Resolution in Digital Photos

**Resolution**

*Resolution refers to the degree of definition in an image* – that is, how much detail one can see in a given amount of space. File resolution is often expressed as file size. But the size of the file for a given resolution depends on the depth (number of color shades) of information assigned to each pixel.

Adding to the richness of the understanding of resolution, we can also remember that each device has its own resolution or range of resolutions. For example, monitors are usually set at or near 72 dpi (dots per inch). When you display a 1-inch by 1 inch, 144-ppi image on a 72 dpi monitor, the image fills a 2-inch by 2-inch area of the monitor screen. With this in mind you can predict how big your picture will appear on your web page for example, if you don't resize them. Furthermore, resizing a picture by dragging the handle and holding the shift key to maintain proportions can mean you are adding unnecessarily large files to your media.

- Here are some **guidelines** for using digital photos for your web pages:
    - For Web graphics file size is everything.
    - The Web is a low-resolution medium.
    - The Web is color sensitive.
    - All browsers support Gif and jpeg files.
    - High bandwidth is no excuse for inefficiency.

**File formats for the Web**[1]

JPEG (Joint Photographic Experts Group) / Lossy compression; supported by JPEG, TIFF, PDF, and PostScript language file formats. Recommended for continuous-tone images, such as photographs. To specify image quality, choose an option from the Quality menu, drag the Quality pop-up slider, or enter a value between 0 and 13 in the Quality text box. For the best printed results, choose maximum-quality compression. JPEG files can be printed only on Level 2 (or later) PostScript printers and may not separate into individual plates.

GIF / Graphics Interchange Format (GIF) is the file format commonly used to display indexed-color graphics and images in hypertext markup language (HTML) documents over the World Wide Web and other online services. GIF is an LZW-compressed format designed to minimize file size and electronic transfer time. GIF format preserves transparency in indexed-color images; however, it does not support alpha channels.

PNG / Developed as a patent-free alternative to GIF, Portable Network Graphics (PNG) format is used for lossless compression and for display of images on the World Wide Web. Unlike GIF, PNG supports 24-bit images and produces background transparency without jagged edges; however, some Web browsers do not support PNG images. PNG format supports RGB, indexed-color, grayscale, and Bitmap-mode images without alpha channels. PNG preserves transparency in grayscale and RGB images.

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[1] See also **FlashPix® File Format (.FPX)**
Most file formats present photographers with a dilemma. Low-resolution images are fine for display on the Web but high-resolution images are much better for printing and publishing. Large high-resolution files make both editing and display time-consuming. The **FlashPix**® format developed by Kodak, Hewlett-Packard Company, Live Picture Inc., and Microsoft attempted to solve these problems. Images in the FlashPix format are stored at multiple resolutions, and each resolution is further subdivided into square tiles.

Here are **four ways of expressing image resolution** in pixels (picture elements):

a. As **ppi** (pixels per inch). This is a linear measurement.

b. As an **array**, such as 640x480 (pixels is understood)

c. As a total **number of pixels**. This is the result of multiplying the pixel (or dot) dimensions of the array. Thus a 640x480 image would be 307,200 pixels.

d. As the image's **file size**. This is the result of multiplying the pixel dimension of the image by the pixel depth (in bits) of the image and then dividing that by 8 (the number of bits in a byte).

**File Size Predictor**:

| pixel dimension | times | bit depth (1, 2, 8, 16, 24. etc.) | divided by 8 (no. of bits in a byte) | equals | file size |
|---|---|---|---|---|---|
| 640x480 | X | 24 | /8 | = | 921,600 (or 920K) |
| | X | | /8 | = | |

Another factor that affects file size is file format, so the above calculations will be more accurate in an uncompressed file format such as RAW[2]. Due to varying compression methods used by file formats such as GIF, JPEG, and PNG, file sizes can vary considerably for the same pixel dimensions. Similarly, in addition to color bit-depth, the number of layers and channels in an image (and the bit depth required to carry this additional information) affect file size.

Many file formats use compression to reduce the file size of bitmap images. Lossless techniques compress the file without removing image detail or color information; lossy techniques remove detail.

**Bit Depth** and number of colors.

| Number of bits per pixel | Number of colors |
|---|---|
| 1 bit | 2 colors |
| 2 bits | 4 colors |
| 3 bits | 8 colors |
| 4 bits | 16 colors |
| 5 bits | 32 colors |
| 6 bits | 64 colors |
| 7 bits | 128 colors |
| 8 bits | 256 colors |
| 16 bits | 32,768 high color |
| 24 bits | 16.8 million (true color) |
| 32 bits | Billions |
| | |

[2] When an image sensor captures data for an image, some cameras allow you to save the raw, unprocessed data in a format called CCD RAW (.CRW). This data contains everything captured by the camera. Instead of being processed in the camera, where computing power and workspace is limited, the raw data can be processed into a final image on a powerful desktop computer. The increased power and workspace can make a significant difference in the results. In addition, you can save the raw data and process it with other software or in different ways. When the raw data is processed in the computer into a JPEG or other image, it's a "one size fits all" form of processing and the RAW data is discarded. In the final file, not only has some of the original data been changed, some has also been deleted.