MAC & COMPUTER BASICS TOPICS

MACINTOSH OPERATING SYSTEM

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- MacOS (8, 8.5, 8.6, 9)

02. Why Macintosh?

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COMPUTER BASICS

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WHAT IS A COMPUTER Although the term computer can mean anything (from an abacus to a slide rule) which performs mathematical calculations, in today's world the word computer generally means an electronic, digital device which processes information.

In the 1950s there were about 100 computers in operation in the entire world. These computers occupied entire rooms and cost millions of dollars to create and operate. Today, computers are found in everything from toasters to TVs, and more than 200 million personal computer (PC) workstations can be found in homes and businesses around the world. As computer use has proliferated throughout our society computers have also become more specialized — we have computers that bake cakes, figure taxes, design publications, play games, fight wars and just about everything else … but all computers really have the same job: they process information.

WHAT IS AN OPERATING SYSTEM A computer is made up of many physical objects (microchips, casings, disks and drives) known as hardware. These physical components can be divided into three categories: input devices (mouse, keyboard, etc.), processing devices (logic board, processor chip, etc.), and output devices (monitors, printers, etc..) All of these devices are controlled by a set of digital codes, or software, known as the Operating System (also called the "OS" or just the "System".) The OS is the code which controls the basic functions of the computer. Operating Systems provide a computer with its User Interface (the means by which a user interacts with a computer). They allow users to insert data and once that data is processed the OS enables the data output back to the user.

PCs & THE GRAPHIC USER INTERFACE In the 1970s and '80s several companies began producing inexpensive computing machines which accepted typed commands from users and displayed the resulting information on monitor screens. (IBM was the leader in this field, and to this day IBM PC compatibility unites the majority of non-Macintosh computers.) These machines were the first "personal computers," and although they were useful and popular their text based interfaces required users to learn specialized sets of typed commands. This made them clunky and difficult for the average user.

This all changed in 1984 when Apple became the first manufacturer to release a PC with an interface that used icons (small pictures), buttons and windows, and a mouse to aid in navigating around the screen and manipulating objects. Apple realized that an interface metaphor based upon a user's normal life experience would help to make computing easier, more productive and fun. By making the interface friendly and eliminating the need to remember arcane text commands, Apple reasoned, computer users would be more likely to enjoy their work and become more productive.

This new type of image based interaction became known as a Graphic User Interface (see images below). Most of today's personal computer operating systems contain Graphic User Interfaces (GUI — pronounced *gooey*). The two most popular GUIs are Apple's Mac OS and Microsoft's Windows — an OS designed to emulate the look and feel of the Macintosh.
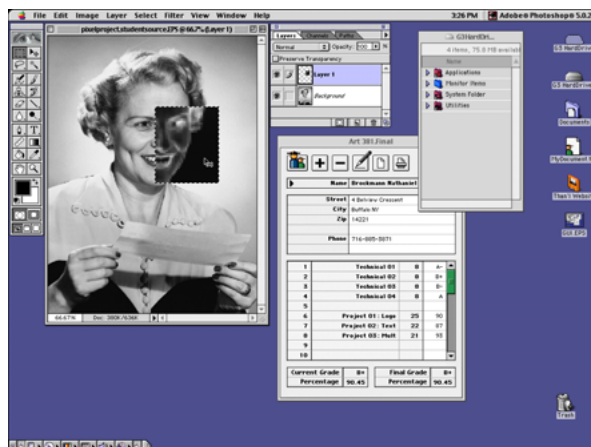
THE MACINTOSH OPERATING SYSTEM or MacOS is the operating system which runs all Macintosh computers. The MacOS was designed to be the most engaging and user friendly interface in the computer world. Apple has staked its reputation and its entire business on this concept, and in most cases has arrived miles ahead of any operating system developed by the competition.

Everything in the MacOS from its "general look and feel" to the width of its scrollbars and the directions its cursors point is based on an exhaustive research project known as the Macintosh Human Interface Guidelines (available online at http://www.apple.com or in book form at http://www.amazon.com). The Macintosh Human Interface Guidelines have been developed over the past 15 years to give programmers a detailed overview of Apple's ideas about interface metaphors and design principles. The great thing about these guidelines is that they give everyone developing Macintosh software a common ground to start from.

This means that no matter what program you're in, no matter what Mac you use, they'll always have the same "general look and feel," everything will always work (programs will open, documents will save, applications will quit, etc.) in basically the same way.

Another good thing that Apple has built into the MacOS is its robustness. The Mac is hard to screw up, it's difficult to break. You can click anywhere, and you can open most everything. If you're not supposed to do something, the Mac will beep and tell you something is wrong, and often it will tell you what to do to fix it. If the Mac gets confused or is not sure what you want it will usually ask you for help or to be more specific.

The Macintosh is easy, elegant and intuitive but it's not simple — there are rules and procedures which must be learned in order to use a Mac well. The notes in the following pages will give a general overview of Mac rules and usage. Read them and learn, but always remember the best way to learn on a Mac is to start wandering around and clicking on stuff that looks interesting. Enjoy the Mac, it's made to be fun!

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THE FINDER The Mac's designers chose to create their screen display around a metaphorical desktop so that when a user works on the Macintosh's computer screen it is as if she is working on an actual desk with documents, files and folders; even a trash can is nearby.

The program which creates the Macintosh's "virtual desktop" is named the Finder. The Finder is the application which allows you to copy and save files and manage your computer. The Finder is one of the core components of the Mac OS, without it your computer would not work.

Working in the Finder is fairly simple, and by learning how to use the Finder you will begin to learn to use all of the rest of the Mac as well. In the Finder:

- To SELECT an item, click on it once
- To OPEN an item, click on it twice.
- To MOVE an item, click and drag it to a new location.
- To COPY an item to a new location, hold down the Option key while moving.
- To RENAME an item, click on its name and pause for a second or two. The item's name will hilight. Type in a new name and press Return.
- To create a NEW folder, choose File >> New Folder, or press Command-N.
- To DUPLICATE an item, select it and then choose File >> Duplicate, or press Command-D. (Command is also known as the Apple or Clover key.)

ICONS The basis for all Graphic User Interfaces, Icons are graphic representations of items (such as documents, programs, folders and drives) or tools (such as the cursor) which are available on a computer's desktop.

THE CURSOR This is a small icon (usually an arrow, a bar, or a hand) which is controlled by the movement of the mouse, and which replaces the operator's hand on a desktop. The cursor will often change its shape to indicate a user's actions or choices while working within programs.

THE MENUBAR The light grey strip across the top of the Macintosh screen, which contains the names of "PullDown" menus available to the user, is called the MenuBar. The MenuBar contains menus which list important commands or options available to the computer user. The MenuBar is the only item on the Mac's desktop which doesn't really have a real world equivalent. For more information on this topic see the "MenuBar" notes elsewhere in this booklet.

FOLDERS are a storage place for files, applications or other folders on the desktop. Folders are used to organize information. Folders may display any of a number of icons but each folder's icon will usually be based on the generic folder icon pictured at left.

WINDOWS When any item (other than an application) is opened on the desktop, whether it is a disk, a folder, a document or the trash; it opens into a Window. A Window is a frame in which items or documents are displayed.

FILES & DOCUMENTS are items which a user creates and modifies or which are used within application programs. Examples are a letter, a drawing, a picture or a sound file. Files & Documents may display any of a number of icons but each will usually have a page with a turned corner incorporated into the design.

DISKS AND DRIVES (which have many different icons) are storage devices which are inserted into the computer, attached to the computer, or housed within the computer itself. Drives are simply spinning metallic or coated plastic disks. The computer's main "Hard Drive" is usually represented by an icon in the upper right corner of the monitor. The Mac OS allows you to easily change the name of your disk as it appears on the desktop.

THE TRASH looks like a small trash can, and is the icon for the Mac's file disposal and disk ejection unit.

- To EJECT a disk, drag and drop it onto the trash icon, or press Command-E. The disk will eject. Information on the disk will not be effected in any way.
- To ERASE a file, drag and drop the file onto the trash icon (or select the file and type Command-Delete.) The trash will become fat or full. At this point the file is stored in the trash but not erased. To erase all files in the trash select Special >> Empty Trash... Once a file, folder or document is put into the trash--and the trash is emptied --that file or folder can NEVER be recovered.

WINDOWS A Window is a frame in which items or documents are displayed. Windows are one of the most common visual metaphors in the MacOS, they are used to organize files, inform users of important information, alert users to problems, and display open documents. A few of the most common windows are depicted here...

STANDARD FINDER WINDOWS are windows which have a title bar and scroll bars and are used to display folders, lists and documents. For more information on using standard windows, see the notes later in this booklet.
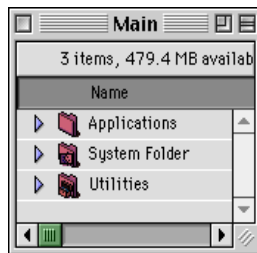
APPLICATION WINDOWS are used by applications to display open documents. Application Windows are in many ways similar to Standard Finder Windows. They generally have titles, scrollbars, close-boxes, window-shaders and size boxes.

PALETTES are windows which float above standard windows in applications and contain items such as toolbars, Options and Object Information. To select an item on a Palette click on it once.
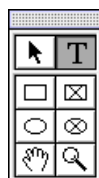

DIALOGUE BOXES AND ALERTS are windows which the System, or an application, uses to warn a user of problems (example 1), give information (example 2) or ask for information (example 3). Dialogue Boxes usually float above all other items on the screen and require user input before any other actions can occur.

If a Dialogue Box (like the one below) has buttons on it then the button with the wide border (OK in the example below) can be selected by pressing Return.

In the "Copy Progress" Dialogue below the arrow on the left can be used to show or hide important information. "Copy Progress" Dialogues display a progress bar which shows a user how much progress is being made in the current operation.
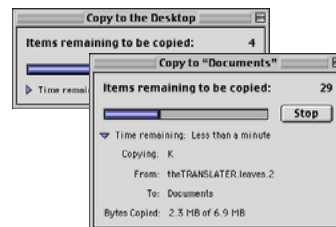
The "Save As" Dialogue is used to save a document. The "Save As" dialog allows a user to make a new copy of a document by changing its name or its location; it also allows a user to change a file's format type.
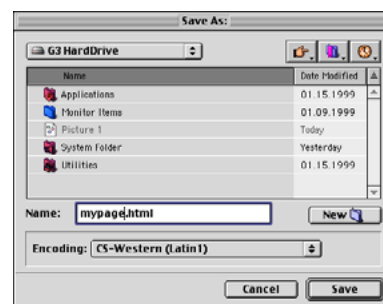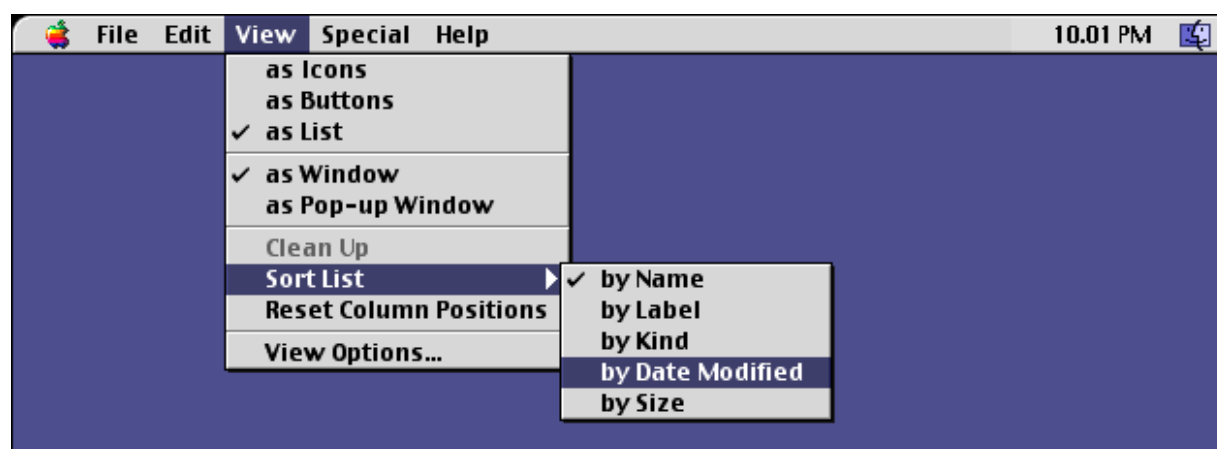
THE MENUBAR The light grey strip across the top of the Macintosh screen, which contains the names of "pulldown" menus, is called the MenuBar. To use the MenuBar...

01. Move the cursor over any of the bar's various menu headings and press the mouse button.

02. Pulldown menus will appear which highlight various options and commands available to the user.

03. To choose an item from a pulldown menu, drag the cursor down the menu and click (or release) the mouse button when the desired item is highlighted.

• GREYED ITEMS: When an item within a menu, or on the MenuBar, is not available to a user; it will appear grey instead of black.

• SUBMENUS: Some items within pulldown menus open new menus called "submenus." An item with a submenu will display a small arrow to the right of its name. (as with the "Sort List" item below)

• DIALOGUES: Some menu items (like New or Open) will require additional input from the user when selected. The names of these menu items will be followed by three dots. (as in the "View Options..." item in the example below)

• CHECKED ITEMS: When a group of menu items is related (as with the "as Icons, as Buttons, and as List" items below) the item which is currently selected in the group will be preceded by a checkmark.

FINDER MENUS When a user is working on the desktop (or "Finder") there are several constant "pulldown" menus available. All of the Finder menus except for the Special and View menus, are considered to be "universal menus" which means that they are available in every application on the Macintosh. The Finder menus include the Apple, File, Edit, View, Special, Help, and Application Menu. In addition to the MenuBar items listed above, each individual program may add or subtract menus and menu items from the menubar. The Desktop Menu's are...

• The APPLE menu contains aliases (shortcuts) to important items, applications, folders, files and other frequently accessed items.

• The FILE menu contains file manipulation commands. It is used to Open and Save files, to Quit programs, and sometimes to set user preferences within programs.

• The EDIT menu contains document editing commands such as Cut, Copy, Paste and Select All.

• The VIEW menu contains folder and window customization options.

• The SPECIAL menu contains items which are only used by the Finder including Eject and Erase Disk, Empty Trash, Sleep and Shut Down.

• The HELP menu contains links to the Help utilities which are available in many programs.

• The APPLICATION menu is designated by a small, ever-changing icon in the right hand corner of the menubar. The current Application menu icon depends on the program which is the active program on the Mac desktop. Clicking the Application menu will display icons for all programs which are currently open whether they are "active" or not. To switch between open programs; select any icon in the Application menu.

🍎 File   Edit   **View**   Special   Help   10.01 PM   📧

| as Icons |
| as Buttons |
| ✓ as List |
| ✓ as Window |
| as Pop-up Window |
| Clean Up |
| Sort List ▶ |
| Reset Column Positions |
| View Options... |

Sort List submenu:
| ✓ by Name |
| by Label |
| by Kind |
| by Date Modified |
| by Size |

THE SYSTEM FOLDER and its contents, is the only folder that is absolutely necessary to the operation of your computer. It contains several essential items...

SYSTEM This is the program which provides all of the basic functions to the Mac; from copying and pasting, to its file storage system, folders and windows.

FINDER This is the program which provides the Macintosh with its desktop.

APPLE MENU ITEMS This folder contains all items which are available in the Apple Menu.

The **EXTENSIONS FOLDER** contains **EXTENSIONS** which are software that expand the System's capabilities. Extensions allow the System to display digital movies, use printers, CD-ROMs, scanners, etc. (Some extensions are shown at left)

For Extensions to work they must be stored in the Extensions Folder in the System Folder when the computer starts up.

There are hundreds of Extensions available for the Mac, designed by hundreds of companies. Not all of these Extensions work well with each other, and sometimes too many Extensions can cause problems on the computer. Apple provides a Control Panel called the Extensions Manager on all new computers. This program allows the user to organize Extensions and gain quick access to changing configurations. Extensions are divided into two primary groups:

- Chooser Extensions appear in the "Chooser" (in the Apple menu) and provide networking, printing and scanning functions.
- System Extensions, like the QuickTime Movie Extensions and OLE Extensions, expand the capabilities of the System in general and provide extra functionality to certain programs.

PREFERENCES FOLDER this folder contains special files which hold user defined settings for all programs on the computer. For instance in Photoshop a user may choose to use pixels, inches, or centimeters as units of measurement; once this choice has been made a preference for it is stored in the Preferences Folder. In many programs Preferences can be accessed through the Edit or File menus.

CONTROL PANELS FOLDER and **CONTROL PANELS** are utilities that let users adjust basic parameters of the System such as the speaker volume, desktop pattern, date, time and internet usage.

To work properly, Control Panels must be in the Control Panels Folder in the System Folder when the computer starts up.

The **FONTS FOLDER** contains **FONTS** which are software that provides different typefaces on the Mac. For fonts to work they must be stored in the Fonts Folder (in the System Folder). (For more information on this topic see the Fonts notes elsewhere in this booklet.)

The **CHOOSER** is an Application which is always accessed via the Apple Menu. The Chooser (along with the some Control Panels and Extensions) allows users to access File Sharing, Printing, Scanning, and other Input/Output and Networking functions.

FONT Typefaces on the computer are generated using software called "Fonts." Fonts must be stored in a special folder in the System Folder, called the "Fonts" folder.

FONT SUITCASE There are thousands of fonts available on the Macintosh. To help organize fonts, Font Suitcases were developed. Font Suitcases act just like folders except they can only hold bitmap or TrueType fonts. Suitcases cannot hold PostScript fonts.

TO INSTALL A FONT Installing fonts is remarkably easy, but it takes a certain set of properly performed steps.

01. ACQUIRE the font to be installed, either from a Type Foundry (such as Adobe, Agfa, P22, BitStream or FontHaus) or from some other source.
02. CHECK carefully to make sure you have all versions of the font you need including any PostScript and bitmap, or TrueType versions which may be necessary (see the opposite side of this page for information on Font Types)
03. CLOSE all open programs on the machine on which fonts will be installed.
04. COPY all fonts (or font suitcases) directly into the Fonts Folder (in the System Folder) of the new machine where the fonts are to be used. Fonts MUST be in the Fonts Folder of the active System Folder to work.
05. START any program and the newly installed fonts should be available.

FONT PROBLEMS Fonts are usually not stored in the documents in which they are used. This means that if the document is taken to a different computer and opened fonts may be missing, pages may look choppy, text may look blocky and everything may look really bad.

To prevent Font problems, always use standard fonts (Geneva, Times, Palatino, etc.) or always carry fonts with documents when moving to a different computer.

Fonts are seductive, but they can cause many problems on a computer. Users should never have more than 128 Fonts in the fonts folder, and should always remember that the more fonts that are active, the slower the machine will run.

There are three main types of Fonts on a Macintosh, and each has benefits and problems.

BITMAP FONTS (Screen Fonts) were the original fonts of the Macintosh. These fonts were created by drawing each letter of the alphabet, pixel by pixel. When the Mac was released the monitor and all printers had the same resolution, 72dpi. This meant that the bitmap font could be used as both the printer font and the screen font. Bitmap fonts were built for various sizes from 8 to 72 pixels tall. This font format was soon outdated as printers and screens improved, but bitmap fonts were rescued by Adobe's PostScript Font format. Bitmap fonts may be stored in Font Suitcases for easy handling.

POSTSCRIPT FONTS (Printer Fonts) (also known as Type 1 and Type 3 Fonts) Are outline (vector) fonts which are designed using Adobe's Page Description Language known as Postscript. The Postscript Language is used by most printers and many image-setters to translate what is seen on the screen to what is printed on the page. PostScript fonts translate bitmap fonts into smooth vector images on a printed page, but cannot be used alone to draw images on the screen. Because of this, to use a PostScript Font, a bitmap version of the same font MUST always be present in the Fonts folder and you MUST be using the Adobe Type Manager Control Panel (which is free with most Adobe products)

TRUETYPE FONTS (Screen & Printer Fonts) are outline (vector) fonts developed using Apple specifications. TrueType fonts are vector images which are totally scalable and are readable by both the computer screen and the printer. Because of this scalability and readability, TrueType fonts can act alone without bitmap or PostScript fonts. TrueType fonts may be stored in Font Suitcases for easy handling.

MEMORY ALLOTMENT When a program is running on a computer is assigned a certain amount of RAM (memory) with which to work. Depending on how you use a program you may need to assign it more or less RAM to fit your own needs. There are several ways to tell if you need to change the memory allotment settings for a particular program:

- Sometimes when a program senses that it needs more memory to run properly it will display a warning dialog box to inform you that it needs more RAM.
- If when you are using a certain program your computer crashes frequently or runs slowly, the program may need more RAM.
- You can also watch how your computer is using RAM by opening the "About This Computer" window when you are in the Finder. By leaving this window open you can watch the assigned memory bars (shown at right) while you are running a program. If the memory bar for any program (except the Mac OS) gets more than three-quarters full then that program probably needs more RAM. If any memory bar stays consistently under one-half full then you might want to decrease the memory you are allotting to that program.
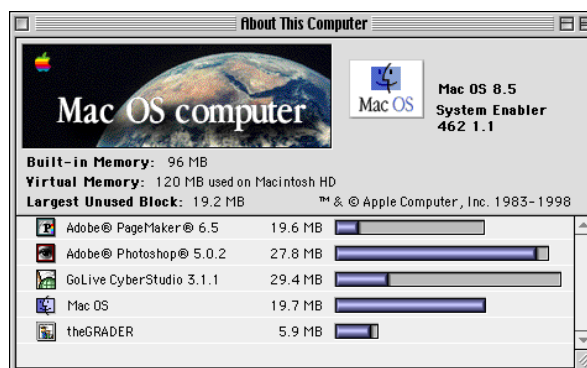
TO CHANGE A PROGRAM'S MEMORY ALLOTMENT...

01 QUIT - Make sure the application whose memory allotment you want to change is not running. To quit an active application select File >> Quit (Command-Q).

02 LOCATE PROGRAM - Find the application program's icon (not an alias or the program folder) and click on it once to select it.

03 GET MEMORY INFO - Once the program icon is selected, choose File >> Get Info >> Memory.

04 The MEMORY INFORMATION WINDOW should contain information about an application's memory settings. If your Info Window shows "General" or "Sharing" information, use the "Show" popup menu to select "Memory" information. To change your memory settings...

- Suggested Size - This size was determined by the program's manufacturer and your system. It cannot be changed.
- Minimum Size - This is the minimum amount of RAM which the computer will require before opening the program. This should not be set below the "suggested size." It may be set above the "suggested size" if you feel you have enough RAM available.
- Preferred Size - This is the most important number within the "Memory Requirements" area. This is the amount of RAM which you would like the program to have. The computer will decide, when the program is opened, exactly how much RAM it can assign, but it will use this number as its maximum memory allotment. Because programs and usage may vary you will have to experiment to know what number to use here, but remember... Too little memory and you will have problems running your program. Too much and you will be wasting memory which could be used elsewhere.

06 PROBLEMS - If "Memory Requirements" boxes are grayed out, make sure the application whose allotment you are changing is not open and the "Lock" checkbox at the bottom of the memory information window has not been checked.
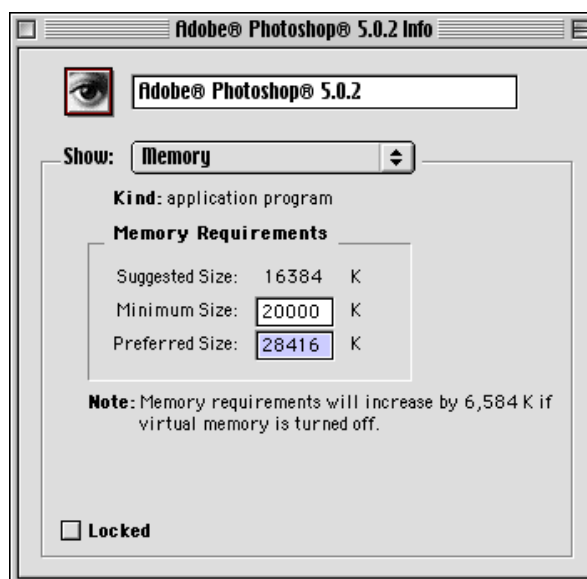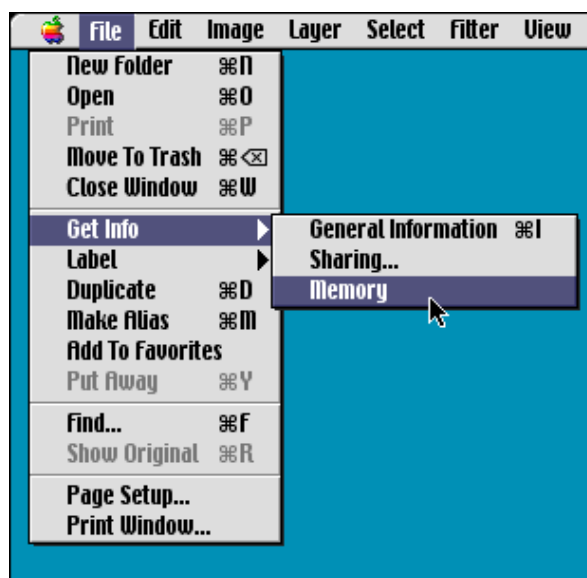
LINES OF DEFENCE There are many problems which can occur on a computer. As software and machines get more and more complex, new problems seem to proliferate. Below are described some of the problems and some solutions to help in everyday computer use.

BACKING UP WORK Life with a computer is impermanent. The work performed on computers lacks any materiality or permanence until it has been saved on a permanent storage device. (For instance a Hard Drive, Zip Disk or a Floppy Disk) Work which is not saved can be lost in a second through computer error, crashes, human error, power surge, or unexpected plug disengagements.

Rigorous BACKUP procedures should always be practised! Here, as in the real world, loss of data is NEVER an excuse for late work.

It is a good idea to save copies of work as you go so that you can easily backtrack if need be. To backup a file to disk do the following:

01.   INSERT a new disk.
02.   OPEN Click twice to view the disk's contents.
03.   DRAG & DROP the items to be copied to the disk.
04.   A DIALOGUE box will appear as the items copy.
05.   VERIFY that all of your documents have been transferred to the disk in their latest form.

DIALOGUE BOXES One nice thing about Macintoshes is that they are very hard to break, and when they do have problems they will usually tell you what is going on and how to fix it. The way Macs do this by using Dialogue Boxes. Dialogue Boxes, like the one shown below, will usually appear when your computer is having a problem. READ THEM! THEY HELP! DO WHAT THEY SAY!

REBUILDING THE DESKTOP When things seem to be really slow and the computer seems to be crashing constantly. When icons are amiss and all just does not seem well, try Rebuilding The Desktop.

The Desktop Folder is an invisible folder which holds everything that is stored on the Desktop (i.e. the harddrive, any disks which are inserted into the machine, work which is copied onto the desktop, files which are saved to the desktop, etc.). The Desktop Folder can get worn out and corrupted. When this happens things like icons start disappearing, the computer starts running slowly and sometimes it even crashes. To fix this, Rebuild the Desktop. To Rebuild the Desktop...

01.   QUIT all open applications
02.   Press and HOLD COMMAND and OPTION.
03.   SELECT RESTART from the "Special Menu"
04.   KEEP HOLDING the COMMAND and OPTION keys while the computer starts up. Keep holding Command and Option until the computer has completely started and asked you if you want to rebuild the desktop.

VIRUSES have traditionally been a rarity on the Mac platform, more of a myth than a reality. For every 1000 PC viruses there is about 1 Mac virus. In recent years though Mac viruses have become more prevalent and in a busy lab with full internet access and hundreds of users there can be problems. There are many protection programs which will detect and eradicate viruses including Norton Anti-Virus and Dr. Solomon's Virex.

NORTON DISK DOCTOR Sometimes problems occur which are beyond an easy fix. Sometimes B-Trees get confused and file dates get wrong and bad dates occur and all sorts of weird computer stuff happens. When that happens call Peter Norton of Norton Disk Doctor fame and he will help all that ails. Norton Disk Doctor is by far the most popular general software fix-it tool around. It will scan your computer for a variety of problems and it will usually be able to fix them.

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HARDWARE is the physical components which make up a computer. Hardware takes many forms from hard disks and drives, to printers, scanners, cards, chips, mice, keyboards, the Mac casing and circuit boards, etc. Basically everything that you can hold, drop or break on a computer is hardware.

There are many components which make up the Mac's Hardware, and all are important but some deserve special mention…

CENTRAL PROCESSING UNIT or **CPU** is the brain of the computer where all decisions occur and instructions are carried out. Millions of decisions occur within the CPU every second. CPU speed is determined by clock speed which is measured in Megahertz. Generally, the faster and more powerful the CPU, the better and more expensive the computer.

CPU chips come in many flavors. Currently Mac CPUs are known as G3s and run at speeds from 266MHz to 450MHz. New chips and speeds are released almost monthly.

It is important to realize that CPU speed is only relative when compared to a chip in the same family. For instance, a G3 at 400MHz makes more decisions more quickly than a G3 at 300MHz, but the G3 at 300MHz is actually faster than a Pentium II at 400Mhz. Oh Boy…

MOTHERBOARDS and **DAUGHTERCARDS** until recently the CPU of a computer was soldered directly onto a large set of computer chips collectively called a motherboard. This meant that to upgrade the CPU a whole new motherboard, and therefore a whole new computer, had to be purchased. In recent computer models "daughter cards" have been used to lift the CPU off of the motherboard, allowing CPU's to be swapped and upgraded more easily as they fall out of date.

The **BUS**, actually the Data Bus, is the pathway by which data moves from the CPU out to the rest of the computer. Faster Busses are better, but even a fast Bus is slow by today's MHz standards. Most busses currently run between 80MHz and 160MHz.

HARD DRIVE The hard drive is the main storage unit of the computer. Hard drives are usually measured in Gigabytes. Currently 4 to 12GB hard drives are standard.

VRAM CHIPS control the number of colors available to a computer's monitor. Some computers with very little VRAM (say 256K) can only support screens with 256 colors or less while some with lots of VRAM (say 16MB) can support millions or even billions of colors.

RANDOM ACCESS MEMORY (RAM) is high speed, temporary storage (…as opposed to the permanent storage space of disks and drives) used for quick access of open programs and documents. RAM is generally volatile which means that it is erased or lost when the computer is shut down.

If the CPU is the brain of the computer then RAM chips are the oxygen which feeds the brain. The more RAM a computer has, the more the computer can think about. Each program which is open requires some of the computer's RAM to function. If a program can't get enough RAM it will not function properly. If a computer doesn't have enough RAM it will work slowly.

To see a display of RAM usage click on the desktop and select Apple Menu >> "About this Computer."

RAM is usually measured in megabytes (MB). Five years ago a computer with 24 Megs of RAM was a powerhouse, today a computer with 32 Megs of RAM is a bit below standard (to put it politely).

RAM chips are expensive and come in many sizes and flavors. Different computer models require different kinds of RAM and each computer only has a certain number of slots in which to insert RAM. When purchasing RAM be careful to know your computers capabilities and plan for possible future RAM expansions. RAM chips currently come in sizes from 32 to 256MB.

LEVEL 2 CACHE is a confusing thing, basically this is a chip which stores frequently used instructions for quick access by the processor. A Level 2 Cache allows the computer processor to bypass the relatively slow system bus.

There is no data available on exactly what good a Level 2 Cache does, but everyone agrees that it speeds up processor activities, often significantly. A hefty size for Level 2 Cache is currently 1 or 2 Megs.

There are now several kinds of Level 2 Cache, the best being backside Cache, the middle being inline Cache, and the worst (but still good) being regular Level 2.

DISKS AND DRIVES are storage units which are inserted into the computer, attached to the computer, or housed within the computer itself. Drives are simply really formidable disks. Any Disks or Drives which are currently available to a user will appear on the desktop as graphic icons. To open a Disk/Drive click on it twice, a catalogue of the Disk's/Drive's contents will appear.

STARTUP DISK In the Upper right hand corner of the desktop, but below the menubar, is a symbol for the disk or drive which was used to set the computer into operation. This disk contains a folder called the System Folder which contains programs the Macintosh needs in order to run.

FLOPPY DISKS originated as large flimsy plastic envelopes which held floppy magnetic sheets. Now though, floppy disks are usually small hard plastic cases which can survive a good throw across the room. (Don't try this at home.) The cases hold a magnetically readable and writable disk which can be damaged by spills or close proximity to strong magnetic fields. Airport X-Ray machines will not hurt disks. These disks spin at a rate of 300rpm when they are being written to or read from.
- DSHD: High Density Disks hold 1.3M
- DSDD: Double Density Disks hold 800K

HARD DISKS or **HARD DRIVES** are individual rigid disks (or stacks of rigid disks) and the drives that house them. A hard disk generally stores more than 500MB (megabytes) of data. Most of today's computers come with a large internal hard drive housed within the computer's body. The computer's internal hard drive is a moderate speed drive which spins between 3600rpm to 7200rpm when it is read from or written to.

CD-ROMs are large capacity, low cost read only storage devices. They can hold up to 600MB of information, but can only be written on once using a special CD Writing machine. CD ROMs are generally slower than hard disks, but faster than floppies. CD ROMs are not magnetic, instead they use light to record and store information as small dents. Lasers read the reflections created by the dents.

REMOVABLE DRIVES In recent years there has been a trend towards high capacity removable storage devices. Many of these high capacity drives have speeds rivalling traditional hard drives. These drives have removable disks which store between 100MB - 2.5G of data. Due to low cost and ease of use and expandability, several of these drives are now popular throughout the graphic design, fine art, technical production and print industries. Within this category would be ZIP and JAZ drives as well as Magneto Optical drives, and Syquest Drives..

DVD DRIVES Just over the horizon in drive technologies is the Digital Video Disk or DVD. These disks can hold up to 18 Gigabytes of data and are being used by the movie, music and computer industry. The MacOS is the first System to offer native DVD support.

GRAPHIC TYPES On computers there are two primary types of graphics: bitmap and vector. Both of these graphic types are used constantly on your computer without much worry. For instance the icons on your desktop are bitmap images while graphs and charts are usually made of vector images. Text on your screen is often created out of bitmaps but text which has been printed is almost always based on vector images.

Although vector and bitmap images are used together seamlessly, each graphic type has very specific uses, characteristics, benefits and faults. Understanding graphic types can help you to make the most out of your computer and the works you create on it.
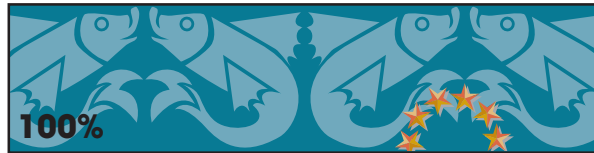
VECTOR GRAPHICS An image which is made up of "discrete" objects and lines is known as a vector drawing. The shapes (sometimes called object-oriented graphics) which make up vector drawings are created by connecting mathematically defined points with line segments to create finished images.

Objects which are vector based remain separate from each other in an image. The benefit of this is that vector objects may be selected, altered, reshaped or resized at any time without loss of image quality. In the images at right both the fish and the stars are vector images; as the images are scaled, the stars are moved around on top of the fish. This would not be possible using Bitmap images which are defined by groups of pixels rather than distinct shapes.

Vector images are created by drawing programs like MacroMedia FreeHand, Adobe Illustrator and Deneba Canvas; they are great for logos, fonts (text), scientific drawings, 3D models, graphs, etc.

Vector shapes tend to be characterized by large solid areas (like the ones shown at right) and lines. They do not recreate the gradual tonal and color shifts of photography well. (This limitation is gradually being overcome as drawing programs introduce more sophisticated gradients, curve and path tools; but for the time being photographic imagery remains the purview of bitmap imagery.)

Because they are mathematically defined, vector images are infinitely scalable. This is a great benefit because they will look good at any size whether on a pencil or the side of a bus. Vectors may be scaled to any size, edited any number of times and mutated in any way without any loss of image quality. One final benefit of using vector images is that they take very little room to store, usually a vector image will take less than one Megabyte of disk space to save.

100%

200%

400%

800%

13

BITMAP GRAPHICS An image which is made up of individual pixels is called a bitmap or raster image. Bitmap graphics use individual colored pixels to define an image rather than the mathematical points and paths used by vector images. Bitmap images are used in painting and photographic programs like Adobe Photoshop or MetaCreations Painter.

When an image is scanned into the computer it becomes a bitmap image. Bitmap images are great for photographs and realistic imagery. The one great limitation of bitmap images is that they are "size dependant" meaning that they are made to be viewed at a certain physical size. If a bitmap image is blown up (as in the example at right) it will begin to look choppy or pixilated.

For a bitmap image to be of photographic quality it must have a resolution of at least 144 ppi (pixels per inch). This means that in each square inch of a photo-realistic digital image there are at least 144 x 144 or 20736 pixels. The huge number of pixels required to create a realistic high quality image make bitmap images very large and difficult to store. A single photo-realistic image which would print out at 20 x 24 inches can take up to 100 MB of disk space to store.

Bitmap images replicate painting and photography very well. When editing a bitmap image it can be smudged as if it was wet and filtered to create a painterly look. Bitmap images are intuitive to edit; they can be smudged like wet paint, filtered as if wind or rain has splattered the image, and objects can be blended into one another so that their edges combine. With bitmaps there is no worry about bezier curves or paths, editing is easy. Easy editing though can cause problems. Bitmap programs don't usually store objects as individual shapes (as in vector images) so that when an area is selected and moved (as with the circles at right) it leaves a blank space behind.

CONCLUSIONS Both bitmap images and vector graphics have their benefits and drawbacks. In the end it is up to the computer user to determine which type of program and which type of graphic is appropriate for each new project. Many programs now combine some form of vector and bitmap into their interfaces rather than seperating one type of graphic from another. Experiment with the programs you know to find out what graphic works where and when each one is needed.

100%

200%

400%

800%
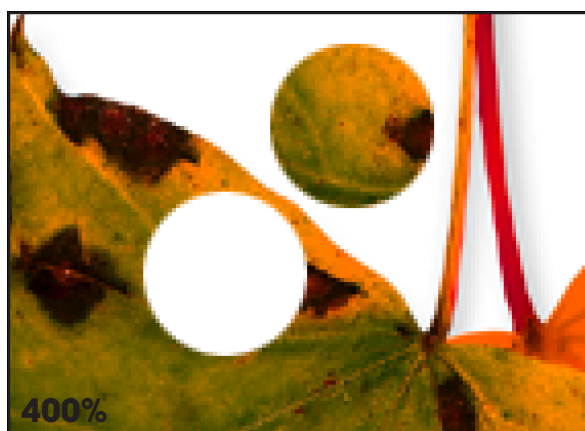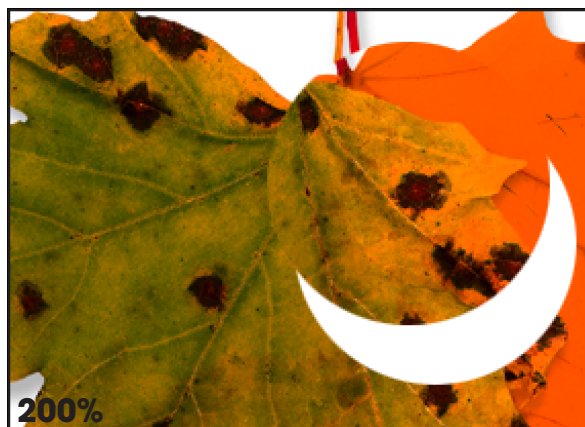
MEMORY and STORAGE MEASUREMENTS A computer's memory (RAM) and storage space (hard drives and disks) is measured using a binary number system. This number system is based on only two numbers, 0 and 1, instead of the decimal number system that we are used to which uses 10 numbers (0 - 9). A single binary cell known as a BIT is the smallest unit of information on a computer. A group of eight bits is called a BYTE.

The listings below should help you visualize what each of these measurements means.

- BIT is a single binary unit: on or off, 1 or 0, black or white.
- BYTE is a group of 8 binary units. Generally a byte can hold one alpha-numeric character.
- KILOBYTE or K is a measure of computer memory or storage space equal to 1024 bytes. One K of memory would hold just about all of the text which you have read on this page so far.
- MEGABYTE or MB is a measure of computer memory or storage space equal to 1024 K (1048576 bytes) (about 175,000 words)
- GIGABYTE or GB is a measure of computer memory or storage space equal to 1024 MB (1,073,741,284 bytes).

STORAGE SPACE and MEMORY Because both memory (RAM) and storage space (disks and drives) are described using binary measurements people sometimes get confused as to which one is currently being discussed.

Memory is the word usually used to describe a computer's Random Access Memory (RAM). RAM is a temporary high-speed storage place for programs and files which are currently in use by your computer. The amount of RAM a computer has determines how many programs or files can be open at any given time. RAM is measured in Megabytes.

Storage space is the disks or drives which are attached to or housed within your computer. Storage space is where programs and files are permanently stored when not in use. Storage space should never be referred to as "memory." Typically storage spaces might include a floppy disk (1.3 MB) a ZIP disk (94.6 MB) a CD-ROM (630 MB) or a hard drive (2 - 30 GB).

SCREEN DEPTH or BIT DEPTH is the number of bits of a computer's video memory (VRAM) assigned to each pixel on the screen or each sample point on a scanner.

- 1 BIT: 2 possible colors (black or white)
- 4 BIT: 16 possible colors
- 8 BIT: 256 possible colors or greys
- 16 BIT: 65536 possible colors (thousands)
- 24 BIT: 16.7 million possible colors

1 bit color

4 bit color

8 bit color

8 bit grey

16 bit color

24 bit color

15
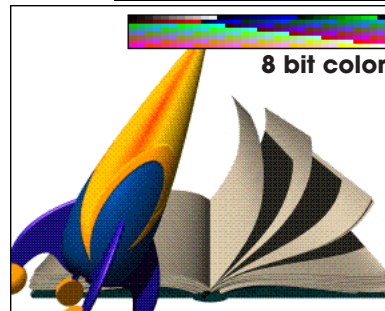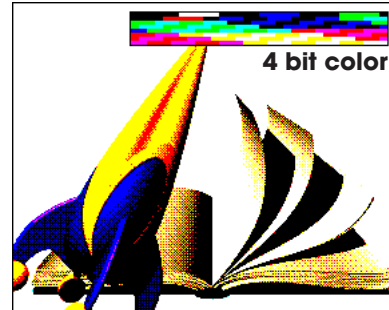
RESOLUTION in general, refers to how sharp and clear an image looks on screen or on paper, and how much detail you can see. Resolution is determined by the number of dots (or pixels) displayed per square inch - the more there are the higher the resolution. Resolution is used to describe quality in printers, monitors, and graphic images.

SCREEN RESOLUTION A PIXEL is the smallest element visible on a computer screen, therefore screen resolution is measured in Pixels Per Inch (ppi). Most computers have a screen resolution around 72 Pixels Per Inch (ppi) which means each inch holds about 72 x 72 pixels.For an image to look good on screen it should be saved at a resolution of 72ppi.

The problem with "Screen Resolutions" vs. "Print Resolutions" is that what looks good on the screen will not necessarily look good in print. Generally a photographic quality print must have a resolution between 144 and 300ppi. When a 300ppi image is viewed at full size (showing all pixels) on the screen it will appear much larger than it will in print.

In the examples pictured here images in the left column show "actual pixel dimensions" and images in the right column show "final print size."

Notice in the left column that as resolution increases the on screen viewing size also increases. This is because your computer displays images at a fixed number of pixels per inch (usually 72). As an image's resolution increases above this fixed number your screen scales the image display to accomodate the additional pixels. As an image's resolution decreases your screen reduces the on screen image display to reflect the smaller number of pixels.

PRINTER RESOLUTION Most printers use small dots of ink or toner grouped together in different concentrations to create shapes and images on a page. The more dots per inch that a printer can deliver the more realistic or continuous the tones and images it creates will appear. Laser and Inkjet printers generally have resolutions between 600 and 1440dpi.

Although dpi and ppi sound similar, they are not. There is NO DIRECT CORROLATION betwen dpi and ppi. A 600dpi printer will print at 600dpi regardless of the number of ppi in the image.

In the right column below, the same image is presented at different resolutions but is always kept at the same print size. Notice how the images with a higher pixel resolution (ppi) look better but use the same number of dot per inch (dpi) as images with lower pixel resolutions.

1ppi PRINTED

9ppi PRINTED

36ppi PRINTED

72ppi on SCREEN

72ppi PRINTED

144ppi on SCREEN

144ppi PRINTED