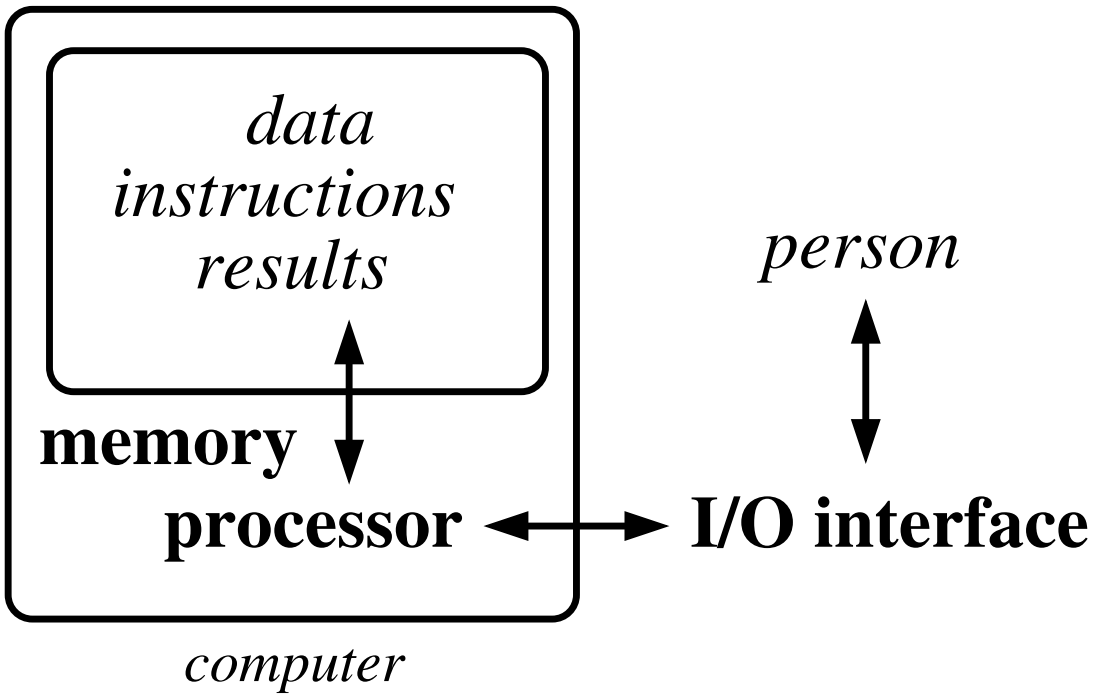
Computer Science 1400: Part #4

Getting Here:
The Personal Computer Revolution (1970–1990)

THE DAWN OF PERSONAL COMPUTERS

THE COMPUTER USABILITY REVOLUTION

What *is* a Computer? (Take III)



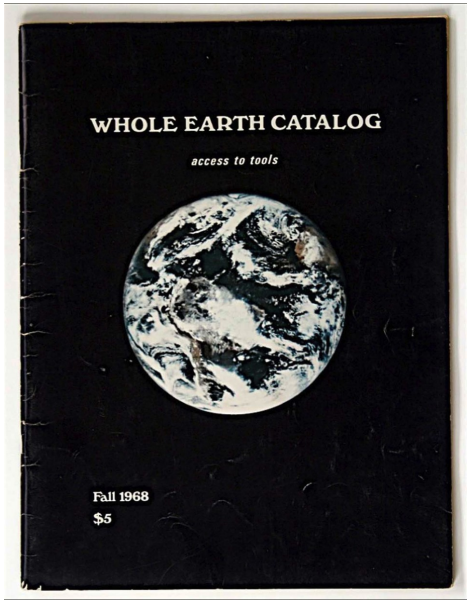
Computing in 1970: The State of the Art

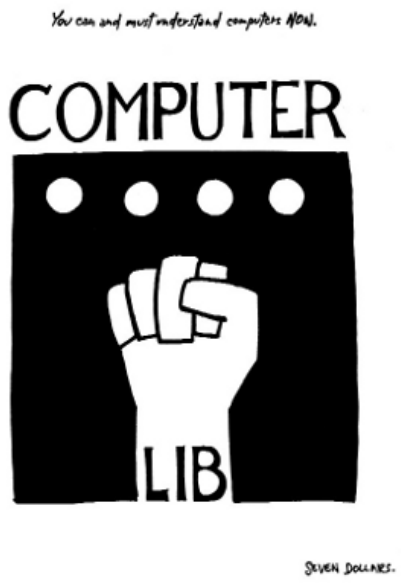
- Mainframe computers (government / business / scientific)
- Minicomputers (business / scientific)
- Consolidation of the computer industry (IBM and BUNCH)
- Most computers operate in isolation from their human users and other computers

Computing for the People (Take II)

- **Time-sharing** = switching computer between group of users such that each user thinks it owns computer.
- IPTO funds prototype time-sharing system, Project MAC, at MIT in 1963; supports up to 30 users over 160 terminals.
- Various large-scale academic (Multics) and commercial (Telcomp, Keydata, Tymshare: “computer utility”) systems underway by 1967; almost all such efforts collapse by 1970 due to software development problems.
- Small time-sharing systems survive at universities; many such systems based on versions of UNIX created at Bell Labs in 1970 in the wake of the Multics fiasco.

The Computing Counterculture





- Computers as alternative technology for promoting liberty, knowledge, and happiness (“New Communalists”).
- Key documents were *Whole Earth Catalog* (Stewart Brand) and *Computer Lib* (Ted Nelson); latter proposed **hypertext**.
- Communalists and hobbyists envision computing as low-cost computer utilities and minicomputers, respectively.

The Computing Counterculture (Cont'd)

Community Memory Public Terminal
(San Francisco, 1973–1975)
[FINDing: free / ADDing: 25 cents]

CM Terminal
(CRT version)

Making Computers Personal: Hardware

BusiCom Calculator (1971)

- Intel co-founded by Noyce and Moore in 1968; made chip-sets for implementing personal calculators.

Making Computers Personal: Hardware (Cont'd)

Instead of being a little mainframe, the PC is, in fact, more like an incredibly big chip. – Robert X. Cringely

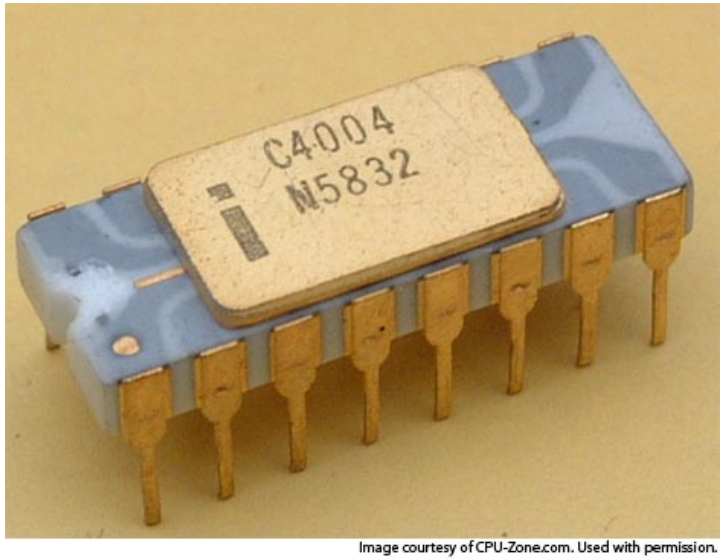
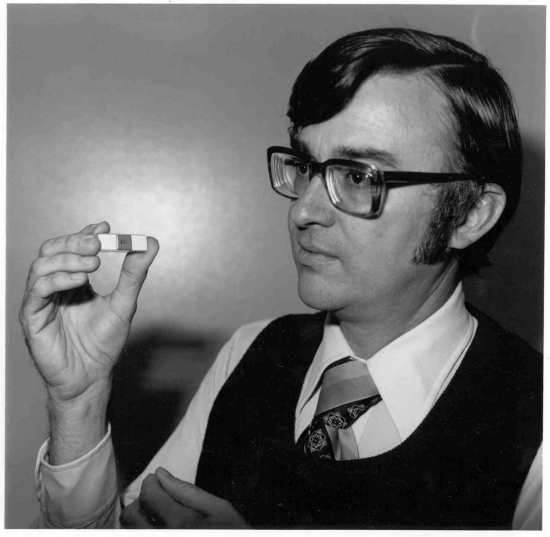


Image courtesy of CPU-Zone.com. Used with permission.



- The microprocessor was invented by Ted Hoff in 1971.
- Manufactured massively and marketed cheaply as per Noyce policy; widely available after calculator collapse.

Making Computers Personal: Hardware (Cont'd)

Ed Roberts
(1941-2010)

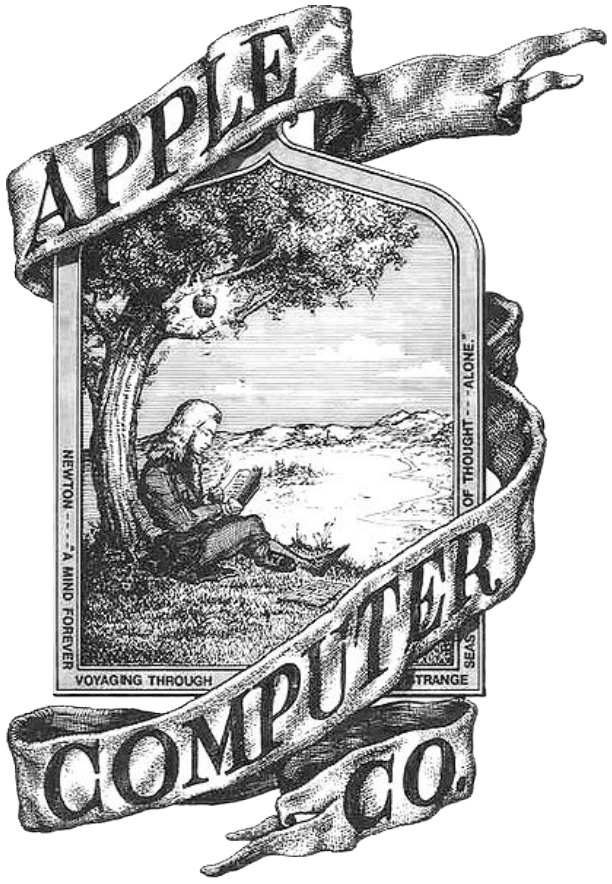
Altair 8800 (1975) [$399]

- Computer kit produced by Micro Instrumentation Telemetry Systems (MITS); I/O hardware and software provided by other companies, *e.g.*, Micro-soft BASIC.
- Dozens of companies in microcomputer market by 1976.

Making Computers Personal: Hardware (Cont'd)

Steve Wozniak (1950–) and Steve Jobs (1955-2011)

Making Computers Personal: Hardware (Cont'd)



First Apple Logo (1976)

- In high school, Wozniak and Jobs build and market "blue boxes" for making free long-distance phone calls; Wozniak designs computer that self-destructs at demo.
- In early 1975, when Wozniak at HP and Jobs at Atari, Wozniak designs and builds microprocessor-based Apple I; demos to acclaim at Homebrew Computer Club.
- Manufacture of 200 Apple I's in Job's parent's garage financed by sale of Jobs VW Microbus and Wozniak's calculator.

Making Computers Personal: Hardware (Cont'd)

Apple I (1975) [$666.66]

Making Computers Personal: Hardware (Cont'd)

- Wozniak designed Apple II in 1976; Jobs obtained venture capital for manufacture from Mike Markkula.
- Originally retailed for $1298 (basic: 4K memory) and $2638 (full: 48K memory).
- New versions created until 1988; most popular model was Apple IIe (1984).
- Apple II series remained major ($\sim$80%+) source of Apple revenue into 1990s.

Making Computers Personal: Hardware (Cont'd)

First Portable Personal Computer: Osborne I (1981) [$1795]

Making Computers Personal: Hardware (Cont'd)

IBM Personal Computer (PC) (1981) [$2880]

- Developed over 18 mths starting in 1980.
- In break with tradition, uses all off-the-shelf hardware components (except BIOS chip), all software contracted out, *and* sold by others (Sears, ComputerLand).

- Demand dramatically exceeds expectations, due in large part to insightful advertising and IBM reputation.
- Rapidly becomes standard industry personal computer.

Making Computers Personal: Hardware (Cont'd)

Compaq DeskPro (1985)

- Despite IBM copyright and publishing of BIOS code, BIOS chip legally reverse engineered, allowing creation of fully IBM PC compatible "clones" by other manufacturers.

- Driven by innovative sales strategies, *e.g.*, custom mail-order PCs (Dell), increasing sales of clones drove hardware component prices and clone prices lower, resulting in mid-late 1980's "clone wars".

Making Computers Personal: Software

Figure 7.2 VisiCalc Spreadsheet

VisiCalc (1979)

- PC software market not cost-effective for traditional firms; early companies focus on systems software, *e.g.*, CP/M.
- Most early PC software free, *cf.*, Bill Gate's 1975 open letter.
- By late 1970's, thousands of PC software companies.

- Early PC software successes cluster into three markets: games, business (spreadsheets (VisiCalc), word processing, and databases), and education.
- "Killer apps" crucial to sales of PCs and PC software.

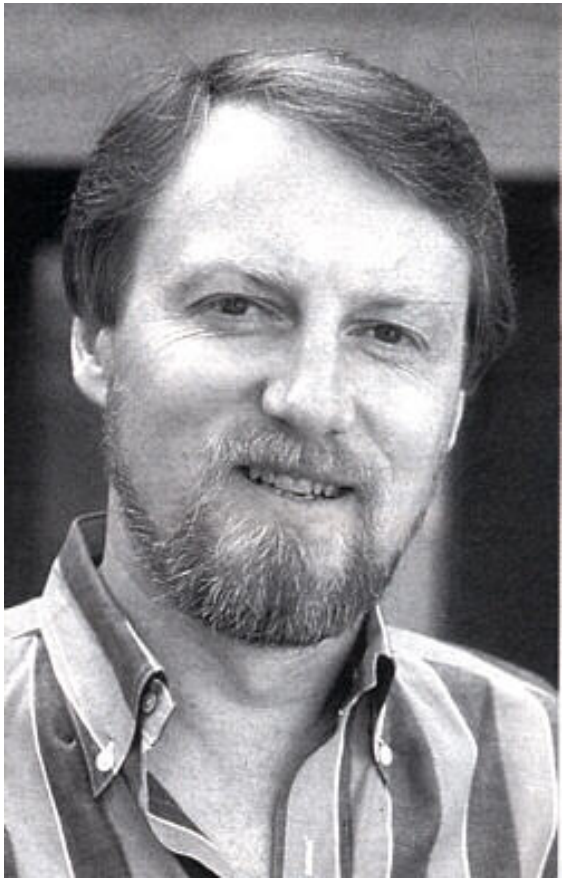
Making Computers Personal: Software (Cont'd)

Paul Allen (1953–2018) and Bill Gates (1955–)

Making Computers Personal: Software (Cont'd)

- In high school, Allen and Gates develop class scheduling and traffic simulation software for Traf-O-Data.
- In early 1975, develop BASIC for Altair 8800. Move to Albuquerque, NM, to develop other Altair software as Micro-soft.
- On sale of MITS in 1977, establish Microsoft in Seattle, WA; build on BASIC expertise to create compilers for other languages like FORTRAN and COBOL.

Making Computers Personal: Software (Cont'd)



Gary Kildall
(1942-1994)

- Kildall develops first PC OS, CP/M, in 1973-74 and BIOS in 1975; founds (Intergalactic) Digital Research.
- Though CP/M is first choice for IBM PC OS in 1980, Kildall and IBM fail to make deal.
- Microsoft ends up providing both compilers and MS-DOS OS for IBM PC; MS-DOS is actually re-written QDOS purchased for $50K cash from Seattle Computer Company, who based QDOS on CP/M.

Making Computers Personal: Software (Cont'd)

- By early 1980's, MS-DOS is standard OS for both IBM and IBM-compatible PCs; Microsoft is now a billion-dollar company based on $10-50 fee per copy (on compatibles!).
- Application-software market consolidating to a few large companies; many early companies that do not adopt polished business and advertising strategies perish.

Advertising the Personal Computer

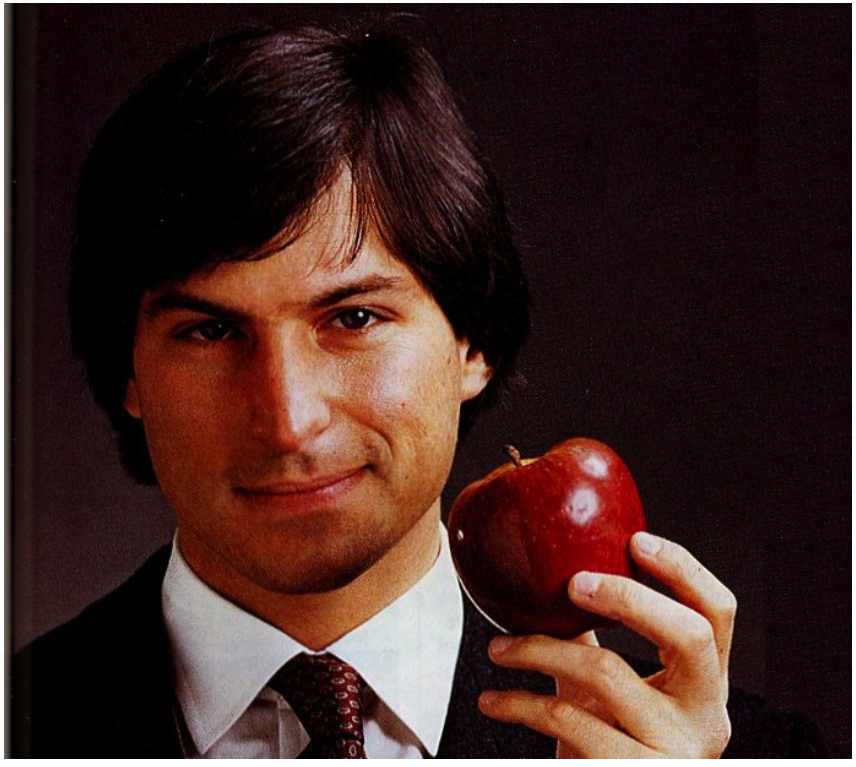
Altair 8800 (1975)

Apple I (1976)

IBM PC (1981)

- Early advertising targeted hobbyists; subsequently moved on to individuals and businesses. Latter arguably primary until truly easy-to-use computers available in late 1980s.

Advertising the Personal Computer (Cont'd)



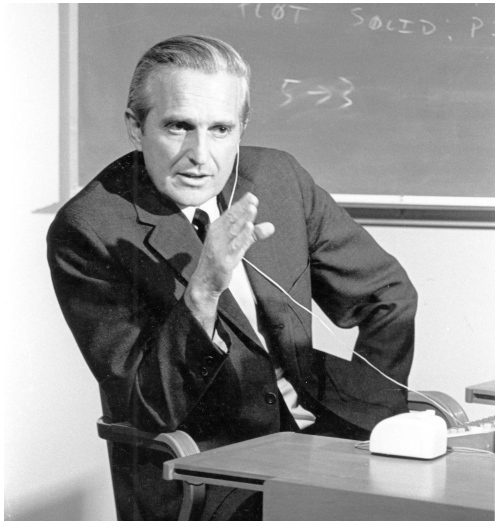
- For the first time, advertising computers involved the creation of publicly-recognizable corporate heroes, often by over-simplifying corporate history, *e.g.*, Wozniak and Allen.

Making the Personal Computer Usable

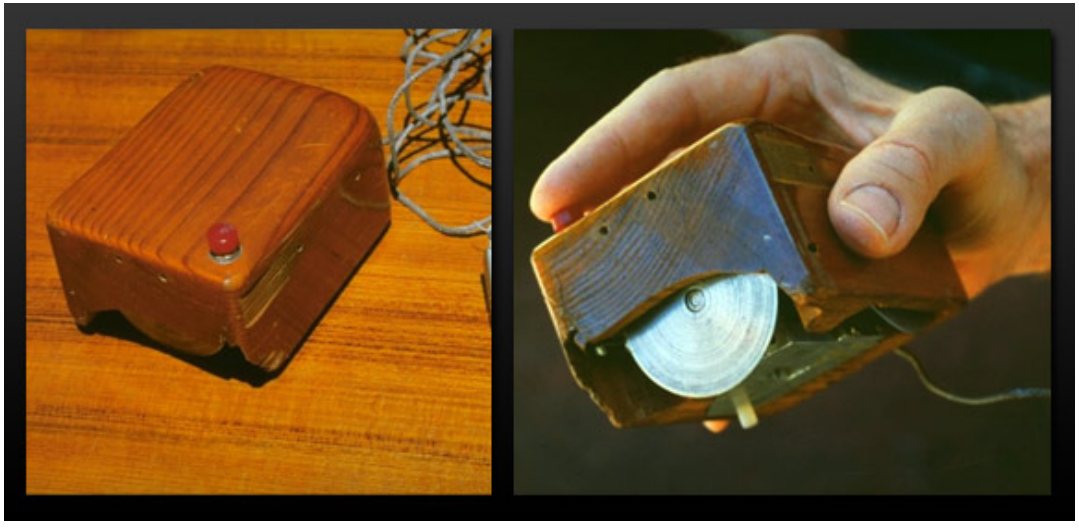
People weren't about to buy $2,000 computers to play a video game, balance a checkbook, or file gourmet recipes as some suggested. The average consumer simply couldn't do something useful with a computer. Neither could the home market appreciate important differences in computer products. Computers largely looked alike and were a mystery for the average person: they were too expensive and too intimidating. Once we saturated the market for enthusiasts, it wasn't possible for the industry to continue its incredible record for growth.

John Sculley (1939–) in his 1987 book

Making Personal Computers Usable (Cont'd)



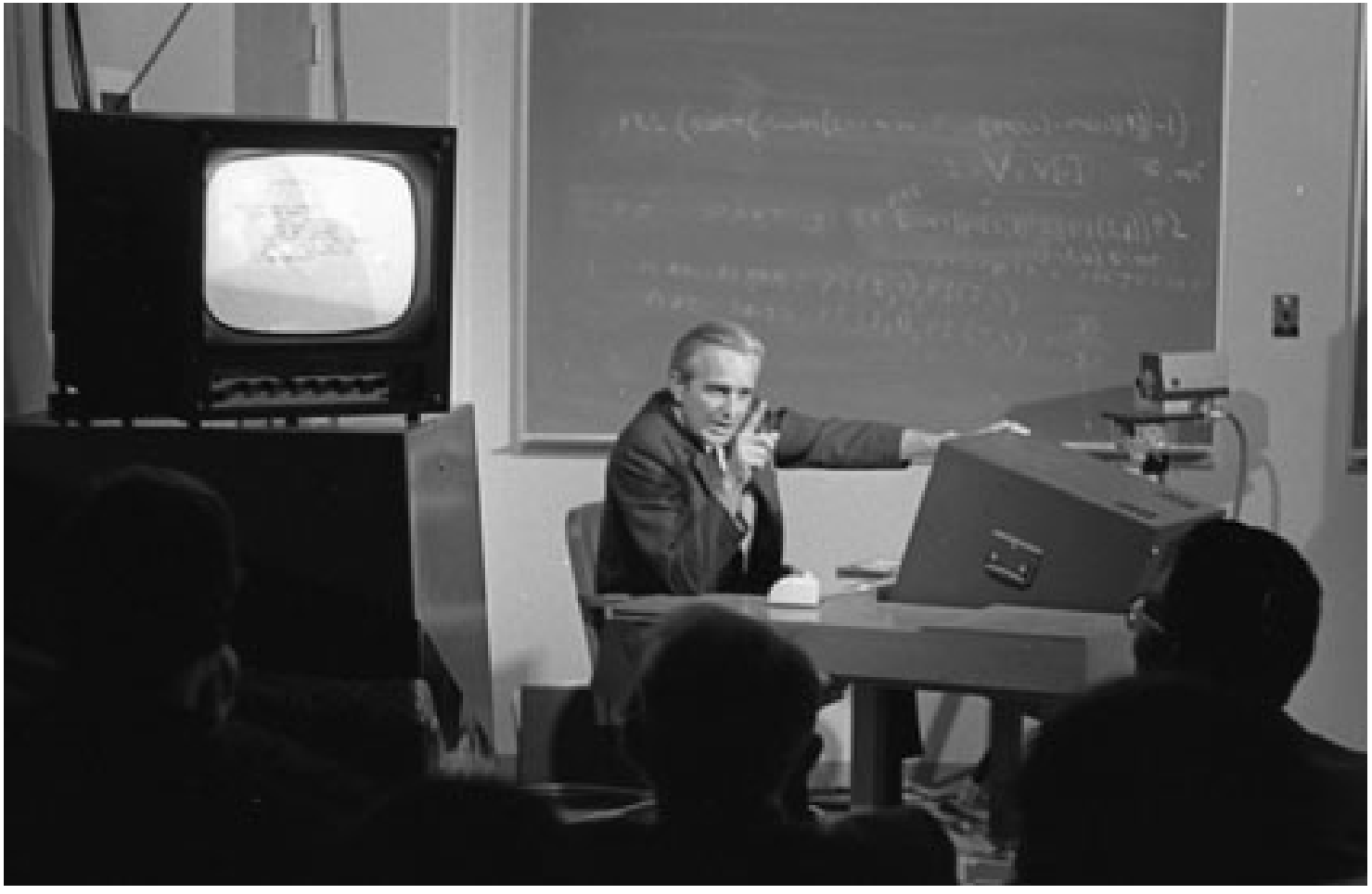
Doug Engelbart
(1925-2013)



Computer Mouse
(1965)

- Engelbart founds Augmentation Research Center (ARC) at Stanford in 1963; key computer usability technologies, *e.g.*, graphical user interface (GUI) and computer mouse, developed at ARC in mid-1960s

Making Personal Computers Usable (Cont'd)



"The Mother of All Demos" (1968)

Making Personal Computers Usable (Cont'd)

- Xerox creates Palo Alto Research Center (PARC) in 1969 with aim of establishing competitive advantage.
- Half of $100M budget in 1970s spent on hiring top computing personnel and developing advanced personal computing technologies ("office of the future").

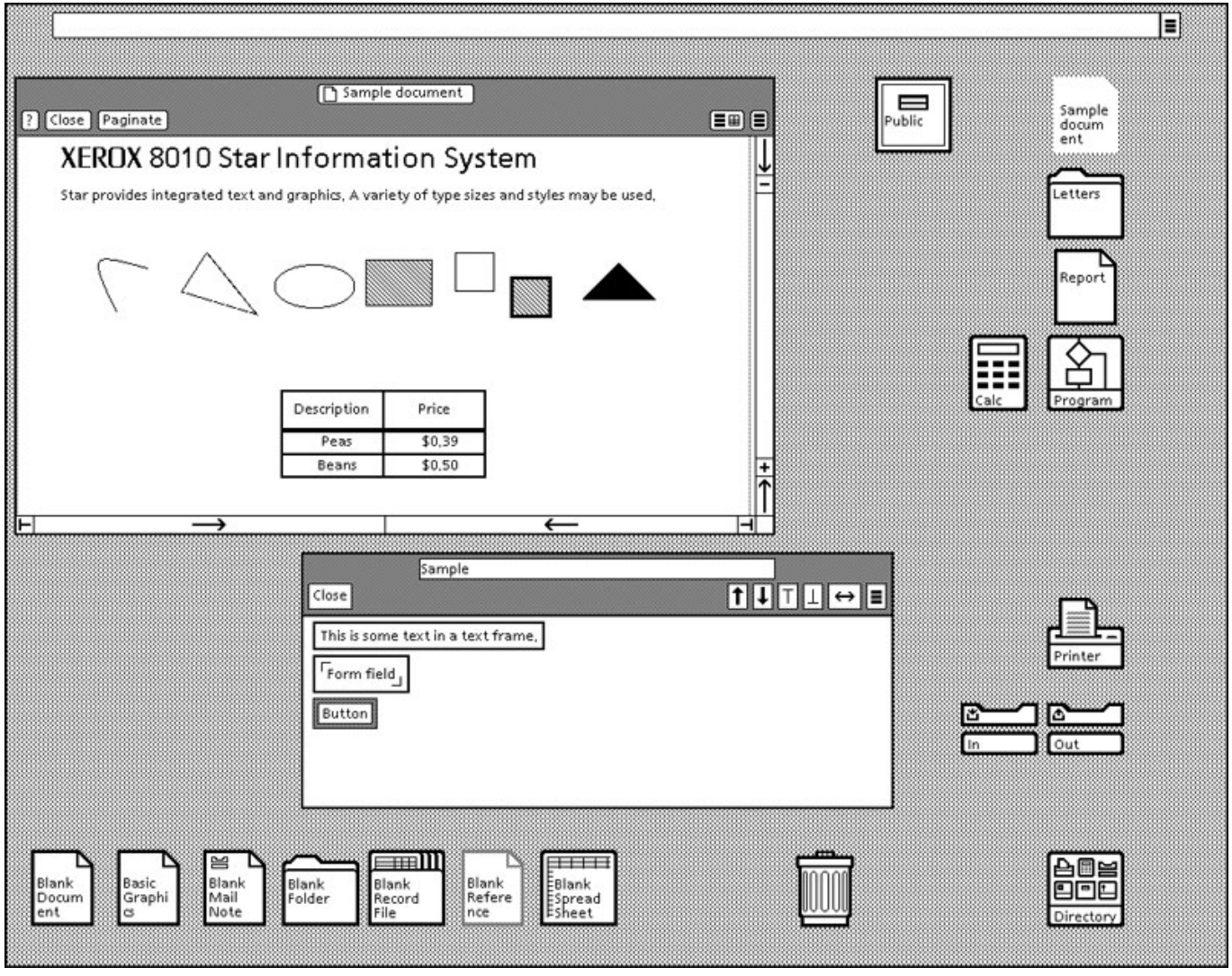
Making Personal Computers Usable (Cont'd)

Xerox Alto (1973) [$25K (est)]

Xerox Star (1981) [$75K]

- Alto was first modern GUI-driven PC; also incorporated local-area networking and laserjet printers (WYSIWYG).
- Star intended for use in large corporations.

Making Personal Computers Usable (Cont'd)



Making Personal Computers Usable (Cont'd)

Apple Lisa (1983) [$16,695]

- Following invitation by Xerox Head Office to view PARC innovations in 1979, Jobs starts Lisa project to re-create GUI-based functionality of Alto and Star.
- Development of special-purpose hardware boosts price of Lisa.

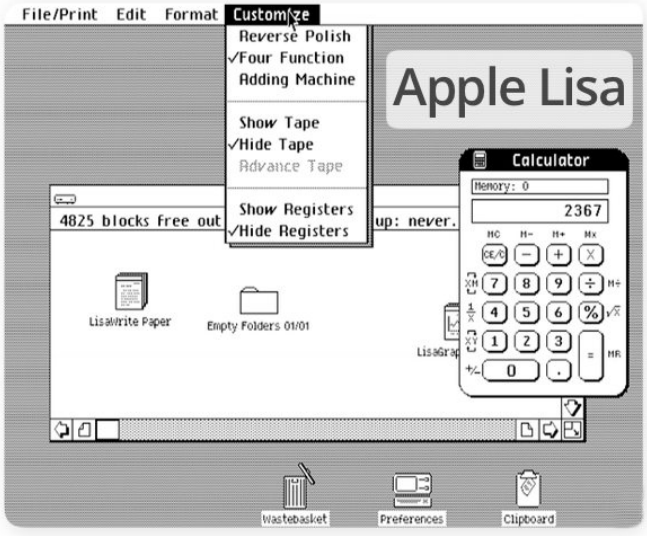
Making Personal Computers Usable (Cont'd)

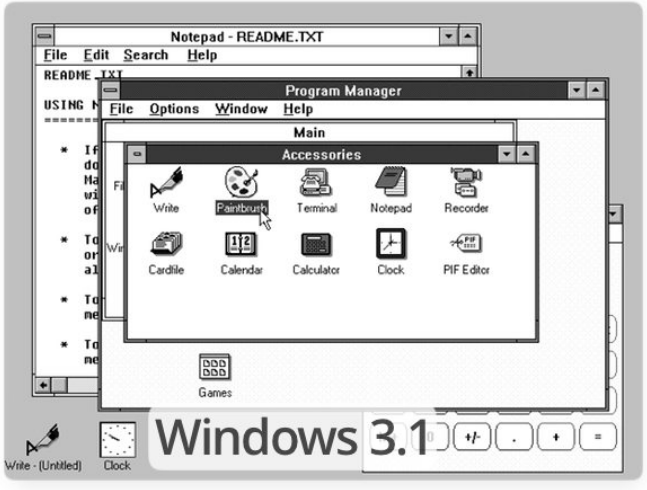
Apple Macintosh (1984) [$2,500]

- Macintosh development started in 1979 by Jeff Raskin (1943-2005); taken over by Jobs in 1981.
- Built on re-engineered Lisa technologies.
- Job's management style splits Apple tech division, leading to Job's removal from Apple in 1985.

- Part of Macintosh application and OS development sub-contracted to Microsoft starting in 1981; by 1987, half of Microsoft revenue derived from products for Macintosh.

Making Personal Computers Usable (Cont'd)





- Microsoft releases Windows v1.0 (built on top of MS-DOS) in 1985; legally emulated portions of Mac look.
- Microsoft releases Windows v2.0 in late 1987; is not only much faster but (now illegally) *identical* to Mac look.
- Apple sues Microsoft over Windows 2.0 "look and feel" in 1988; case dismissed in 1991.
- By late 1980s, Windows has 90% market-share in GUI-based PC computing.

Personal Computing: The Beginning Ends