

A History of the GUI

By [Jeremy Reimer](#) | Chapter 3, 4 and 5

Xerox PARC

Douglas Englebart's demonstration in 1968 amazed many people and overwhelmed many more. It opened people's eyes to what could be possible in the future — a future where people all over the world collaborated on electronic documents displayed on computer screens and transmitted instantly over networks to other users. Such a future did not bode well for a company that had made its fortune selling photocopiers.

Xerox upper management, fearing the inevitable demise of their paper-based company in the "paperless" future, decided that they had better make sure they controlled this new technology. They formed the Palo Alto Research Center, or PARC, in 1970.



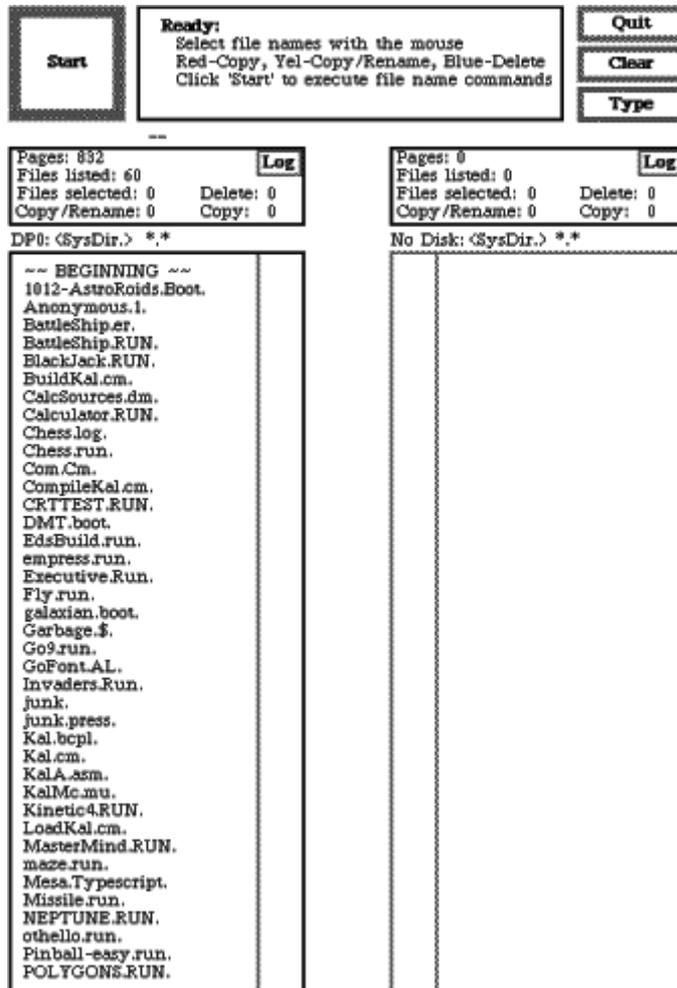
The Xerox Alto.

People came to PARC to work on five-year projects that were their dreams, and were given great freedom and latitude to do whatever interested them. This allowed the group to attract the top computer science researchers in the country. The atmosphere was relaxed, yet charged with excitement. PARC researchers truly believed they were inventing the future of computing, and they ended up doing just that.

One of the first things they invented was the laser printer, a natural complement to Xerox's copier business. But such a printer demanded a more graphical way for a computer to prepare documents to begin with. Since there were no such computers at the time, PARC invented their own. This was dubbed the Alto, and was first completed in 1973.

The Alto was not a microcomputer as such, although its working components did fit in a minibar-sized tower that fit under the desk. Its most striking feature was its display, which was the same size and orientation as a printed page, and featured full raster-based, bitmapped graphics at a resolution of 606 by 808. Each pixel could be turned on and off independently,

unlike typical terminals of the time which could only display fixed text characters, and unlike the vector-based NLS which could only display text and straight lines. It also had a keyboard and a modernized version of Englebart's mouse, again with three buttons. The mouse cursor itself became a bitmapped image, and for the first time took the familiar diagonal-pointing arrow shape we know today, as well as morphing into other shapes depending on the task being performed.



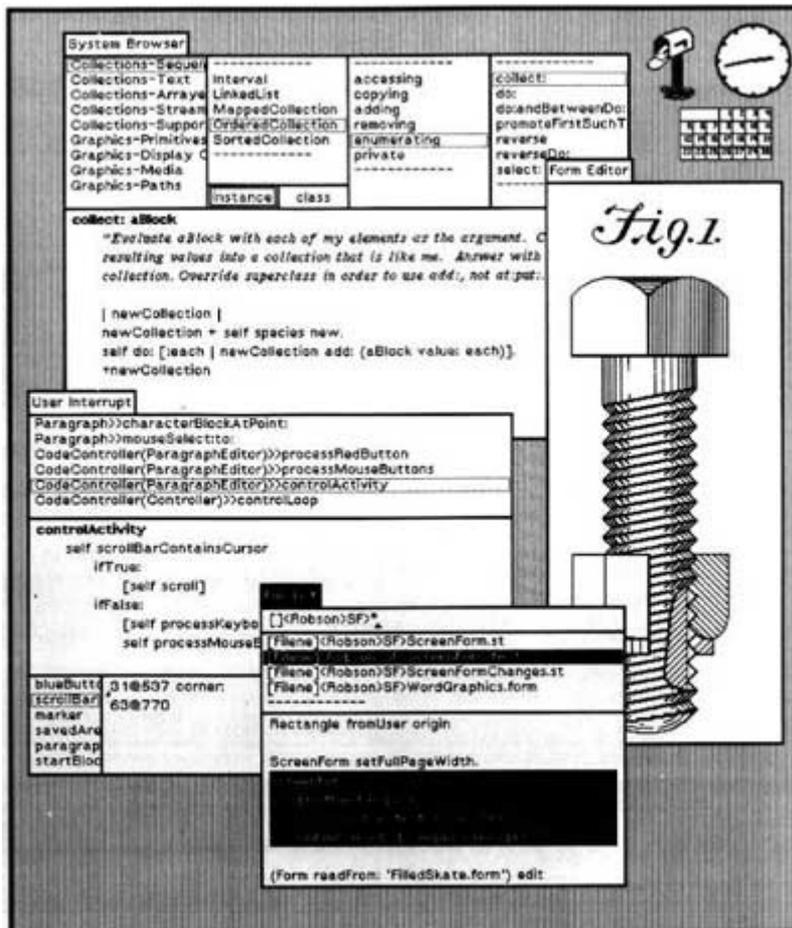
The Alto File Manager.

The first software written for the Alto was rather crude, and only slightly graphical. For example, the file manager displayed directory listings in two columns (like Norton Commander) surrounded by boxes, but there were no "windows" as we know them today. A graphical word processor, called Bravo, was developed that could display different fonts and text sizes on the screen at the same time, but it had a slightly different user interface with menus on the bottom rather than on the top. (The author of Bravo, Charles Simonyi, would eventually join Microsoft and recreate his work as the original Word for DOS.) There was a bitmapped graphics editor that worked a lot like Paint does today, but it too had its own, different user interface. The PARC researchers realized that what was needed was a consistent user interface for new applications, and to make that happen a whole new visual code development environment would have to be invented. This was Smalltalk, the first modern GUI.

Smalltalk

Smalltalk was conceived as a programming language and development environment so easy to use that a child could understand it, and in many respects was successful in this goal. Smalltalk was the world's first object-oriented programming language, where program code and data could be enclosed into single units called objects that could then be reused by other programs without having to know the details of the object's implementation. It also had modern, Java-like features like automatic memory management, to take some of the hard work away from the programmer. The development environment of Smalltalk was also the user interface that Smalltalk programs ran in, and introduced many modern GUI concepts. It first began to take shape around 1974, and was continuously updated and enhanced.

SmallTalk was a graphical development environment (like a modern visual IDE), but it was also the environment that it ran under. It was kind of like if Microsoft had developed Visual Studio as a single application that was itself Windows. You would launch Smalltalk from the file manager just like a regular application, but once it launched it took over the whole way the Alto's environment was presented.



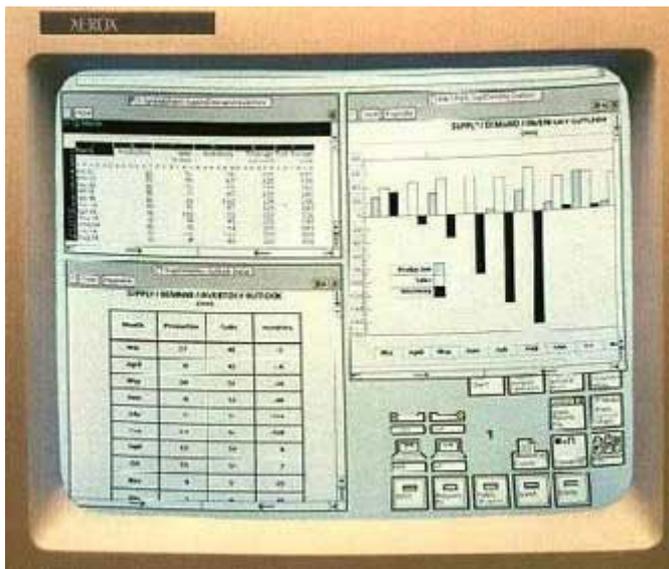
The SmallTalk development and GUI environment

Individual windows in Smalltalk were contained by a graphical border, and stood out against the grey pattern of the background below them. They each had a title bar on the top line of each window which could be used to identify the window and move it around the screen. Similar to BeOS, the title bar did not stretch the full length of the window, but started at the top left and only extended as far as the title itself. Windows could overlap other windows on

the screen, and a selected window would move itself to the top of the "stack." The concept of "icons" was also invented at this time — small iconic representations of programs or documents that could be clicked on to run them or manipulate them. Popup menus were also invented at the same time — the user would click one of the mouse buttons and hierarchical, graphical menus based on the task at hand would appear at the last position of the mouse cursor. Also appearing for the first time were scroll bars, radio buttons and dialog boxes.

The combination of Smalltalk and the Alto was essentially a modern personal computer with a very similar graphical user interface to the ones we use today. Altos had networking and could send e-mail to and receive it from one another, and seemed ideal for an office environment. Many of the PARC team wanted Xerox to market the new, cost-reduced Alto III as a commercial product (the original Alto was never available for sale) but Xerox management declined.

Eventually, a stripped-down version of the Alto, the Xerox Star 8010 Document Processor, was released to the public in 1981 for US\$17,000. The Star had some differences from the Alto, most significantly the ability to overlap windows was removed as it was thought too confusing for the general public. Instead, the Star used tiled windows. As significant as the Star's release was, it was too little and too late for Xerox, who had by that time lost most of its top researchers to other companies.

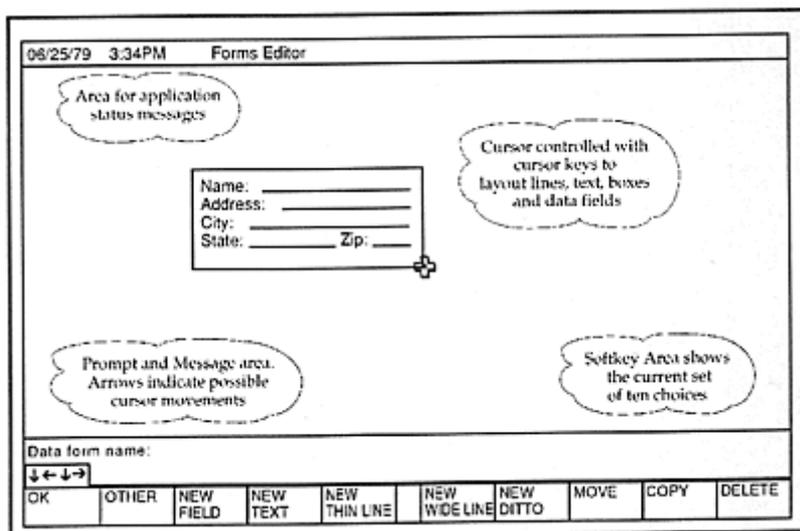


Screenshot from the Xerox Star. Note the tiled application windows.

Apple

The most important of these GUI pioneers was a small startup founded in a garage in 1976 by Steve Jobs and Steve Wozniak, called Apple Computer. Apple had built its fortune on the wildly popular Apple][, which displayed both text and graphics but had a traditional command line interface. Apple was a young company that found itself flush with money, and was more willing to take risks. Many former Xerox PARC engineers found new jobs with Apple, and set about to recreate their work on the Alto and Smalltalk but on a product that would actually see commercial release and potentially become very popular.

Work on Apple's next-generation Lisa computer, which had started life as a traditional text-based command line computer for business use, was transformed by the influx of PARC people. Steve Jobs himself became a convert to the GUI religion when his employees arranged a grand tour for him of the PARC facility. The Lisa would henceforth become a graphical computer, but the design of the interface was not yet set in stone.



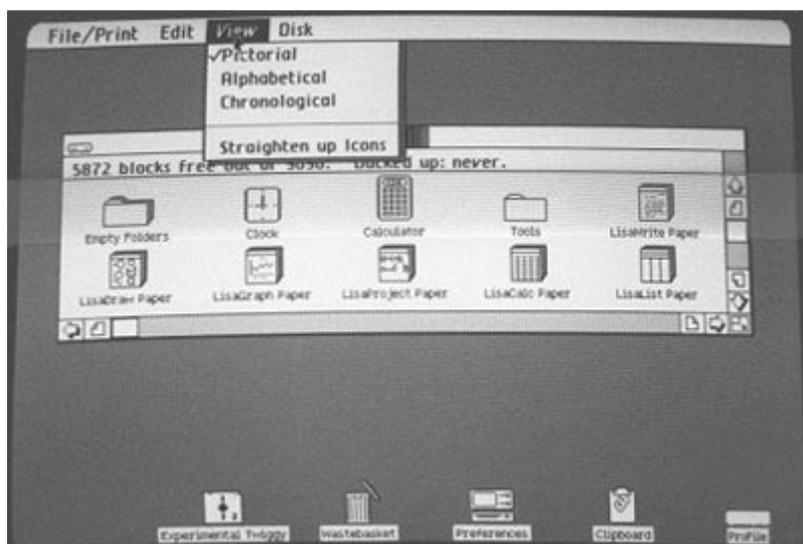
Early Lisa user interface mockup, circa 1979.

Many different prototypes for the Lisa interface were mocked up on the Apple][, including a task-based interface dubbed "Twenty Questions" because it seemed to take that long to get the computer to do anything, and a four-column file browser similar to one that appeared with Smalltalk and would reappear much later in NeXTstep and Mac OSX. The Lisa team eventually settled on an icon-based interface where each icon indicated a document or an application, and developed the first pull-down menu bar, where all menus appeared at the very top line of the screen.

Other innovations from the Lisa team included the idea of checkmarks appearing next to selected menu items, and the concept of keyboard shortcuts for the most frequently used menu commands. The Lisa also changed some PARC conventions, such as eschewing proportionally-sized scroll bars for fixed-height ones, and added new conventions, such as a trash can for dragging documents scheduled for deletion, and the idea of "graying out" menu options if they were not currently available. The three-button mouse, which had been changed to a two-button design in the Star for simplicity, was further simplified to have only one button for the Lisa. As the interface required at least two actions for each icon (selecting and running) the concept of double-clicking was invented to provide this functionality. Double-

clicking would later become a standardized way for all GUIs to launch a program, even those with multiple-button mice.

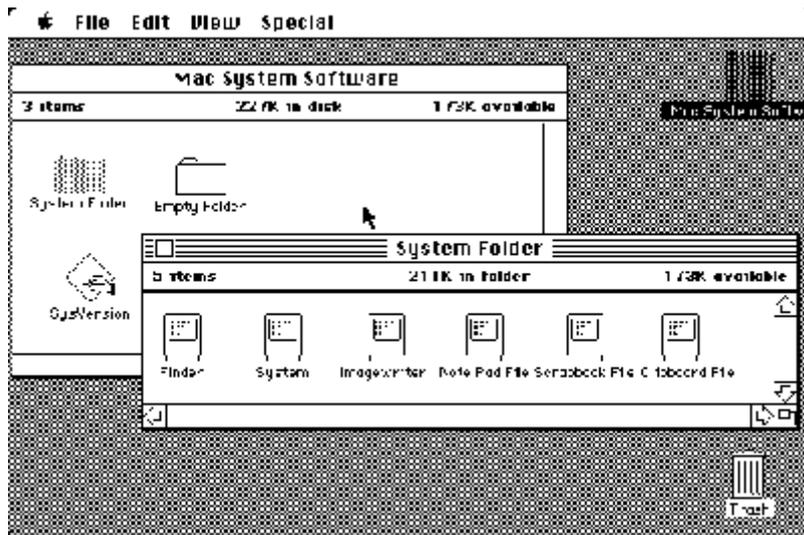
The Lisa user interface invented other GUI concepts that we still use today. While SmallTalk and the Xerox Star had icons that represented files, the Lisa interface was the first to have the idea that icons could represent *all* files in the filesystem, which could then be browsed through using a hierarchal directory structure where each directory opened in a new window. The idea of "drag-and-drop" was also invented at this time, and the concept of using drag and drop to do file manipulation (for example, selecting a group of files with the mouse and then dragging them to a new folder to copy them) naturally developed from this concept. Less visible but still important to the user interface was the idea of "resource forks," which embedded information about a file separately from the file itself, and the idea of "creator classes" meant that each file could be assigned an application that would launch when you double-clicked on that file.



Final Lisa user interface.

One critical advance from the Lisa team came from an Apple engineer who was not a former PARC employee, but had seen the demonstration of Smalltalk. He thought he had witnessed the Alto's ability to redraw portions of obscured windows when a topmost window was moved: this was called "regions". In fact, the Alto did not have this ability, but merely redrew the entire window when the user selected it. Despite the difficulty of this task, regions were implemented in the Lisa architecture and remain in GUIs to this day. (Try rapidly moving, say, an Explorer window over top of a Word document. If your eyes are very fast, you can still see which parts of the window are redrawn and which are not.)

Work on Lisa started in 1979 but the computer was not released until 1983. Despite its advanced features, the price tag of US\$10,000 and the difficulty of writing software for the new machine limited sales. A low-cost, stripped down version of the Lisa was needed, and this task fell to Steve Jobs himself. His Macintosh project achieved the goal of a lower-cost graphical computer by shipping with a small 9-inch monochrome screen (512 by 384 pixels), a mere 128 kilobytes of memory, no multitasking or even the ability to task switch between more than one program, and a single floppy drive. This was introduced to the world in dramatic fashion in 1984, selling for US\$2,495. It retained most of the GUI features of the Lisa, and even shared some of its low-level code, but the operating software itself was written from scratch to fit in the small memory footprint.

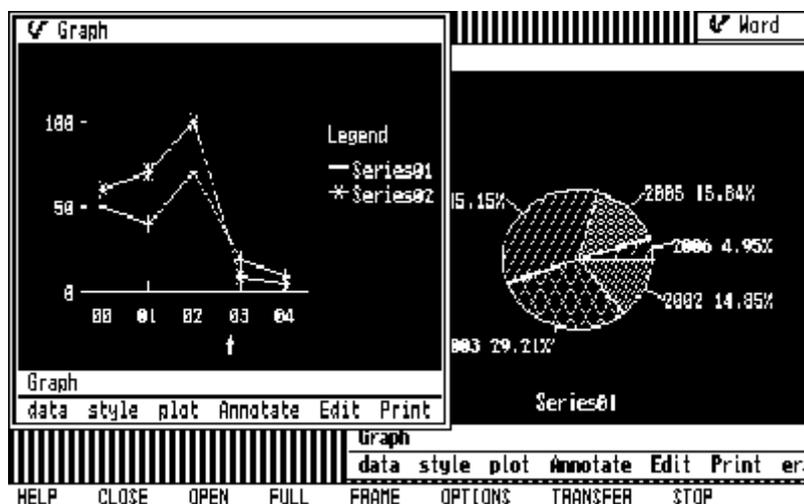


Macintosh System 1

Other GUIs during the 1980s

VisiOn

By this time more than one company besides Apple was working on graphical user interfaces for personal computers. VisiCorp, makers of the first ever spreadsheet VisiCalc, was working on a graphical interface for IBM PCs. It was released as VisiOn in 1983, but the extremely high price (US\$1,495 for the software alone) and steep hardware requirements for the time (PC-XT with hard disk, 512KB of memory, and a mouse) kept it from being a big seller. In addition, it was fairly clunky, using the monochrome CGA graphics mode (640 by 200 pixels) and being much more text-based than other GUIs. For example, it did not use icons at all, requiring the user to click on text labels to start programs or work with documents. It did not use proportionally-spaced fonts, the way the Alto, Star, Lisa and Macintosh had; instead, all characters were of fixed width. It even abandoned the diagonally-pointing mouse cursor arrow, reverting to 1968 with a vertical one!

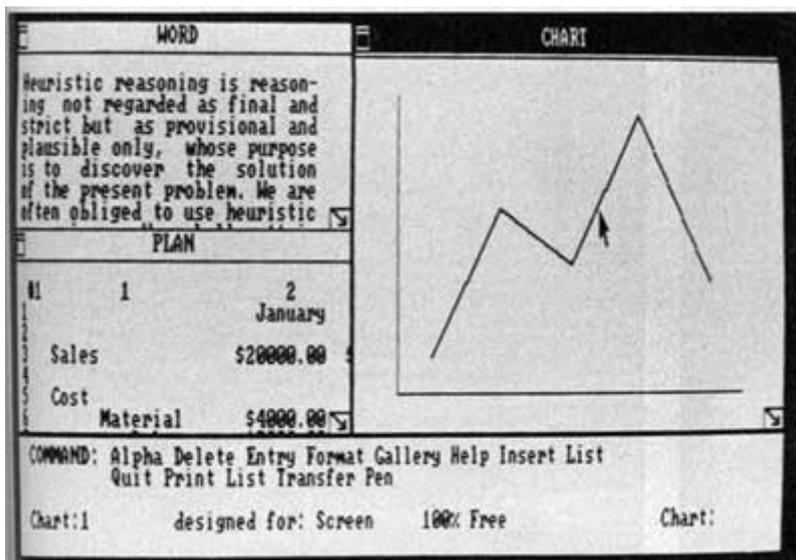


VisiOn user interface

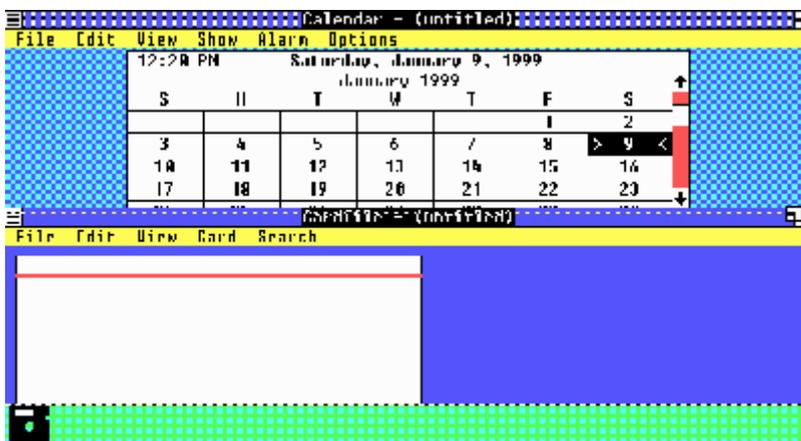
Windows 1.0

Overall, VisiOn was clunky and a failure, but its mere announcement inspired Bill Gates to come up with a competing product, initially titled Interface Manager, but later renamed to the somewhat more familiar Windows. Announced in 1983, early screenshots looked like a cross between VisiOn and the Microsoft Word for DOS interface (which itself descended from Bravo, the first GUI word processor on the Alto), but by the time it was released in 1985 it was in color and had all the usual GUI trappings, such as scrollbars, window control widgets, and menus, although instead of a single menu bar as on the Lisa and Macintosh, each application had its own menu bar attached to it, just below the title bar.

Another departure was the use of tiled, rather than overlapping windows. This decision was made by the same people from Xerox PARC who had decided on tiled windows for the Star to avoid confusing users, but Bill Gates didn't like it very much and all future versions of Windows would use the overlapping model. Microsoft was one of the earliest 3rd-party developers for the Macintosh, and actually got to use beta models of the first Mac before it was released to the world. Undoubtedly this influenced the direction of future releases of Windows.



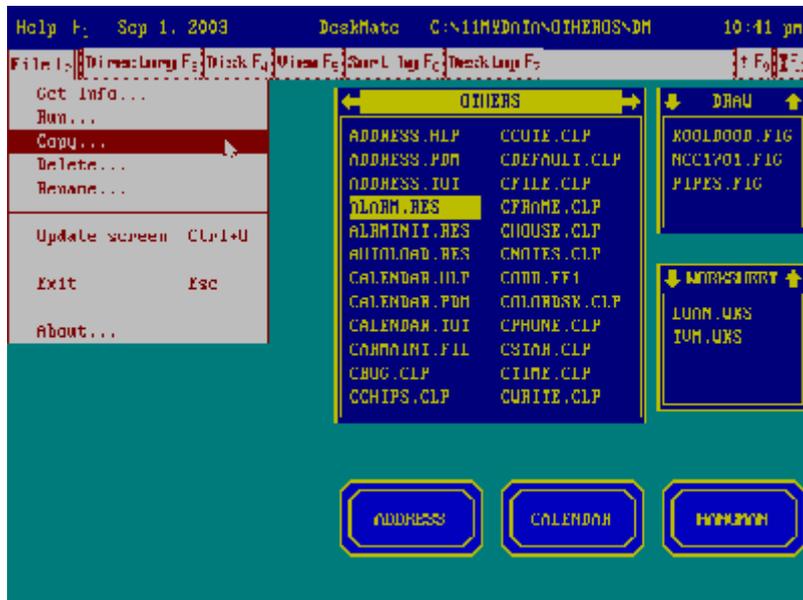
Windows prototype, circa 1983. Note the similarity to Word for DOS.



Windows 1.01. The boundary between the two tiled windows is being resized.

Tandy DeskMate

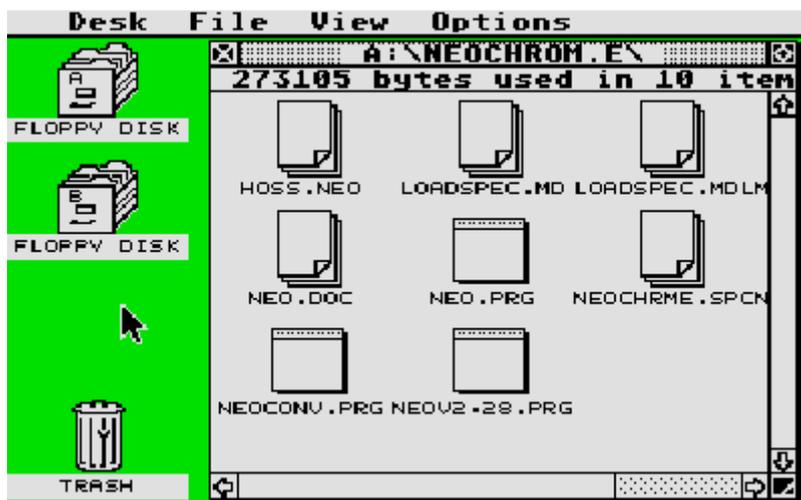
Tandy Computers released the first version of their own GUI in 1984. Called DeskMate, it was designed to be used primarily with the keyboard, using function keys as shortcuts for menus, and did not have overlapping windows. It was quite difficult to use and did not achieve much success beyond being bundled with Tandy PCs for a few years.



Tandy DeskMate.

GEM

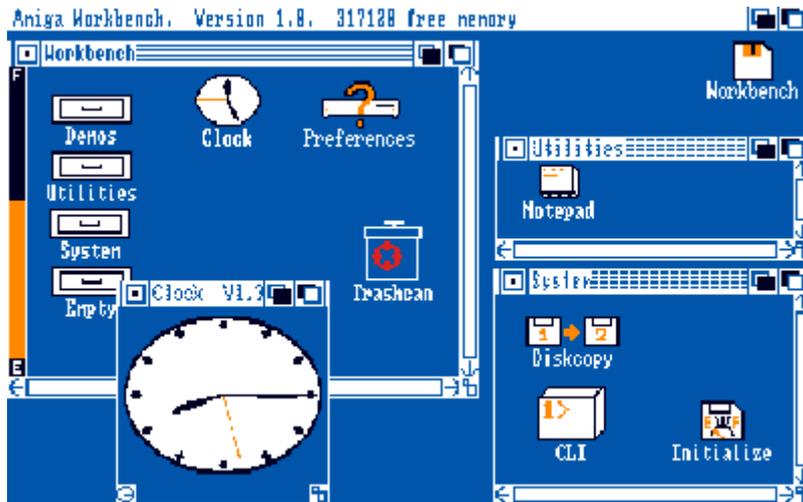
Later in 1985 Digital Research introduced GEM, a windowing GUI for DOS, and also for Atari's new ST computer that was released in the same year. GEM was quite similar to the Lisa/Macintosh GUI, so similar in fact that Apple would sue Digital Research, with the result that they ultimately castrated the PC version. Strangely, the Atari version was allowed to continue untouched. It also used a single menu bar at the top of the screen.



GEM 1.0 running on the Atari ST computer.

Amiga Workbench

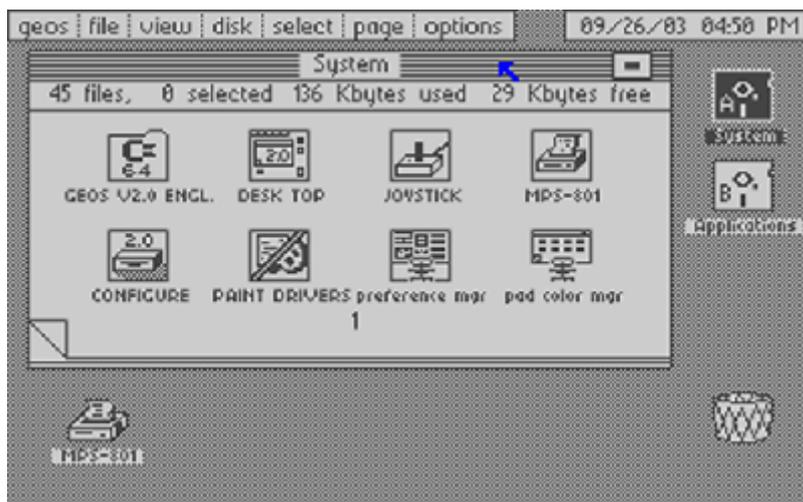
Commodore's Amiga computer, introduced later that year, came with its own GUI, Workbench. It featured some new ideas, such as the ability to move windows up and down the "stack", and the ability to select, move, and work in a window without automatically bringing it to the front. It also had a single menu bar at the top that was normally hidden from view and activated using the right mouse button.



Workbench running on the Amiga 1000.

GEOS

In 1986 Berkely Softworks released GEOS, a GEM-like GUI for older computers like the Commodore 64 and Apple II. It was later ported to the PC as GeoWorks and briefly became a competitor to Microsoft Windows.



GEOS running on the Commodore 64.