

## Jonathan Gladden

Research Paper  
Art 894x12 History of Computer Graphics  
Instructor: Wayne Carlson  
Autumn Quarter 2000

Coyote GUI: *Copierheads give birth to the graphical user interface: Xerox PARC and the development of the modern desktop operating system.*

### Research Paper

### Xerox PARC and the GUI

### Introduction to the Graphical User Interface:



Some may ask, what is a GUI? What are its characteristics? A GUI is a Graphical User Interface, usually part of a computer's operating system which is characterized by WIMPs and WYSIWYG. WIMPs are Windows, Icons, Menus, and Pointing devices (such as a mouse or a trackball). WYSIWYG or What You See is What You Get, refers to the ability to print out exactly what you see on the screen, this made effective desktop publishing possible. The GUI is based on the principle that pointing in menus to a command you want to computer to do is easier than having to remember hundreds of key words like in command line operating systems such as MS DOS or Unix. The GUI is based on the idea that pointing to something is the most basic human gesture, and the mouse is easier to use than a keyboard. In a graphic user interface a user points at windows, icons, and menus by means of a mouse on a metaphorical 'desktop' environment which relates to the user's known physical office environment. The graphical desktop is a metaphor of an office desk, which files and folders on top of it, making it easier for new users to visualize how the computer works.



The innovations of the GUI and WYSIWYG were first developed in the 1970's by Xerox's Palo Alto Research Center years ahead of the rest of the computer industry. Xerox PARC's researchers would fundamentally alter the nature of computing, and the relationship of human-computer interaction.

### Part I: The Birth of GUI:

In 1975 the researchers at Xerox PARC (Palo Alto Research Center) moved into their permanent headquarters at 3333 Coyote Hill Road near Stanford University in Palo Alto, California. Jacob Goldman had founded PARC just five years previous, and already at this early date the research team had developed many of the ideas that shaped the future of computing. The Palo Alto Research Center's mission as directed by Xerox management was to create the office of the future. To that end they created many of the technologies we take for granted in the modern office, such as networked personal computers, with E-Mail, word processing, and laser printing, but most significant innovation at PARC was the graphical user interface (GUI), the desktop metaphor that is so



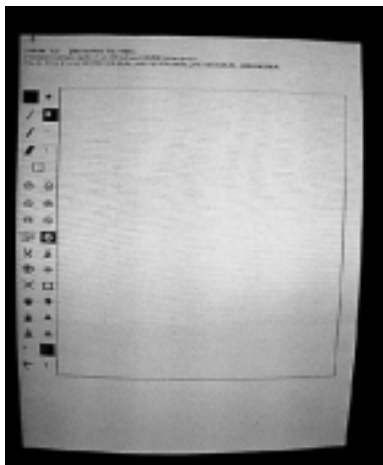
Research Paper continued...  
Xerox PARC and the GUI

○ prevalent in modern operating systems today.



The GUI would make computer graphics an everyday part of the working environment. No longer would the display be simply lines of code and commands, it would be graphical with true representation of typefaces and images. The bitmapped GUI display would help promote the concept of WYSIWYG (what you see is what you get) allowing people to laserprint exactly what they saw on the screen. In workstations of the past, graphics and commands were split between three different screens, a vector device for line graphics, a text display for entering commands, and a video / raster graphics screen coupled with a frame buffer to display the final rendered result. Xerox PARC combined these separate technologies into one raster graphics screen along with an easier way of issuing commands: the pop up menus, icons, and desktop metaphor of the graphical user interface.

As with many other areas of computer graphics researchers from Utah were going to play a key role in the development of the GUI. The idea for a graphical user interface (GUI) was first developed by Alan Kay from the University of Utah who went to work at Xerox PARC on the Alto project in 1970.



The first GUIs tried at Xerox PARC were very slow to work with and depended too much on the processor to re-draw each bit when moving overlapping windows around. In 1974 a PARC research named Dan Inglis invented a procedure for the movement of whole blocks of bits on the screen called "Bit Blit". This display algorithm allowed overlapping windows to be quickly shuffled around the screen without overtaxing the processor.

## Part II: The Life of GUI:



The Xerox Star was the first commercial personal computer to use the now common desktop metaphor. An early publication (David Smith developer of the Star interface, 1982) about the Star said "Every user's initial view of the Star is the Desktop, which resembles the top of an office desk, together with surrounding furniture and equipment. It represents a working environment, where projects and accessible resources reside. On the screen are displayed pictures of familiar office objects, such as documents, folders, file drawers, in-baskets, and out-

Research Paper continued...  
Xerox PARC and the GUI

baskets. These objects are displayed as small pictures, or icons". With the Star began 'messy desk' metaphor seen in so many GUIs today.

### The GUI and Networking:



PARC was initially divided into three units: the computer Science Lab (CSL), the Systems Science Lab (SSL), and the General Science Lab (GSL). The CSL run by Bob Taylor was most responsible for the development of the graphical user interface. Talyor had worked on the ARPAnet, (a distributed network of computers, the predecessor to the Internet) and brought the idea of networked computers to PARC. By 1979 there were hundreds of Altos networked together with more traffic and 'nodes' than the entire ARPAnet. Xerox PARC even had the world's first computer virus called a 'tapeworm' because it would eat it's way through the Ethernet and consume all available resources. Like many of PARC's innovations Networking was ahead of it's time, and would not be widely available in personal computers for another decade. The first Macintosh had no network capabilities, and when asked about it, Steve Jobs, threw a floppy disc at a journalist, saying "Here's my network".



Alto had the ability to show other computers on the network as icons on it's graphical desktop. Much later Macintosh acquired this ability. With the birth of the Internet and the World Wide Web, computers could network to others across the world, but this was done with a separate application that was at first non-graphical (telnet, text-based FTP software). Later applications for accessing the internet became more GUI-like but were not part of the operating system (TurboGopher, Fetch, Anarchie). With the introduction of the first graphical web browser, Mosaic, in 1993 accessing the internet began to look more like a GUI. Netscape further refined the GUIness of the web browser application. With the release of Windows 95 and NT, Microsoft attempted to blur the distinction of the web browser application and operating system by bundling 95 with Internet Explorer. The windows and interface of 95 could be set so that browsing the local computer looked almost the same as browsing the Internet. Wether this is a good idea remains to be seen. Microsoft got into legal trouble because the bundling strategy was seen as an attempt to block competition from Netscape and other browsers. Apple now now allows users to create an

Research Paper continued...  
Xerox PARC and the GUI

iDisk (a storage space on the Apple webserver) with OS 9 that appears as regular disk icon in the GUI desktop, and the Sherlock (find file) application allows users to search the internet as they would a local disk.



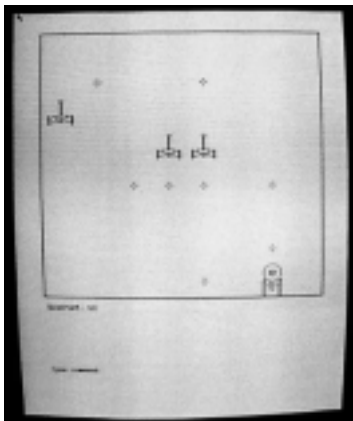
### The GUI, WYSIWYG, and Desktop Publishing:

John Warnock helped develop Interpress and other printing and page description systems at PARC which allowed the Alto to become the first WYSIWYG computer when coupled with Xerox's laser printer. Later Warnock would found Adobe Systems which helped bring about the desktop publishing revolution of the late 1980s along with Apple computer. The combination of the Macintosh, the LaserWriter, and Adobe's page description software, would forever change the world of publishing, typesetting, and graphic design.



Larry Tesler at PARC, who would later be part of the Apple LISA development team, begin work on Gypsy, the world's first user friendly word processing application using pop-up menus and icons in 1974. Gypsy was later to become the basis for Microsoft Word when it's co-creator Tim Mott and others at PARC went to work at Microsoft. Gypsy was essentially the world's first desktop publishing software with advanced features such as drawing and editing graphics within the same application as the word processor. These features have only recently begun to emerge in software packages such as Adobe InDesign, and QuarkXpress 4.0.

### Steve Jobs visits PARC:



The Xerox corporate management never realized what they had at PARC they never shared the same vision as the researchers. The innovations of developed there where never marketed successfully under the Xerox name. It took outside companies to market PARC innovations in GUI and WYSIWYG to make them the standards they are today.

In 1979 Steve Jobs and engineers from Apple visited Xerox PARC and where given demonstrations of the Alto and it's graphical user interface. They would later incorporate much of what they saw into the design of the Lisa and Macintosh. Bill Atkinson and the architects of Lisa had begun working on a GUI before the demonstration at PARC, but it was far more

Research Paper —————○  
continued...  
Xerox PARC and the GUI



static than that showed on the Alto. The original Lisa interface was less reliant on the mouse, it used a 'softkey' as its primary pointing device, which was essentially arrow keys on the keyboard. The demo gave those at Apple devoted to a more dynamic GUI for the Lisa and Macintosh with the proof they needed that the graphical desktop was the direction to head. Atkinson recalls that "mostly what we got was inspiration from the demo, and a bolstering of our convictions that a more graphical way to do things would make a business computer more accessible." Steve Jobs liked what PARC had done with the GUI so much that he convinced Larry Tesler to switch to Apple and help him develop the interface for the Lisa.

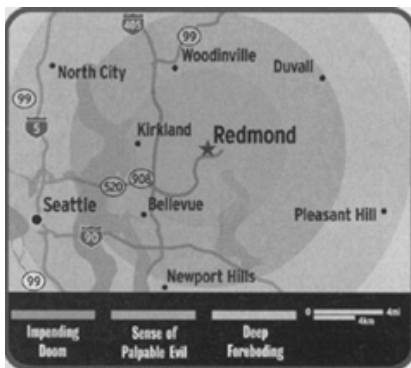


The Apple Lisa did not sell well because, like the Xerox STAR, it was too expensive (\$10,000) as compared to IBM PCs of the day which sold for around \$1000. Macintosh was the first personal computer with a GUI to be marketed successfully because of its more reasonable price (\$2,500), and well planned advertising strategy. At first the Mac did not sell as well as expected, because of its lack of software, MacPaint and MacWrite were not enough for businesses who needed spread sheets, and accounting software.

### Microsoft and the Proliferation of an Imperfect GUI:



The IBM PC continued to be more popular with businesses than the Mac even though it didn't have a GUI. Enter Bill Gates and Microsoft, which began developing useful applications for the Mac which helped increase sales. Microsoft's early partnership with Apple allowed them access to the Mac OS which led to the development of their own GUI, Windows 1.0. Microsoft saw the Mac OS as a threat to their non-graphical operating systems for IBM PCs, MS DOS and knew that they had to develop a GUI to compete. Steve Jobs had quoted a saying of Piccsaso "that good artists borrow, but great artists steal" in describing what the Macintosh had got from Xerox PARC. Microsoft might say the same about what they got from Apple. Windows appeared to copy many of the same metaphors and icons as the Mac GUI with just the names changed, for example the Trash Can in Mac, became the Recycle Bin in Windows (and later the Dumpster in X-Windows for SGI Workstations). Windows became more popular not because it was better than the Mac OS, but because it was more open, and could run on millions of IBM PCs and Mac



Research Paper continued...  
Xerox PARC and the GUI

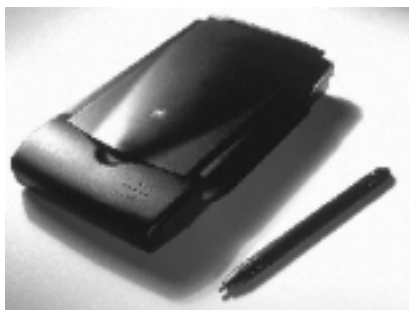


Clones. Apple never licensed the Mac OS to clonemakers except for a brief period in the mid 90s. This caused Apple to lose market share, but kept the quality of their product more consistent than with IBM clones. Windows had flaws because it was built on top of the non-GUI MS-DOS, and it would behave differently on each type of PC clone.

In 1986 Steve Jobs left Apple after disagreements with the board of directors and founded a new company called NeXT which would develop NeXTStep, a GUI for it's Unix based workstations in 1988. This becomes the first GUI to simulate a three-dimensional screen. Later when Steve Jobs returned to Apple, NeXTStep would merge with the Mac OS to create Mac OS X.

Around the same time as NeXTStep, in the late 80s, other Unix workstation manufacturers wanted a piece of the GUI action. In 1987 X Windows System for Unix workstations became widely available. Around 1989 several Unix-based GUIs were introduced. These included Open Look, by AT&T and Sun Microsystems, and Motif for the Open Software Foundation by DEC and Hewlett-Packard. Motif's appearance is based on IBM's Presentation Manager a rival GUI to MS Windows.

### The GUI of the Future:



Recent times have seen a convergence of electronic media, web TVs, DVD video on PCs, and wired toasters all connected by the Internet. GUIs will probably become the standard interfaces of all new appliances where they can be useful. Some VCR controls have gone from a complicated set of programming buttons to a GUIesque set of on-screen menus. Web phones and PDA computers use scaled-down GUIs like the Palm OS and Windows CE. The World Wide Web is the GUI of the future, although it will appear in infinite forms and variations. Whereas operating system GUIs look more or less standard across the computers that use them, website and webapplications will appear different depending on which device or appliance is using them. Websites are a form of GUI that is a lot less standardized than the operating systems of GUI past, which is not as easy for users to learn, but has the advantage of being more flexible across a host of internet capable devices. The future of GUI looks bright and full of possibilities.



Research Paper —————○  
continued...  
Xerox PARC and the GUI

## The History of GUI Timeline:

1962

- Sketchpad is developed at MIT by Ivan Sutherland. The Sketchpad application allowed users for the first time to interact with the screen directly by means of a light pen. Although it was not an 'operating system' it introduced the concept of using a device other than the keyboard to interact with graphics on the screen.



1964

- The first mouse-like pointing device is created by Douglas Engelbart at SRI International, and further developed at Xerox PARC in the 1970s.

1969

- Alan Kay develops the concept of GUI in his dissertation research at the University of Utah. The GUI concept is realized in his later work at Xerox PARC.
- Bell Labs developed the first framebuffer for storing and displaying 3-bit images. The framebuffer was an essential to the bitmapped technology of later GUIs.



1973

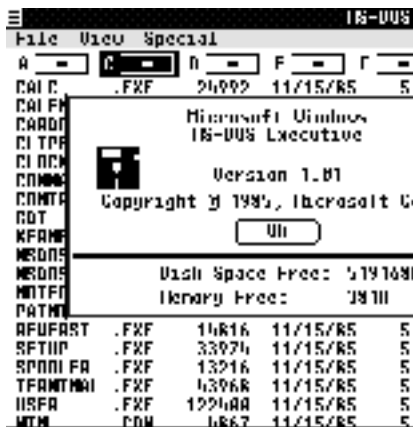
- The Alto, the first computer to have a modern graphical user interface, is born at Xerox PARC.
- Dick Shoup's "Superpaint" frame buffer application stores its first video image. Although most of Xerox PARC's GUI research was on grayscale displays, Superpaint helped lead the way to color GUIs.

1974

- Dan Ingalls at PARC invents "BitBit", a display algorithm that will make possible the development of such features of the modern GUI as overlapping screen windows and pop-up menus.
- Tim Mott and Larry Tesler at PARC begin work on Gypsy, the world's first user friendly word processing application using pop-up menus and icons. Gypsy was later to become Microsoft Word. Larry Tesler later moved to Apple and was one of the key members of the LISA development team.
- The first modern ball-mouse device is created by Ron Rider at PARC as he was inspired to flip a trackball device upside down and use it as a mouse.



Research Paper —————○  
 continued...  
 Xerox PARC and the GUI



1975

- the first major demonstration of a graphical user interface by PARC engineers to their colleagues on an Alto computer including icons, windows, and pop-up menus powered by BitBlit.

1977

- Steve Jobs and Steve Wozniak found Apple computer. The Apple II personal computer does not have a GUI, but uses bitmapped raster graphics.
- The Alto personal computer and its graphical user interface are presented to the Xerox sales force during "Futures Day" at the Xerox World Conference. The laser printer and computer networking are also introduced.
- The first portable personal computer, the Xerox Notetaker, is introduced along with the Dorado.

1979

- Steve Jobs and engineers from Apple visit Xerox PARC. They would later incorporate much of what they saw into the design of the Lisa and Macintosh.

1980

- first commercial distribution of the GUI in the Xerox STAR which introduced pointing and selection with the mouse.
- IBM introduces its PC running DOS, a non-graphical, command line operating system. The IBM PC would later be the main platform for Microsoft Windows.

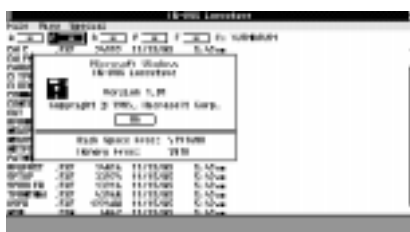


1984

- the GUI is popularized by Apple computer with the Lisa and Macintosh.
- the Macintosh becomes the first successful mass-marketed personal computer with a GUI.

1985

- Microsoft Windows 1.0 is developed for use on IBM PCs, does not become popular until version 3.1



1987

- X Windows System for Unix Workstations becomes widely available.
- IBM's Presentation Manager is released, which is intended to

Research Paper continued...  
Xerox PARC and the GUI

be a graphics operating system replacement for DOS.



1988

- Steve Job's new company NeXT develops NeXTStep, a GUI for it's Unix based computers. This becomes the first to simulate a three-dimensional screen. Later when Steve Jobs returned to Apple, NeXTStep would merge with the Mac OS to create Mac OS X.



1989

- Several Unix-based GUIs are introduced. These include Open Look, by AT&T and Sun Microsystems, and Motif for the Open Software Foundation by DEC and Hewlett-Packard. Motif's appearance is based on IBM's Presentation Manager.
- Microsoft releases Windows 3.0 developed jointly with IBM to become an interim step to OS/2.

1992

- OS/2 Workplace is released by IBM.
- Microsoft releases Windows 3.1.



1995

- Microsoft releases Windows 95 which challenges IBM's OS/2 concept and plans.
- Windows NT replaces Windows 3.1 for Workgroups, a better networked, more professional version of Windows 95.

1996

- NeXT develops OpenStep an improved version of the NeXTStep GUI.

1998

- Windows 98 is released which later becomes Windows Me (Millennium Edition) in 2000.
- the iMac coupled with OS 8.5 gives the consumer market a more user friendly computer, with easy access to the internet.
- other GUI-based operating systems are developed such as the BE OS that is cross-platform, and operating systems for small PDA computers such as Windows CE, the Palm OS, Apple Newton, and others.



1999

- OS 9, the last revision of the original Mac OS is released.
- additional GUI-based operating systems are developed for

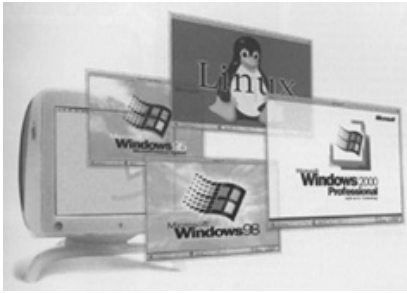
Jonathan Gladden  
Research Paper  
Art 894x12 History of Computer  
Graphics  
Instructor: Wayne Carlson  
Autumn Quarter 2000

Research Paper continued...  
Xerox PARC and the GUI

- web-phones, PDA computers, and other devices.
- the optical mouse (InteleMouse Explorer) is marketed by Microsoft.

2000

- Windows 2000 replaces Windows NT as Microsoft's high-end operating system.
- Apple introduces an optical mouse.
- Mac OS X (Public Beta) becomes the first major overhaul of the Mac OS since the original. OS X combines the Mac GUI's easy of use with the stability of the Unix platform by including elements from NeXTStep and OpenStep, the GUIs developed by Steve Job's former company, NeXT.



## Jonathan Gladden

Annotated Bibliography  
Autumn Quarter 2000

For the thesis proposal:

Developing Representative Websites for Diverse Academic Organizations  
as a Means of Disseminating Information to Multiple User Groups.

## Annotated Bibliography and Literature Review

## Selected Bibliography

### 1) References from printed Literature

#### A) Books

##### GUI Design:

Galitz, Wilbert O. The Essential Guide to User Interface Design: An introduction to GUI Design Principles and Techniques. John Wiley and Sons: New York, 1997.

Galitz, Wilbert O. It's Time to clean Your Window: Designing GUIs that Work. John Wiley and Sons: New York, 1994.

Hiltzik, Michael. Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age. HarperCollins Publishers: New York, 1999.

##### GUI History and Computer Graphics:

Masson, Terrence. CG 101: A Computer Graphics Industry Reference. New Riders, Indianapolis: 1999.

Segaller, Stephen. Nerds 2.0.1: A Brief History of the Internet. TV Books: New York, 1998.

### 3) References from electronic Literature (Internet)

parc history  
<http://www.parc.xerox.com/history.html>

Encyclopaedia Britannica: graphical user interface (GUI)  
[http://www.eb.com:180/bol/topic?eu=117673&sctn=2#s\\_top](http://www.eb.com:180/bol/topic?eu=117673&sctn=2#s_top)

The Graphical User Interface  
<http://www.apple-history.com/horn1.html>

CGI Family Tree Main Page  
<http://www.cgrg.ohio-state.edu/~waynec/history/tree/overall-list.html>

The Story Behind the Lisa (and Macintosh) Interface  
<http://home.san.rr.com/deans/lisagui.html>

1972: Xerox Parc and the Alto  
<http://www.cnn.com/TECH/computing/9907/08/1972.idg/>



Jonathan Gladden  
Research Paper  
Art 894x12 History of Computer  
Graphics  
Instructor: Wayne Carlson  
Autumn Quarter 2000

Research Paper —————○  
continued...  
Xerox PARC and the GUI