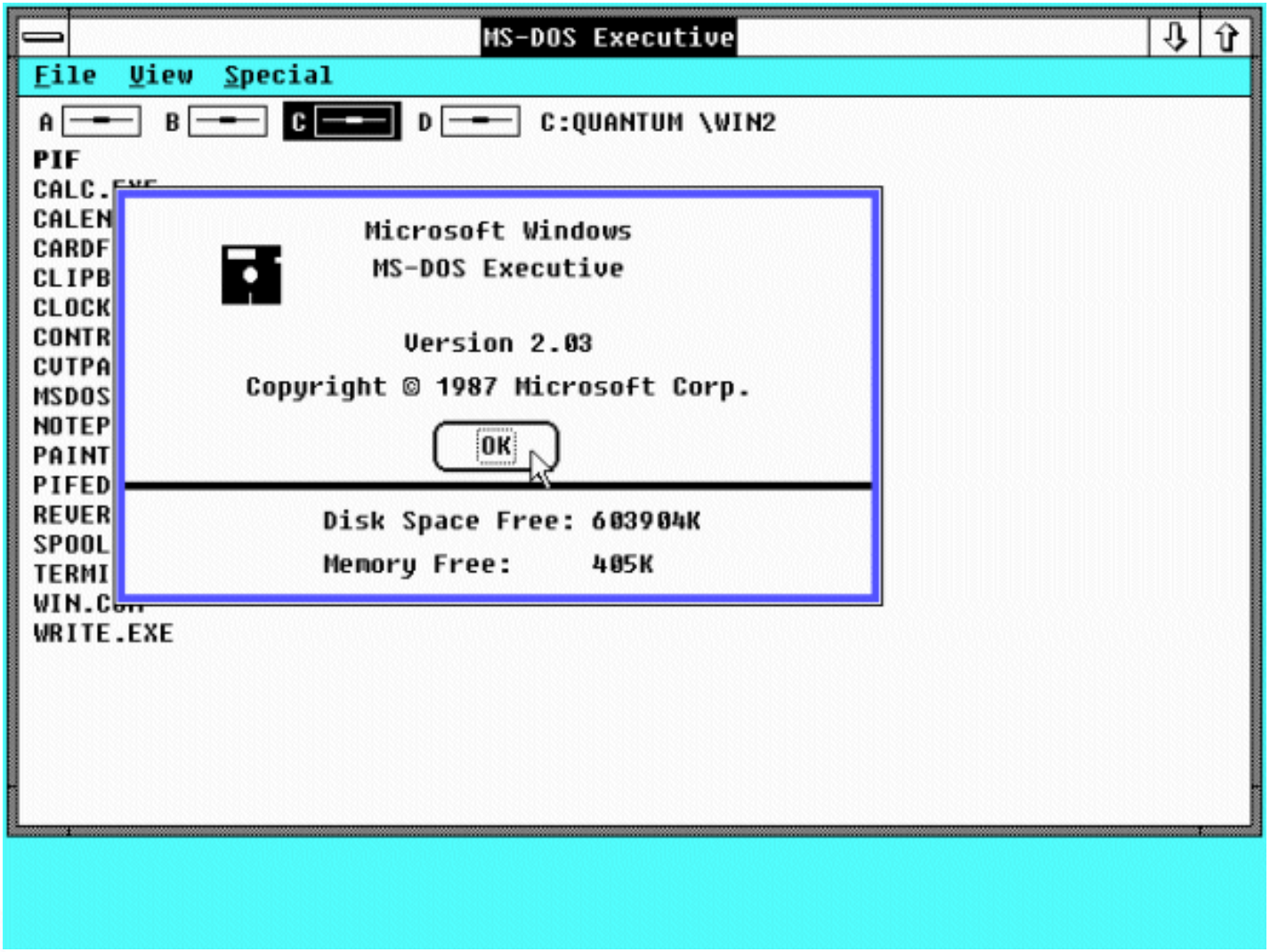
Apple Lisa 1981

Apple Macintosh 1984

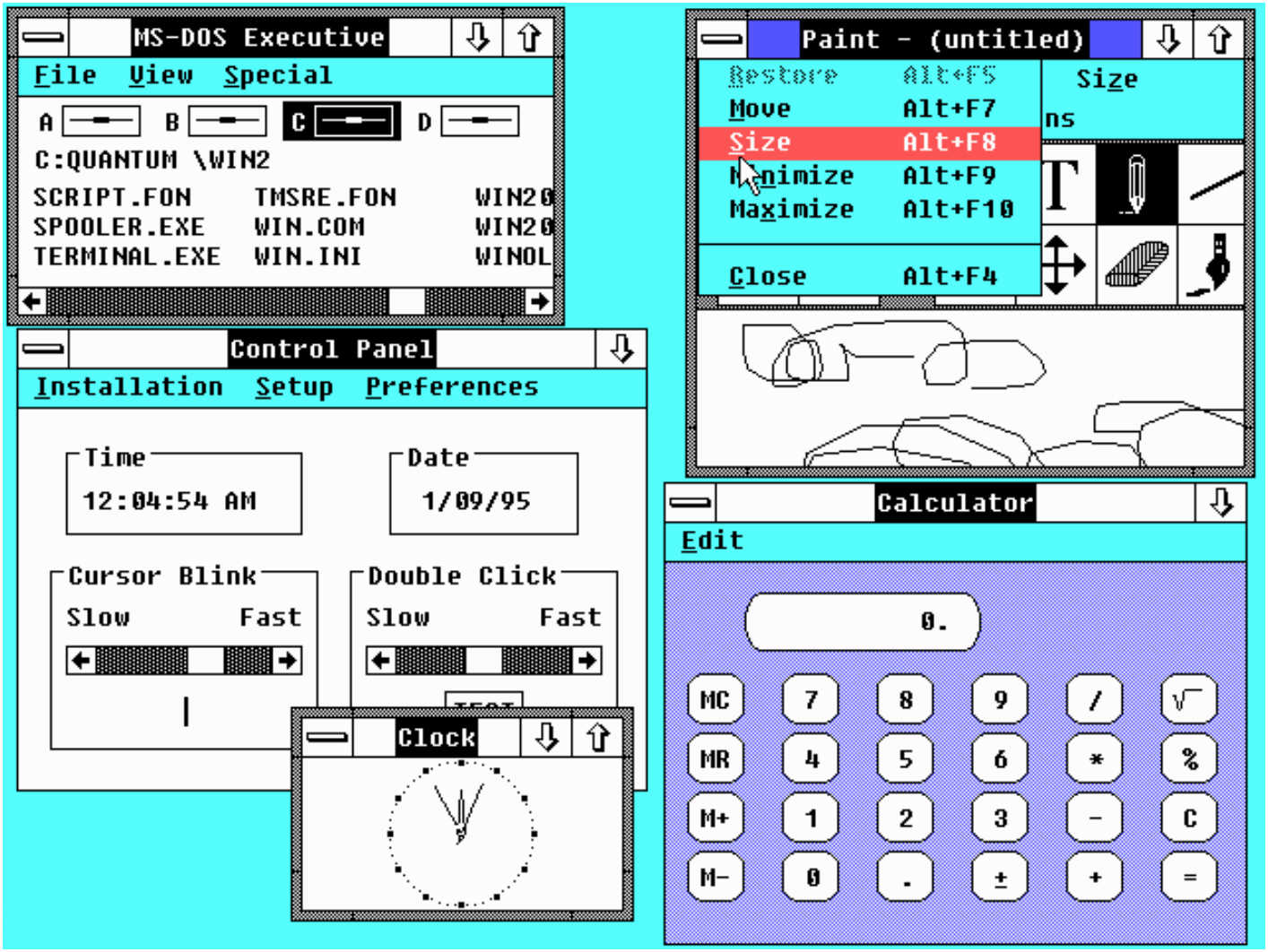
Windows 1.0 1985

Windows 2.0 1987

Windows 2.0 (1987)



Windows 2.0


MS-DOS Executive
File View Special
A B C D
C:QUANTUM \WIN2
SCRIPT.FON TMSRE.FON WIN20
SPOOLER.EXE WIN.COM WIN20
TERMINAL.EXE WIN.INI WINOL
Paint - (untitled)
Restore Alt+F5
Move Alt+F7
Size Alt+F8
Minimize Alt+F9
Maximize Alt+F10
Close Alt+F4
Size
Control Panel
Installation Setup Preferences
Time
12:04:54 AM
Date
1/09/95
Cursor Blink
Slow Fast
Double Click
Slow Fast
Clock
Calculator
Edit
0.
MC 7 8 9 / √
MR 4 5 6 * %
M+ 1 2 3 - C
M- 0 . ± + =

Xerox to Apple and Microsoft

XEROX Alto 1973

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XEROX STAR 1981

Apple Lisa 1981

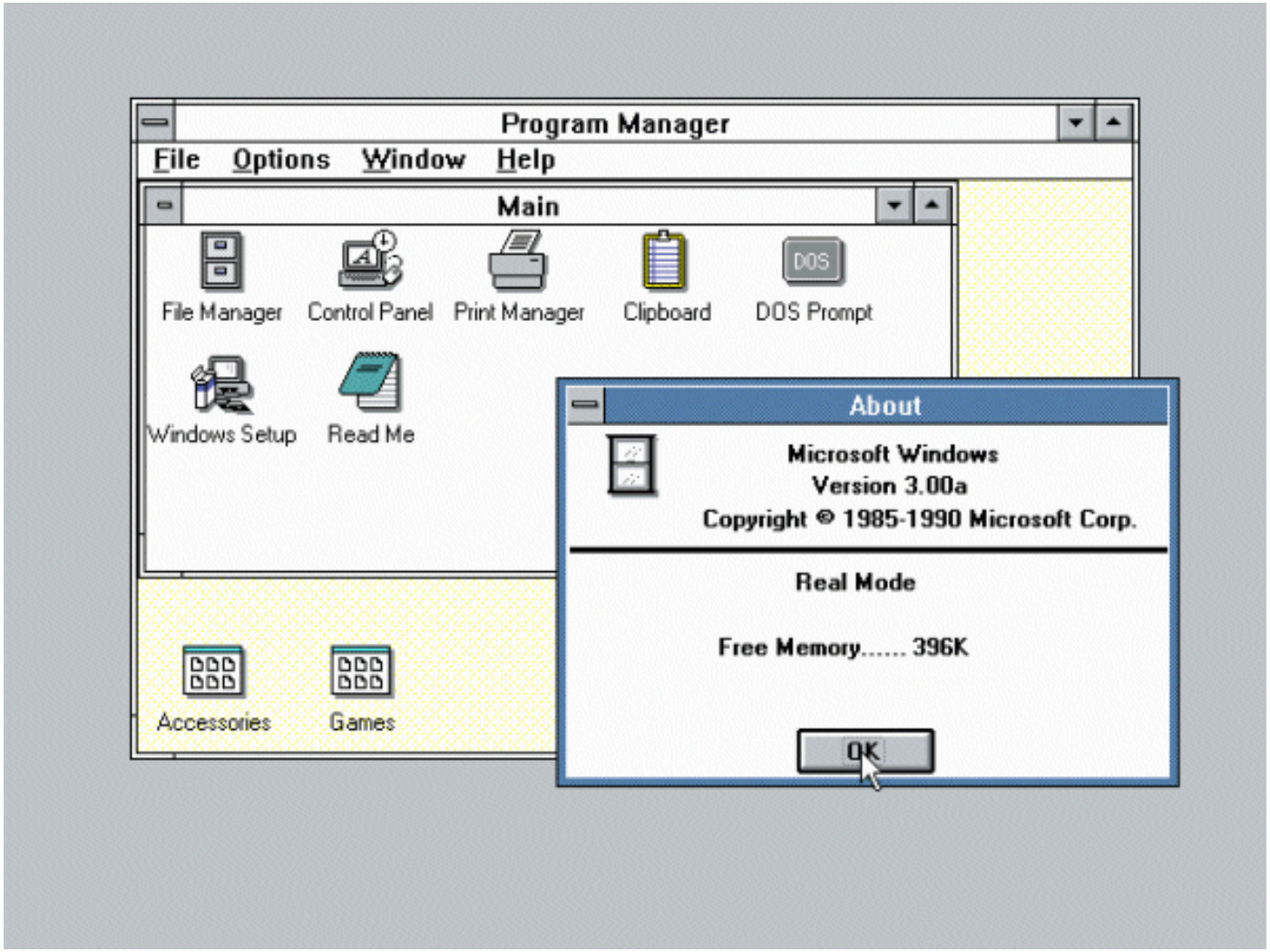
Apple Macintosh 1984

Windows 1.0 1985

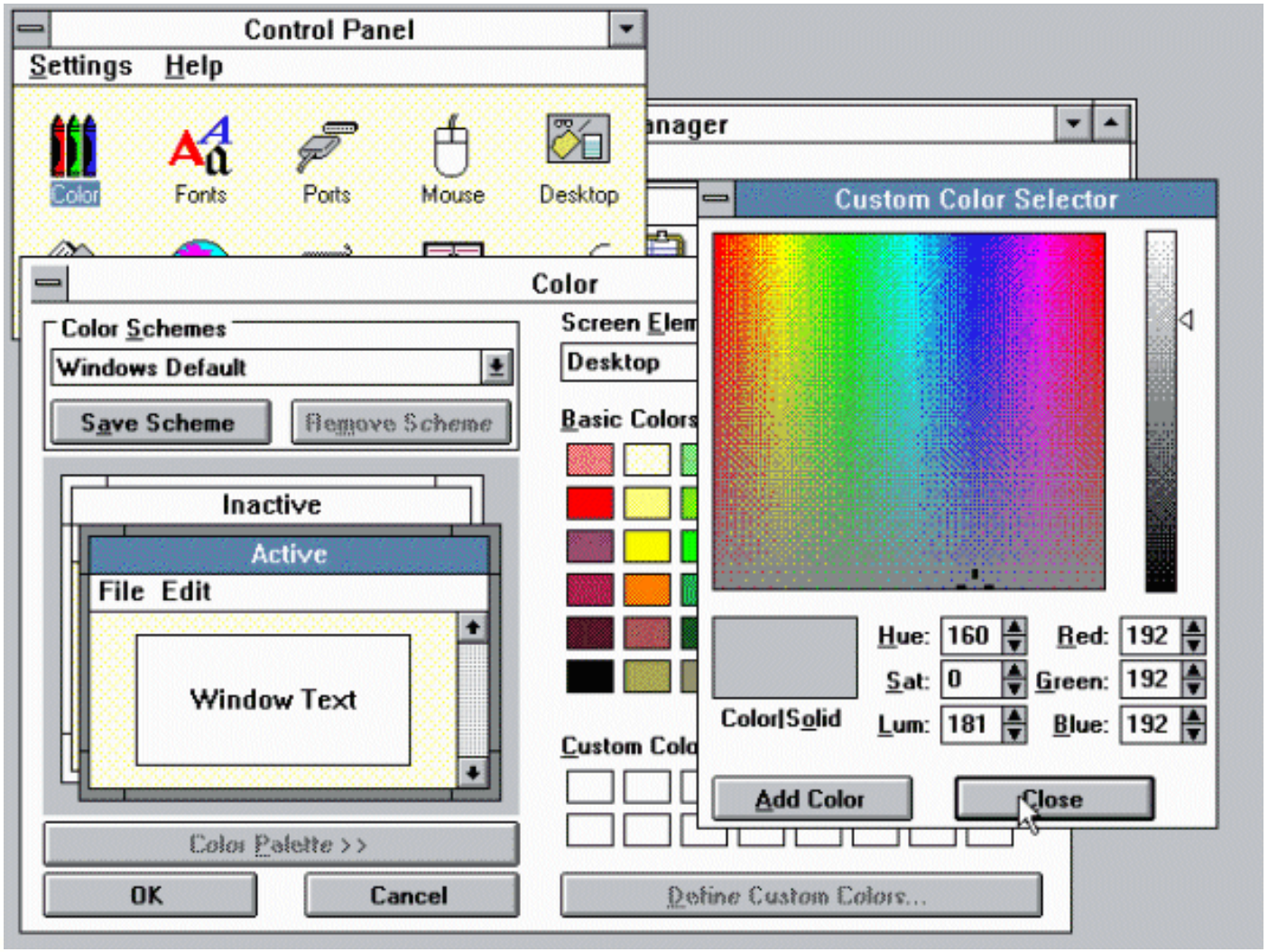
Windows 2.0 1987

Windows 3.0 1990

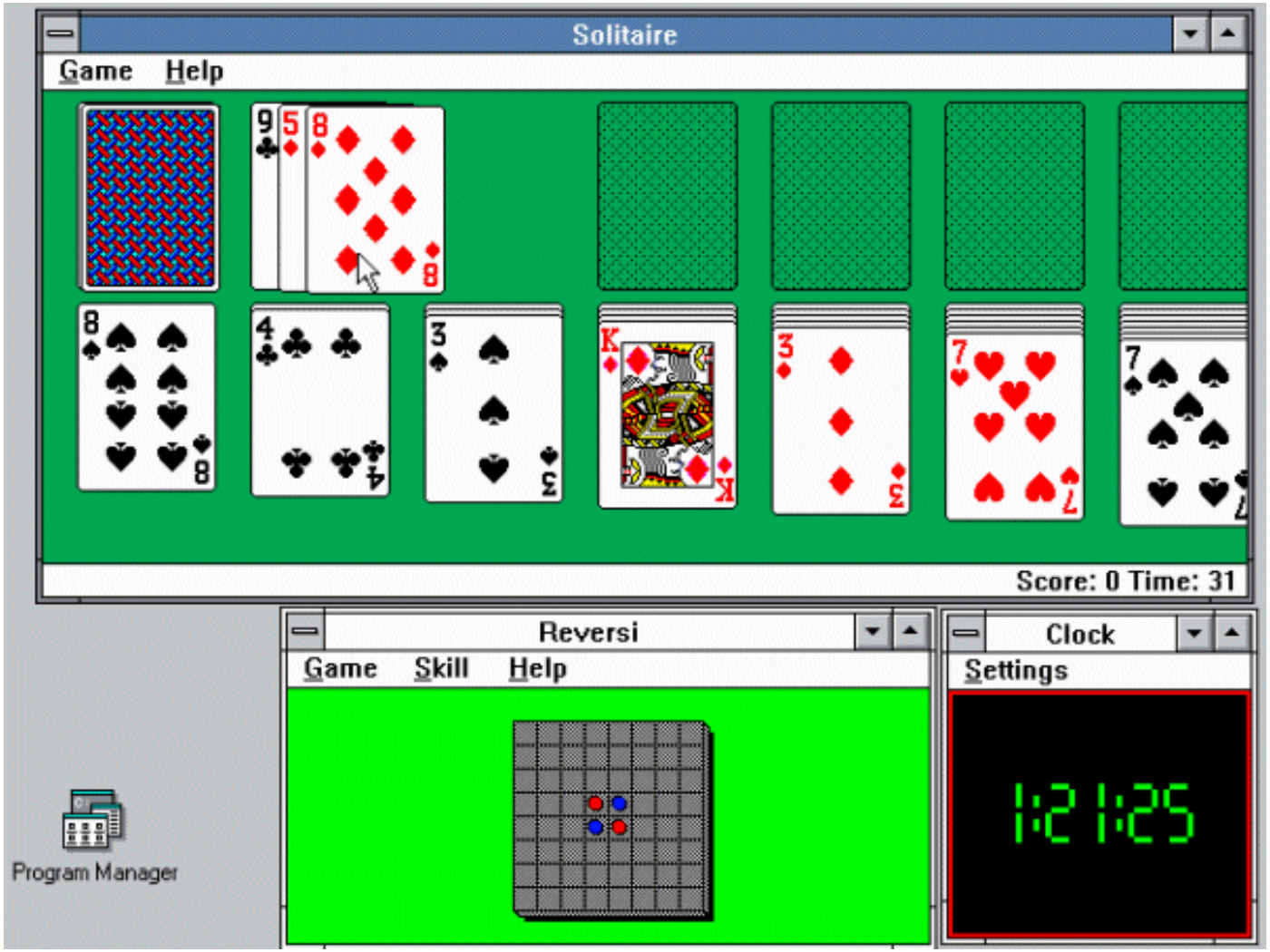
Windows 3.0


Program Manager
File Options Window Help
Main
File Manager
Control Panel
Print Manager
Clipboard
DOS Prompt
Windows Setup
Read Me
Accessories
Games
About
Microsoft Windows
Version 3.00a
Copyright © 1985-1990 Microsoft Corp.
Real Mode
Free Memory..... 396K
OK

Windows 3.0


Control Panel
Settings Help
Color
Fonts
Ports
Mouse
Desktop
Custom Color Selector
Color
Color Schemes
Windows Default
Save Scheme
Remove Scheme
Screen Elem
Desktop
Basic Colors
Inactive
Active
File Edit
Window Text
Hue: 160
Sat: 0
Lum: 181
Red: 192
Green: 192
Blue: 192
Color|Solid
Add Color
Close
Color Palette >>
OK
Cancel
Define Custom Colors...

Windows 3.0


Solitaire
Game Help
Score: 0 Time: 31
Reversi
Game Skill Help
Clock
Settings
Program Manager

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 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

HCI History

James Fogarty

March 5, 2015