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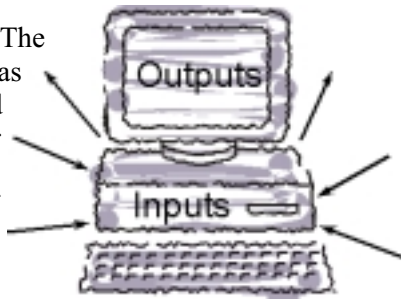
Cleveland Heights Teachers Union

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Using Your Computer - A study of Inputs and Outputs

Your computer's brain is a tiny chip called the processor - usually an Intel Pentium, AMD Athlon or Apple G4. It processes information stored temporarily in random access memory chips (RAM). This is the story of how you get information to the processor (inputs) and what you do with afterward (outputs).

Let's start with inputs. The home or school computer has traditionally been controlled by inputs from your keyboard and mouse or trackpad. The ability of your computer to interpret spoken words or handwritten instructions

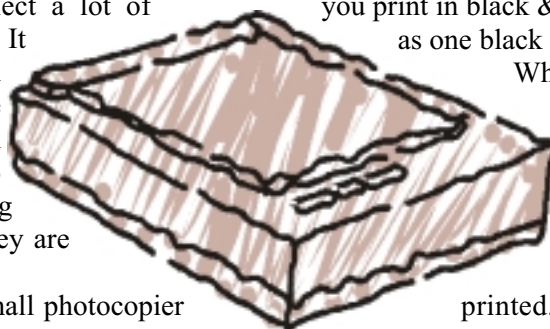


(rather than typed) has been under development for many years and is approaching the day when it may replace the keyboard and mouse for many purposes. The biggest stumbling block for inexpensive systems is speed and accuracy - if you have to do a lot of correcting it is no longer very efficient. Accuracy is related to both the quality/cost of the physical device that tracks your handwriting or records your voice and the software that interprets the digital information. The new palm and tablet computers are getting better at handwriting recognition. Limited vocabulary voice recognition has been available for a number of years but improves with a quality noise-cancelling microphone and some training time with the software. It can be very helpful for those with physical disabilities.

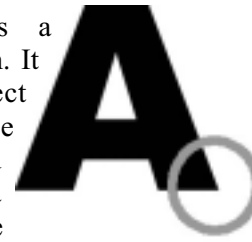
For the time being, the keyboard and mouse is still the preferred method for most people to interact with their computer.

As educators, we create and collect a lot of materials that we use in our teaching. It would be convenient to have them organized electronically so they can be easily retrieved, adapted and used in the classroom. There are two inexpensive means of inputting (digitizing) instructional materials. They are the digital camera and flatbed scanner.

The flatbed scanner looks like a small photocopier



and performs a similar function. It scans the object placed on the glass and converts it to a digital file. The



The file contains a representation of the object as tiny dots (pixels) with information on their color and brightness. These dots are digitized a row at a time and are often referred to as dots-per-inch (dpi). The more dots-per-inch the higher the quality of the image but also the more space is needed to store it.

Before scanning an object, consider the purpose(s) you will use it for. To display actual size on a computer screen you only need to scan at about 100 dpi. The typical computer monitor displays at 75-100 dpi. Scan at a higher dpi if you want to be able to enlarge the image. Most printed materials won't gain much by scanning at higher than 300 - 600 dpi. Because you are scanning in two dimensions (height and width), doubling the number of dots per inch actually quadruples the size of the resulting file.

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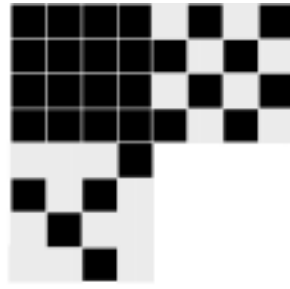
A common mistake when creating Powerpoint presentations is to scan the image at high resolution (300 - 600 dpi) and then import it into the presentation and reduce it to fit the screen. The original sized image file is still there and must be opened and then reduced in size by your computer each time you display it. This creates very large powerpoint files that are slower to display and difficult to use. You should either scan at a lower resolution to begin with or reduce the size of the image in a graphics program before importing it into Powerpoint.

Printers have a higher resolution than a monitor. When you print in black & white one dot in your file will print as one black dot or empty spot on the paper.

When you print shades of grey or color it gets more complicated. The printer represents those shades by creating an array (rows and columns) of dots to represent one pixel in the file. The darker the color of the pixel the more of the dots in the array are printed. If the printer resolution is high



shades of grey



*arrays of black dots
representing shades of grey*

enough - or you are far enough from the printout - your eye blends the dots together to create the impression of shades of color. In the printing industry, this printable resolution is referred to as lines per inch (lpi).

As a very rough guide for color or shades of grey, scan at 1/4 the resolution you plan to print at. Modern ink-jet printers can create 600 or more dots per inch, depending on the quality of paper you use. If you plan to print a color photo on ordinary paper at "600 dpi" - scan the image at 150 dpi. If you plan to print on photo paper at "1200 dpi" scan at 300 dpi. If you plan to enlarge the image you need to scan at a higher original dpi. If you are planning to take the file to a commercial printer, check for their recommended scanning resolution.

Newer scanner software will often handle the resolution settings for you based on the purpose you select from. If you are scanning for more than one purpose, scan for highest quality purpose and save a copy of the file at the reduced size needed for the Powerpoint or web presentation.

Inexpensive digital cameras have a lower resolution than scanners. For display on a computer monitor as part of a presentation or web page this may not be a problem. If you intend to enlarge or print the image, then resolution becomes more important. Consumer digital cameras are sold based on the total number of pixels they can capture for one image. A typical camera image is slightly wider than higher - the same as your tv screen. A digital representation of your tv screen is 720 pixel wide and 480 pixels high. This is equivalent to about 160 dpi for printing and will look ok as a 3" x 4" print. The first digital cameras could capture this many pixels in shades of color using a less than 1 megapixel digitizing chip (CCD) and were often intended to display on a tv or computer screen. New consumer cameras can double, triple or even quadruple that resolution allowing



you to enlarge an image and/or print at higher quality. The trade off is that you will be able to save fewer images before you run out of storage space in the camera and need to change memory cards or download the images to your computer. Some cameras can save to a micro-disk or floppy disk instead of or in addition to a memory card. Floppy disks are only appropriate for low resolution images as they do not hold very much data. Floppies are easy to share, making them useful as a common camera for a group of students — but less important for a camera used by one person at a time.

Digital video cameras record 720 x 480 pixels per image - 30 images (frames) a second. The problem with viewing or printing a still image (frame) from a digital video camera is that the camera actually interlaces alternating scanned lines to help blend the changes in motion between each frame for your eye. This reduces the quality of still images. Some digital video cameras have a still mode that does not interlace the lines creating a better still image at the expense of the impression of motion.

Light is also important. Although many digital cameras work in low light situations, the image will not be as sharp or colorful without a flash or external light source. Different types of lighting produce different colors to the eye. A typical incandescent light bulb has a reddish tint, while fluorescents have a greenish tint compared to sunlight. You can adjust for this using a camera setting - sometimes called white balance.

Traditional film cameras can record more information on a small piece of film than consumer digital cameras are capable of. That is why you can enlarge a film image and it still looks good. The quality of the camera lens, exposure and the film determines the resolution you will get. As digital cameras improve their resolution, the quality of the lens on the camera will become more important.

The zoom lens on a digital camera is often advertised with two enlargement ratios, optical and digital. You should ignore the digital zoom and only compare the optical zoom ratio. The digital zoom feature does the same thing as enlarging the image afterwards in a graphics editor. You will begin to see the individual pixels that made up the original image. It is usually best to turn the digital zoom feature off on your camera.

Next month, I will cover ways to edit scanned graphics or convert scanned text from an image into an editable document that you can update.

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