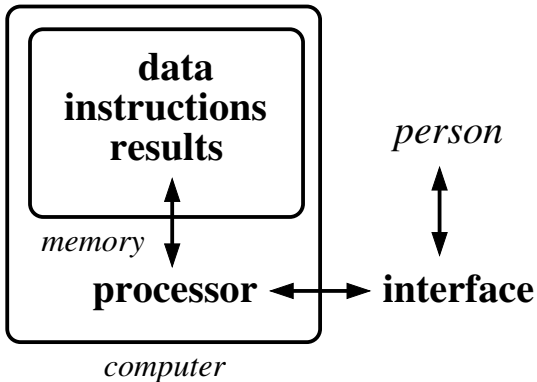


Computer Science 1400: Part #4

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

THE DAWN OF PERSONAL COMPUTERS
THE COMPUTER USABILITY REVOLUTION

What *is* a Computer? (Take III)



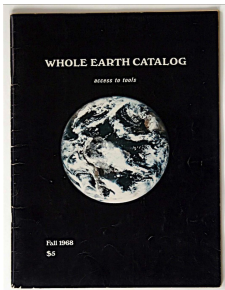
Computing in 1970: The State of the Art

- 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



DIVEN JOURNAL.

- 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.

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

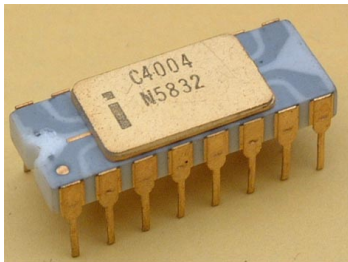
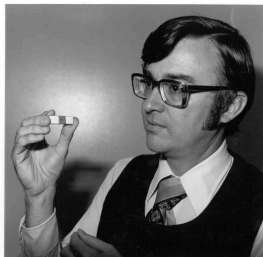


Image courtesy of CPU-Zone.com. Used with permission.



- 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 (~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

	A	B	C
	JANUARY	FEBRUARY	MARCH
SALES	300000	300000	312100
COST/SALE	180000	192700	190550
GR. PROFIT	111000	113200	115484
EXPENSES			
SALARIES	30000	30700	37454
RENT	300	300	300
UTIL	450	450	450
INSUR.	600	600	600
PHONE	1200	12240	12485
INTEREST	75600	77112	78654
SUPPLY/TR	13000	13300	13600
TRISC.	30000	30720	37434
TOTAL EXP	63650	65022	66327

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)



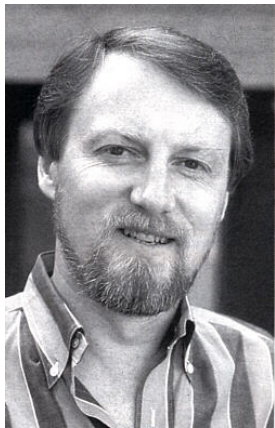
Paul Allen (1953–) and Bill Gates (1955–)

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 and BIOS chip in 1976; 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 \$30K 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 PCs and IBM-compatible PCs; Microsoft is now a billion-dollar company on the strength of \$10-50 fee per copy.
- 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

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

Advertising the Personal Computer (Cont'd)

HOW TO "READ" FM TUNER SPECIFICATIONS

Popular Electronics

WORLD'S LARGEST ALLIANCE REFERENCE MAGAZINE JANUARY 1975/75A

PROJECT BREAKTHROUGH!
World's First Minicomputer Kit to Rival Commercial Models...
"ALTAIR 8800" SAVE OVER \$1000



ALSO IN THIS ISSUE:

- An Under-\$90 Scientific Calculator Project
- CCD-TV Camera Tube Successor?
- Thyristor-Controlled Photoflashers

TEST REPORTS:

- Treble 200 Speaker System
- Pioneer RT-3021 Open-Reel Recorder
- Tram Diarrhoe-41
- Edmund Scientific Hewlett-Packard

Altair 8800
(1975)

A BALANCE OF FEATURES

The APPLE-I SYSTEM is a fully assembled, tested & burn-in microprocessor board using the 6502 microprocessor. The board contains processor & support hardware; complete video electronics for a 40-line screen; 16-line video display; on-board RAM capacity of 4K BYTES; software system monitor in PROM; and fully regulated power supplies. The Apple attaches directly to an ASCII encoded keyboard and a video monitor, allowing the efficient entry and examination of programs in hexadecimal notation. The use of the new 28-pin 4K RAM chips results in low power and high density memory, which can be upgraded to the 16K chips when they become available (2K bytes on-board RAM!).

A fast (1 kilobaud) cassette interface is available and includes a tape of Apple Basic. And - Yes, Folks, Apple Basic is Free!



APPLE-I \$666.66
 *includes 4K bytes RAM

Micro

- 6502 Microprocessor
- Interface** • Full video display electronics - 80 char line, 24 line.
- Complete cassette video.
- The ASCII keyboard interface on-board.
- Cassette interface board available.

Memory

- Fast 4K BYTES RAM.
- 4K BYTES RAM capacity on-board!
- Upgradable to 16K RAM chips.
- Software system monitor in PROM.

Power

- Apple Basic - parallel computer.
- PAST PREP.
- Fully regulated power supplies on-board.

DEALER INQUIRIES INVITED

APPLE COMPUTER COMPANY
 770 Welch Road, Suite 134
 Palo Alto, California 94304
 Phone: (415) 326-4248

ORACLE NO. 42 ON INQUIRY CARD

JULY 1976

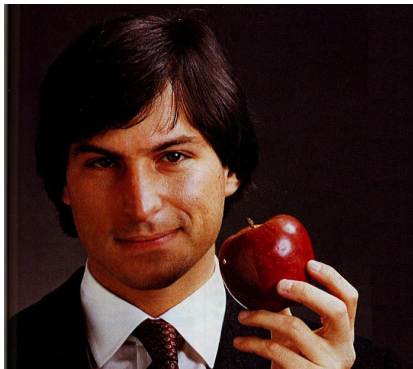
Apple I
(1976)



IBM PC
(1981)

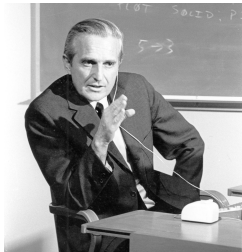
- Early advertising targeted hobbyists; subsequently moved on to individuals and businesses. Latter arguably primary until truly easy-to-use computers available in late 1980s.

Advertising the Personal Computer (Cont'd)

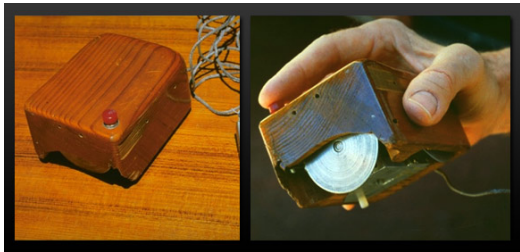


- For the first time, advertising computers involved the creation of publicly-recognizable corporate heroes, often by over-simplifying corporate history, *e.g.*, Wozniak and Allen.

Making Personal Computers Usable



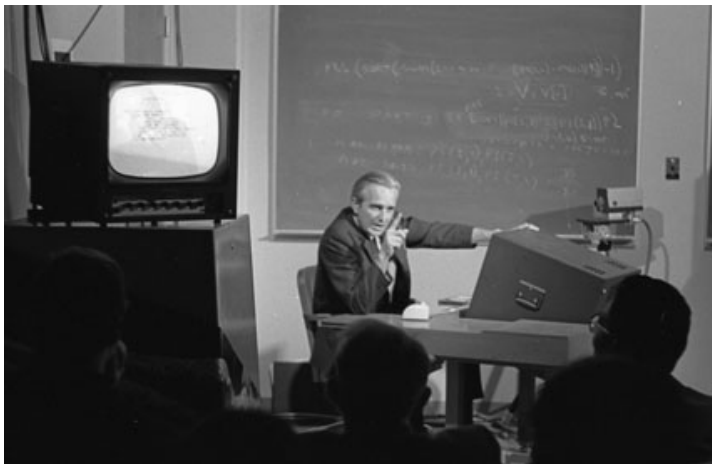
Doug Engelbart
(1925-2013)



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)



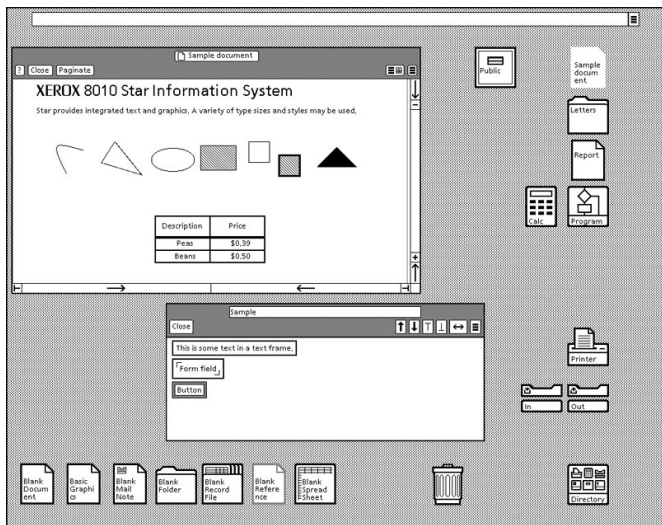
Xerox Alto (1973) [\$25K (est)]



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.

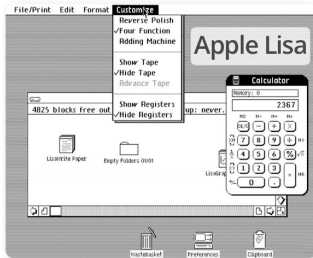
Making Personal Computers Usable (Cont'd)



Apple Macintosh (1984) [\$2,500]

- Macintosh development started in 1979 by Jeff Raskin (1943–); 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

