

# RESOLUTION AND FILE SIZE

Digital Imaging

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A good understanding of image resolution is imperative in digital imaging. Resolution is the basic principal behind digitizing and outputting photographs or any kind of artwork or text. Without understanding how resolution works at the beginning of your process you may find that the end result does not live up to expectations. Here are some terms you need to know that will help you understand how resolution works.

**Pixels/Dots** - In traditional analog photography, film emulsion is made up of tiny pieces of silver. When you look closely at a photograph you can see the texture of the silver which we call "grain." Pixels are the equivalent of film grain in a digital image. They are the smallest unit of information in a bit-mapped image. The term 'pixel' actually refers to two different things. They can be the bits of digital information that makes up your image (in the file); or they can be the tiny units of light on your computer screen. Dots are similar to pixels but are created by printers on paper.

**Bit Map/Raster** - A digital graphic file comprised of a grid of pixels. All digital photographs and some digital graphics are bit maps (or raster graphics). A bit mapped image will lose quality when enlarged or transformed.

**PPI/DPI** - Resolution is measured as either pixels or dots per linear inch (or sometimes centimeter). Resolution doesn't tell you the total number of pixels in the image, but is a measure of pixel or dot density.

**Image Size** - Independent of DPI/PPI, image size is simply the dimensions of the image in pixels, inches, centimeters, picas or whatever you set your preferences to. The image size determines how big the image will be when it is outputted (printed).

**RGB** - Red, green and blue are additive colors because adding all three together creates white. RGB images are what we use in Photoshop because RGB color has the broadest color range available. Computer monitors also use RGB because each pixel on the screen is capable of emitting varying amounts of red, green and blue light in order to render the intended color.

**CMYK** - Cyan, magenta, yellow and black are subtractive colors because removing all four creates white. We rarely use CMYK color in Photoshop because it has a much narrower color range than RGB. All color printers use CMYK inks even though we usually print our images as RGB files. People who use large, commercial offset printers for printing magazines, books and newspapers, will often work with images in CMYK mode.

**Bit Depth** - Digital images are usually made up of one, three or four channels. An RGB image has three channels (red, green blue), CMYK has four (cyan, magenta, yellow, black) and a grayscale image has one (black). Bit depth tells us how much information (in bits) per channel our image has. This aspect of the anatomy of a digital image is not readily visible so you can think of it as a 'third dimension' of information below the 'surface' of the image.

The bigger the bit depth, the more colors or shades of gray the file will be able to render. It will also increase the file size. Photoshop was originally designed to work with 8 bit images, which means that each channel holds eight bits of information and is capable of rendering 256 different tones. The total bit depth of an RGB image in 8 bits would therefore, be 24 bits (3 channels x 8 bits = 24 bits) and the total number of renderable colors is 16.7 million (256 x 256 x 256 = 16.7 million). A CMYK image would be 32 bits deep.

The newest versions of Photoshop are also able to handle very large 16 bit images. This increases the number of renderable colors and/or shades exponentially but is only double the file size of an 8 bit image. So an RGB, 16 bit image would have a total bit depth of 48 bits (as opposed to 24 bits in an 8 bit image), and would

take up twice as many kilobytes, megabytes or gigabytes on your disk (see file size).

**File Size** - File size is how much storage memory your file occupies on your disk and depends entirely upon how much information is in your image. 'Information' is the total number of pixels and total bit depth of an image. The total pixels in an image depends on both ppi and image size (pixel density x area = total number of pixels). Bit depth will vary the file size depending on what bit depth mode the image was captured in (8 bit or 16 bit), and what color mode is being used (grayscale, RGB or CMYK). We measure file size just like we do any other kind of file in KB, MB, GB, etc.

Resolution + Image Size + Bit Depth + Color Mode = File Size

**Resampling** - Once you have scanned an image or captured one with a digital camera, the file size has already been set. The device has captured a finite number of pixels. Resampling happens when the file size (not image size) is changed, thus changing the total number of pixels in the image.

**Down-sampling** - When an image is resampled to a smaller file size than it was originally captured at. If resampling is necessary, this is the way to go because there is no loss of quality. It is usually best to capture your image larger than you need it and then down-sample it.

**Up-sampling** - When an image is resampled to a larger file size than it was originally captured at. This is not recommended because it requires that the computer makes up pixel information that wasn't originally there (see interpolation). Up-sampling causes a loss in image quality and is not usually recommended.

\*If absolutely necessary, the newest versions of Photoshop let us get away with a little upsampling with almost no noticeable difference. Images captured with a digital camera (particularly in camera raw mode) upsample much better than images scanned from film or print.

**Interpolation** - When the computer makes up information in order to fill in missing spaces created by image alterations such as up-sampling.

**Bicubic** - This is the best resampling mode to use. It is an algorithm the computer uses to reconfigure the image size and resolution of an image. If you have to interpolate, this is the best way to do it. Always make sure you are set on bicubic if you are resampling an image.

**Screen Resolution** - Computer monitors have a relatively low resolution at 72ppi. Because the internet is viewed on computer screens this is the resolution used by web designers.

**Print Resolution** - The best photo printers lay down tiny, oval-shaped dots of ink at either 1440 or 2880 dots per linear inch. Your image doesn't have to be at such a high resolution but it is recommended by some that your image resolution for printing be dividable into the printer resolution of 1440. High quality prints are renderable by most high-end printers at 360ppi, 240ppi and 180ppi. The old rule of thumb for printing was 300ppi, which still works fine, although some people will argue that the 'divisible' method renders fine detail better.

# THE IMAGE SIZE DIALOGUE BOX

Using the Image Size dialogue box is a good way to get a handle on how resolution, image size and file size relate to each other. I suggest spending some time changing the settings around to see how the other settings are affected. The most important thing to remember is to never let the file size get bigger than the original (in this case 38.9MB). You can find the Image Size dialogue box under the Image menu at the top of the Photoshop workspace.

## PIXEL DIMENSIONS

This is the width and height of your image in pixels. This is usually most useful for web designers but can also be helpful when sizing captures from digital cameras.

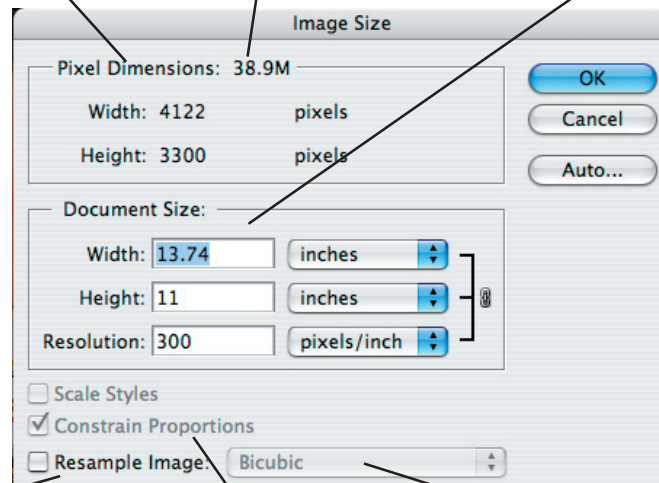
## FILE SIZE

This is the amount of storage space (memory) your file occupies on your disk. If you increase or decrease the file size, a new number will appear with the original number displayed next to it. To avoid upsampling, make sure the new number is smaller than the original.

## DOCUMENT SIZE

The most important information in this dialogue box. It gives you the Image Size, as Width and Height, and the pixel resolution. Each setting is individually changeable, but the other settings may be affected depending on whether the Resample Image or Constrain Proportions boxes are checked.

You can also change the units the dimensions and resolution are measured in. Each unit box has a drop down menu featuring inches, cm, mm, picas, points, columns or percent. Resolution can be rendered in pixels per inch or pixels per centimeter.



## RESAMPLE IMAGE

When this box is not checked, your file size will stay the same. You can alter width, height or resolution and the computer will adjust the other settings accordingly to keep the file size the same. Check this box if you want to create a smaller file size (down sample) or if you need to upsample a bit.

## CONSTRAIN PROPORTIONS

Can be checked or uncheck during resampling. When checked, it will keep the image from stretching by altering one dimension if the other dimension is changed. If unchecked, it will allow only one dimension to be changed at a time which may lead to stretching or compressing of the image.

## RESAMPLE FORMULA

This box allows you to choose the type of resampling you would like to apply to your image. The best formula for resampling is **BICUBIC**. There is no reason to ever change this setting. If you are in the digital lab, it is worth checking to make sure it is set correctly.