Nervous System: Alto: Engineering the Next Generation of Computer Users

BY DAVID KALAT

With the aggressive pace of technological change and the onslaught of news regarding data breaches, cyber-attacks, and technological threats to privacy and security, it is easy to assume these are fundamentally new threats. The pace of technological change is slower than it feels, and many seemingly new categories of threats have been with us longer than we remember.

Nervous System is a monthly series that approaches issues of data privacy and cyber security from the context of history—to look to the past for clues about how to interpret the present and prepare for the future.

Xerox engineered the Alto in 1972 more as a proof-of-concept than an actual consumer machine. It was a critical step toward the personal computers that revolutionized the industry at the end of the decade. The makers of the Alto thought of it as a time machine: an artifact from the future manufactured today, to model what the "computer of tomorrow" would be like. Of all the software and hardware advancements pioneered by the Alto, the most startling was its reimagining of the relationship between Man and Machine.

Today, the term "computer programmer" conjures up images of software engineers, writing the codes that power apps, games, and other software. Not that long ago, however, a "computer programmer" was the term for a computer *user*—because to use a computer, one had to be able to program it. Computers of the 1950s and 1960s were not just hulking behemoths; they were machines with arcane interfaces and clunky, user-unfriendly languages. The computer had the position of priority—the human user was expected to adapt to its needs.

To communicate with a computer, a programmer needed to be proficient in the specific language of that system. Each input was typed and had to be letter perfect. The entire system was off-putting, exclusionary, and limiting.

Changing from a text-based to graphical input interface was a revolutionary transformation that put the user first. Computer interfaces became organized around familiar visual metaphors of typical office environments. These visual metaphors became increasingly intuitive, to the point that they could be used by nonspecialists—even children.

The Xerox Alto pioneered this transformation. It emerged from a specific effort to make computers more welcoming to children. In 1971, Xerox engineers Alan Kay and Adele Goldberg and others in the Learning Research Group turned their attention to making computers accessible to children. The group had been inspired by seminal research done by Seymour Papert at MIT on how children interact with computers. In 1972, Kay published "A Personal Computer for Children of All Ages," setting forth his ideas for a device called the "Dynabook."

The Dynabook was intended to be inexpensive, interactive, handheld, and battery powered, with networked links to online archives of information. It was a vision of today's touchscreen tablets. In 1972, however, the technology to make such a thing remained fanciful. Nevertheless, Xerox's engineers set about trying. The result was the Alto—a small, compact, immensely revolutionary computer that was an essential precursor to the tablet devices Kay had imagined.

The Alto pioneered a visual user interface, where a user could interact with the system simply by moving graphical icons around on the screen. To facilitate this more intuitive type of interaction, the Alto sported an external input device, which the user could move about physically in the real world to trigger corresponding movements of the onscreen representation. They called this object a "mouse," because the wire connecting it to the computer looked like a tail.

The machine was also the first to have built-in Ethernet-based networking capabilities and an email client to take advantage of that. It had a removable data storage unit (with an astounding 2.5 MB capacity). It had a word processor with "What You See Is What You Get" (WYSIWYG) capabilities and "cut and paste" editing tools, meaning the printed document would look like what the user saw on the screen. It came with built-in graphic design and painting software. The screen was a black-and-white display with the same dimensions as a regular 8.5×11-inch sheet of paper, aligned vertically. Altogether, the system occupied a cabinet roughly the size and shape of a dorm refrigerator. There was nothing else like it in 1972.

For all the influence that the Alto had, it was never a best seller—it was never sold at all. Thousands of Altos were built—and then given away—but the machine was never available commercially. Due in part to the high cost of computer memory storage at the time, manufacturing costs for the Alto ranged between $12,000 and $18,000. Had the Alto been made available for sale, the price tag would have been $40,000 (more than a quarter million in today's money). Xerox concluded that price was a nonstarter and never tried to market it.

The Alto was not a commercial product; it was a research tool. It was the computer world's equivalent of a concept car.

Altos could be found in the White House, the halls of Congress, major research universities like Stanford and MIT, select businesses, and the sales offices of Xerox's copier division.

Then, on a fateful day in late 1979, Steve Jobs visited Xerox's Palo Alto Research Center (PARC). He saw the Alto in its glory, with its graphical interface and mouse. Simply knowing that these things were possible—and so useful!—was as valuable as knowing how they had been built. Jobs returned to his nascent company, Apple, and instructed his engineers to create similar technologies. The Apple Lisa, and later the Macintosh, brought these innovations to the masses in commercially available personal computers. They are now, of course, commonplace features of personal computing.

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