

Color and Bit Depth

The term bit depth is used when referring to raster images produced by programs such as PhotoShop and PhotoPaint. What it refers to is the number of colors available to each pixel within the image. Remembering that raster images are composed of an area of pixels, and that each of these pixels has their own color information, the more shades of colors that an image has the more information that is necessary to create the image. This has serious implications on image quality and file size. The higher the bit depth, the more colors that are available to each pixel and the larger the file size. It is important to understand bit depth when creating graphics for desktop publishing, digital presentations, and web designs.

Bit depth is a product of the color palettes used by raster programs. These are each based on the binary code that a computer uses to operate. For example, one bit files, or bitmap files, consist of either black or white pixels, the original options that computers had when they were developed. Now bit depth is divided into the following categories, and is based on black, white and the three color channels of red, green, and blue.

Bit Depth	Number of Colors Available per Pixel
4 bit color	16 colors (2^4)
8 bit color	256 colors (2^8)
8 bit grayscale	256 shades of Grey (2^8)
24 bit color	16 million colors* (2^{24})
30 bit color	1 billion colors* (2^{30})
36 bit color	Billions of colors* (2^{36})

*24 bit color is defined as 3 color channels per pixel. Each color channel, one red, one green, and one blue, is made up of 8 bit color, for a total of 16 million colors. The terms 30 bit and 36 bit refer to formats that have an increased number of bits per RGB color channel available (i.e.: 10/12 bit per channel for 30 bit), that gets interpolated back down to 24 bit color for processing. In essence, these formats have a larger number of shades available to them for the original analysis of the image, like when you are scanning, and these shades will then make up the palette for the interpolation back to 24 bit color.

What an increased bit depth allows you to do is to create accurate interpretations of images due to the increased amount of shades and tones available. But the effect this has on file size is straightforward. A 24 bit color image that is then saved to 8 bit color will be 1/3 the size, because there is 1/3 the amount of color information in the image. Some file formats, such as .gif, only support 8 bit color as a means to control file size.



An 8 bit indexed color image
(GIF, 71 KB)



A close-up of the gif at left. The blocky appearance is due to the limited color palette of an 8 bit image (256 colors)



A 24 bit RGB color image
(JPG, 65 KB)



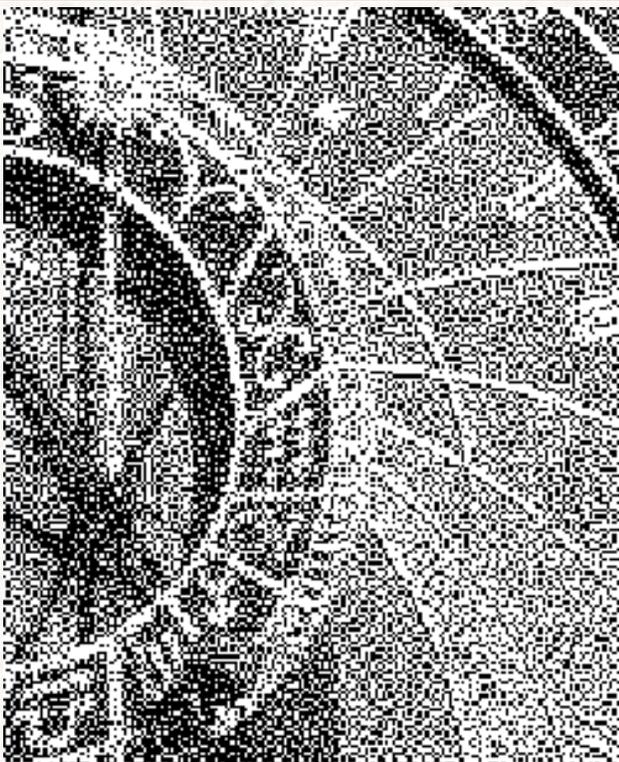
A close-up of the jpg at right. Notice the smooth gradations in color made possible by the wider color palette (16 million colors). This is especially evident in areas with subtle color changes (ie: the black and blue bands). Compare to the image above, which appears blocky even though they were created from the same original, and are both at the same resolution and image size.



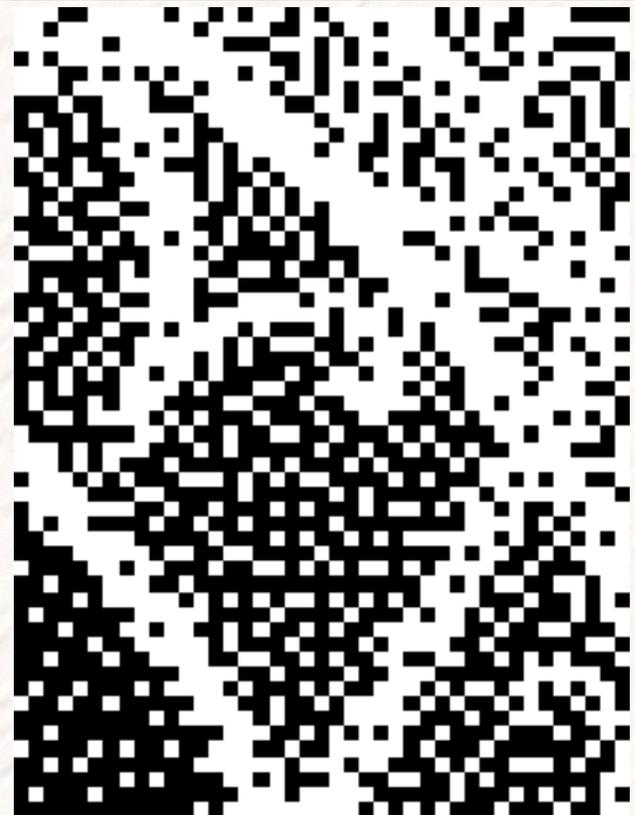
A grayscale image at 8 bit color depth.
(JPG, 35 KB)



Close-up of the grayscale image. Notice that there are black, white, and shades of grey making up the image.



Greyscale image converted to bitmap image at 96 dpi
(GIF, 11 KB)



Close-up of bitmap image. Notice that there are no tones of grey, all pixels are either black or white

Color depth needs to be taken into consideration during all phases of the project, for it does affect the quality of

the final output. Web graphics are generally done in 8 bit color, because there is a wide discrepancy between monitor and graphics adapter capabilities (hence the use of gifs on the web). Also, printing is affected by bit depth. If you have a 24 bit image printing on a 8 bit color output device, the device has to dither the image in order to simulate the other colors, negatively affecting image quality.