

Resolution:

A clear understanding of the term "resolution" is a critical to digital photography and digital imaging. Many people (including professionals) have only a cursory knowledge of resolution, and often give unclear or limited information about digital images.

Pixel (Picture Element):

A pixel is the basic unit of a digital image. Computers understand images as a series of discrete elements with a numeric value representing their color. A good analogy would be to compare a digital image to the old Lite-Brite toys, where each pixel represents one peg on the Lite-Brite (for those of you young enough not to have been subjected to pre-electronic toys -- <http://www.hasbro.com/litebrite>)

DPI (Dots Per Inch) or PPI (Pixels Per Inch)

DPI is a term for how Dots (elements) appear in an image per inch. Designers who work mainly in print often refer to DPI when they use the term resolution (example: an image is 300 DPI).

However DPI alone is not enough to fully describe a digital image. Knowing the DPI of an image tells us nothing of the overall dimensions. A postage stamp scanned at 300 DPI would be a much smaller file than a poster scanned at the same DPI.

Image dimension x DPI = image size

1" x 1" at 300 DPI = 300 pixel by 300 pixel image (90,000 pixels)

24" x 36" at 300 DPI = 7,200 pixels by 10,800 pixels (77,760,000 pixels)

To describing a digital image simply by its DPI (without specifying the size the image is to be printed) would be like if someone asked you, "How far is El Paso?" and you answered, " Oh...75 MPH."

DPI is an important factor when it comes to scanners and printers because it tells how fine of detail they can capture/print per square inch of image. However the physical dimensions of an image are arbitrary to the computer itself. It is better to describe a file by its pixel dimensions, for example you would say an image is 640 X 480 or 1024 X 768.

Standards:

Screen or Web Quality: 72 DPI/PPI

Magazine quality: 300 DPI/PPI

Changing dimensions for outputting in Photoshop

Image > Image Size

- Pixel Dimensions
- Document Size
- Scale Styles
- Constrain Proportions
- Resample Image

• To preserve the image's resolution (PPI), check the Resample box. This adds or subtracts pixels and is Destructive.

• To change the image's resolution while changing sizes, deselect the Resample box. This redistributes the pixels and is not destructive.

Megapixels:

Digital cameras are often described in terms of Megapixels; simply put a Megapixel is equivalent to one million pixels. Obviously the higher the Megapixel rating of a camera the higher resolution image it can capture and therefore the larger you can make a quality print.

- 1 Megapixel = up to 800 X 600 image
- 2 Megapixel = up to 1600 X 1200 image
- 3 Megapixel = up to 2048 X 1526 image
- 4 Megapixel = up to 2272 X 1704 image
- 5 Megapixel = up to 2560 X 1920 image

(These dimensions are in the ratio of 1.33:1)

Bit Depth

Because computers use numbers to describe the color of each pixel in an image, the size of the file can vary based on the size of the number used. Computers think in terms of Bits (1's and 0's), depending on the number of Bits assigned to each pixel determines the number of colors it could possibly be. Here are some basic examples:

- 1 Bit = 2 possible colors (black or white)
- 8 Bit = 256 possible colors
- 24 Bit = 16,777,216 possible colors

Colors on the computer are typically described in terms of RGB, meaning their Red, Green and Blue components. These primary colors can combine to make any color in the entire color wheel. A 24 Bit image actually assigns an 8 Bit number to each of the Red Green and Blue values allowing 256 possible shades of each. Thus 256 shades of Red, 256 Shades of Green, and 256 Shades of Blue make a possibility combination of over 16 million colors.

Obviously the larger the number to describe each pixel will increase the size of the file, so this too can be an important factor in describing an image. The proper way to describe a file would be by its pixel dimensions and its Bit Depth. For example you would say an image is 640 X 480 8 Bit, or perhaps 1024 X 768 24 Bit.

To go back to our analogy of the Lite-Brite, resolution would be the number of columns and Rows of holes you have in the board, and Bit depth would be then number of different colors of pegs you have.

Note that in this class we will be using 24 Bit images to have a great range of color while maintaining a reasonable file sizes and work flow. Many Professional Photographers shoot RAW files, which contain 48 Bit color information. Lower Bit depth images are smaller files and thus tend to be used more in web design and such.

Image Compression:

Obviously large images at high color depth can add up to rather large files. For example a 2048 X 1536 24 Bit images would be over 9 megabytes. However most computer images have a great deal of repetition of color (not every pixel in the image is a unique color). Image compression is a mathematical way of simplifying the way the image is stored as a file. While there are several formats an image can be saved in, there are basically two types of image compression; Lossless and Lossy.

Lossless Compression: Lossless forms of compression (such as TIFF files) look for repeated patterns of color and reduce the number of colors saved accordingly. Because only exact matches of color are combined, there is no real loss of quality in the image when the file is uncompressed.

Lossy Compression: Lossy forms of compression (such as JPEG) use a more aggressive approach and begin to average blocks of similar color into a single color. Because blocks of similar color are reduced to a single color when the file is saved, the quality of the image will suffer when it is uncompressed. File formats such as JPEG often allow you to choose the level of compression sacrificing image quality for smaller file size. A "high quality" JPEG setting will usually have a file

compression of from 1:2 to 1:4, while a “low quality” setting can have as high as a 1:10 to 1:20 compression ratio. High quality JPEG settings will reduce files somewhat, and the quality loss can be almost unnoticeable. However low quality JPEG settings will produce greatly reduced file sizes but have a dramatic affect of the quality of the image.