

# Graphics Info

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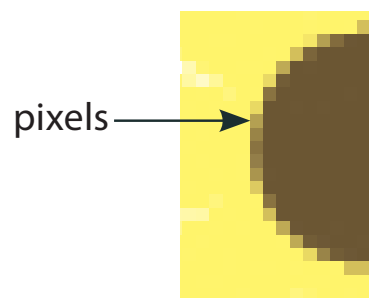
## Graphics Info

All computer based images fall into one of two categories: **Raster** or **Vector**

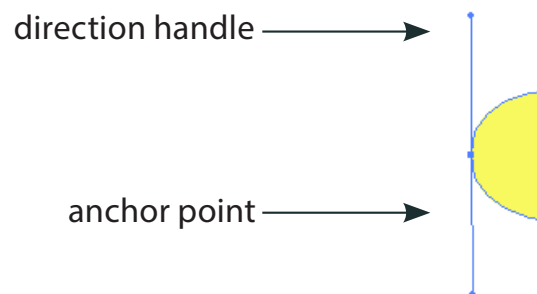
**Adobe® Photoshop®** is the most popular **Raster-based** editing application. Photos (*typically*) are made up of **pixels** (*a raster image may also be called a **Bitmap***).

**Adobe® Illustrator®** is the most common **Vector-based** drawing application (*vector images may also be called **Bézier Curve***). Vector graphics consist of lines and curves, defined mathematically, and are made up of **points**. Vector images have **no resolution**. Vector drawings typically have smaller file sizes than Raster photos. Vector images and can be printed at 2% or 2,000% without a quality loss

### Raster (*pixels*)



### Vector (*points*)



Raster or Bitmap	Vector or Bézier Curve
<ul style="list-style-type: none"> <li>The image resolution made up of <b>Pixels</b> (<i>it is measured in pixels per inch, ppi</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Has <b>no</b> resolution and is made up of <b>Points</b></li> </ul>
<ul style="list-style-type: none"> <li>Images typically <b>can not</b> be <b>scaled</b> up beyond 120% or they become “jaggy”</li> </ul>	<ul style="list-style-type: none"> <li>Printed images will look good at 2% or 2,000%</li> </ul>
<ul style="list-style-type: none"> <li>Raster images are usually much larger than vector</li> </ul>	<ul style="list-style-type: none"> <li>Vector images are typically smaller than raster at the same size</li> </ul>

## How Resolution Affects File Size

Every time you double the resolution of a Raster image, the file size gets 4x bigger. Here are some sample file sizes:

8.5 x 11 • 72 ppi • RGB = 1.39 MB

8.5 x 11 • 150 ppi • RGB = 6 MB

8.5 x 11 • 300 ppi • RGB = 24 MB

8.5 x 11 • 600 ppi • RGB = 96 MB

These file sizes are for flat PSD images, when you add layers the file grows larger.

## Transforming Raster Images

If you take an image that starts at a decent laser printer resolution, for example 150 ppi, then scale it down and decide to scale it up again later, significant quality loss occurs.

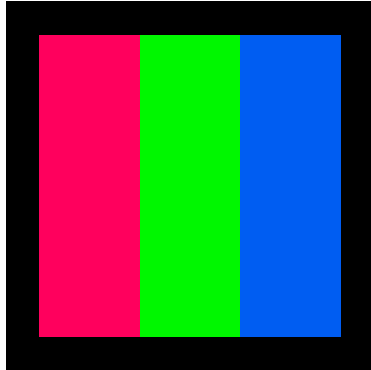




## Color Modes

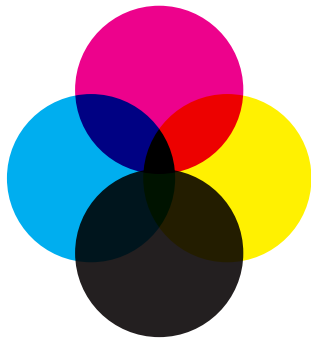
There are two primary color spaces for images: RGB (*Web Only*) and CMYK (*Print*).

### RGB



RGB (*Red, Green and Blue*) is used primarily for web-based images and is known as **Additive** color. RGB is measured in Color Levels from 0 - 255, for a total of 256 shades.

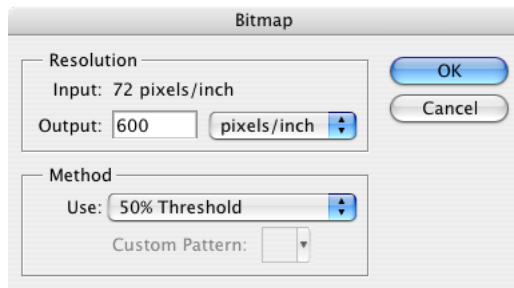
### CMYK



CMYK (*Cyan, Magenta, Yellow and Black*) are the four primary print colors for all printing presses and color printers. CMYK is known as **Subtractive** color and is typically referred to by printers as **Process** color. CMYK is measured in Percent from 0% - 100%.

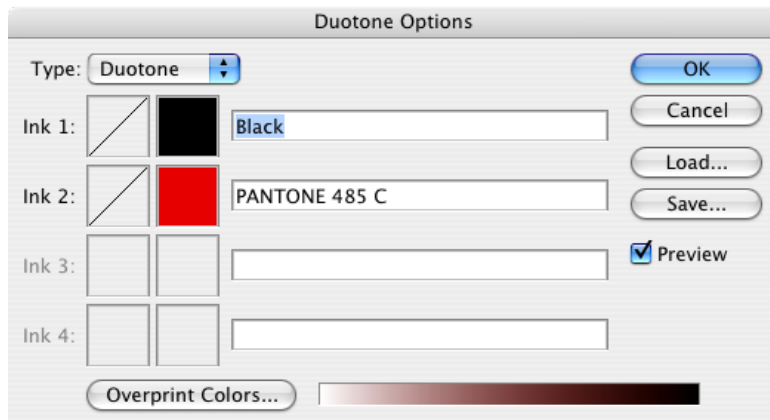
## Bitmap/Line Art

Other print modes include **Bitmap**, which includes **no shades of Gray** instead it's black or white only. Truly Bit on or Bit off, hence the name Bitmap.



## Duotone

When dealing with less expensive (*commonly two color* , also known as *spot color*) print jobs the use of Duotone mode may be necessary. In order to convert to Duotone, you must first go to **Image > Mode > Grayscale**, then choose **Image > Mode > Duotone**.



## Resolution Formula

The formula below is to be used for all Grayscale, RGB and CMYK images.

2 x Line Screen = Ideal Resolution

1.5 x Line Screen = Minimum acceptable Resolution

### Practice

LPI = 85 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

LPI = 100 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

LPI = 133 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

LPI = 150 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

LPI = 175 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

LPI = 200 Ideal = \_\_\_\_\_ Minimum = \_\_\_\_\_

## Common Line Screens

Newspaper = 85 — 100 lpi

Magazine = 133 — 175 lpi

Coffee Table Books = 200 lpi and up

## DPI vs PPI

**DPI** (*Dots Per Inch*) technically refers to dots in an inch, also called **spi**. **PPI** (*Pixels Per Inch*), usually refers to scanned resolution. It is displayed in Photoshop under image size and is also called **dpi**. When referring to hardware resolution, **SPI** (*Spots Per Inch*) is more technically accurate. PPI is a better method of differentiating between hardware and software terminology. PPI would mean software, SPI would mean hardware, unfortunately DPI is used commonly to describe both.



60 lpi



150 lpi

## LPI

**LPI** (*Lines Per Inch*) refers to **Halftone Screen** or **Line Screen** or **Frequency**. When printing on offset presses, gray ink is not actually used. A screen is created of black dots that trick the eye into seeing shades of gray and simulate continuous tone. Fewer lines in an inch create lighter shades of gray. More lines in an inch create darker shades of gray.



## After the Scan

Determining Proper Resolution after an image has been scaled.

Starting PPI  $\div$  Scaling %

Example:  $300 \text{ ppi} \div 200\% (2) = 150 \text{ ppi}$  • or  $300/2 = 150$

### Practice

PPI = 100 Scaling = 200 % New Printed Resolution = \_\_\_\_\_

PPI = 200 Scaling = 150% New Printed Resolution = \_\_\_\_\_

PPI = 300 Scaling = 50% New Printed Resolution = \_\_\_\_\_

## Resolution vs Quality



**30 ppi ▪ 12 KB**



**72 ppi ▪ 28 KB**



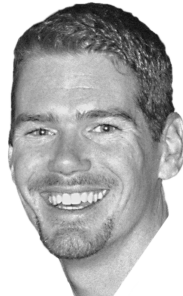
**100 ppi ▪ 40 KB**



**225 ppi ▪ 144 KB**













**300 ppi ▪ 240 KB**



**500 ppi ▪ 644 KB**

## Exception to the Rule

LineArt/Bitmap is the exception to the scanning rule. All LineArt images should be scanned at 600 – 1200 ppi. You may go as high as your imagesetter output resolution, for example 2400 or 2540 ppi.

		100 ppi • 16 KB
		300 ppi • 76 KB
		600 ppi • 284 KB
		1200 ppi • 1 MB
		2400 ppi • 4.2 MB

## Graphic File Formats

It is important as a graphics professional to choose the correct format for the intended use of the image. Here is a summary of the most popular file formats.

### Print Formats

#### PSD

Adobe® Photoshop™ Document is the default file format for newly created images with layers. This encoded format is the only one that supports all available image modes (*Bitmap, Grayscale, Duotone, Indexed Color, RGB, CMYK, Lab, and Multichannel*). As well as other features such as guides, grids, alpha channels, and layers (including adjustment layers).

#### TIFF

TIFF (*Tagged Image File Format*) was developed by Aldus Corporation as a standard for images created by scanners. TIFF is one of the two primary print applications. TIFF is used for black and white (bitmap), grayscale, indexed, RGB and CMYK.

- Always smaller than EPS (unless the EPS is JPEG compressed)
- Can do LZW (Lossless) compression
- Whites are transparent in Bitmap (LineArt) by default

#### Lempel-Ziv Welch compression

LZW was designed by Terry Welch in 1984 in hardware for high-performance disk controllers. It is a variant of LZ78, one of the two Lempel-Ziv compression schemes. LZW compression and decompression are licensed under Unisys Corporation's 1984 U.S. Patent 4,558,302 and equivalent foreign patents.

## EPS (not recommended today)

EPS (*Encapsulated PostScript*) is a platform-independent graphic file format that is supported by most illustration and page layout programs. An EPS file has two parts, PostScript code that describes the image and a graphic used as the on-screen preview. When printed the PostScript portion of the file is sent to the output device. When printing to a non-PostScript printer, the preview is printed instead. An EPS can be **Raster** (*made of Pixels*) or **Vector** (*made of Points*) EPS is usually larger because it can store special things in the header of the file that TIFF can not.

Those things are:

- A Clipping Path (*Silhouette*), this can be done on TIFF's now
- Spot Colors, such as Pantone®
- JPEG Compression (*inside the EPS file, not raw JPEG*)
- DCS (*Desktop Color Separation*), 5 file format which pre-separates the images in the file structure
- Transfer Function (*Curve*)
- Fixed Line Screen (*to override what is sent by the Page Layout program to the output device*)
- Photoshop EPS also supports transparent whites in Bitmap mode.

An used to need to be in EPS format to support these color modes: Monotone, Duotone, Tritone or Quadtone. PSD now works better for these. You may still need to go back to EPS for a fixed line screen or a custom transfer curve.

*Note: Save the EPS with a **TIFF preview** (also known as PC format). The Mac OS 72 ppi PICT preview is stored in the file's resource fork. Since Windows applications cannot read the Mac resource fork, a PICT preview does not display on Windows. Instead, the words "PostScript Picture" display on a gray background in the picture box. If you save the EPS on a Windows computer, choose a TIFF preview instead of a WMF preview.*

## DCS

Desktop Color Separation (DCS), was developed by Quark Inc. and it enables certain applications, such as QuarkXPress, to print Low Resolution placement files with separations off and High Resolution data with separations on. When you save a CMYK image in Photoshop EPS format, you have the option of saving the image as an extension of the standard EPS format. Saving in DCS format creates five files: one file for each of the color channels in the CMYK image and a fifth master file corresponding to the composite color channel. To save the file in standard EPS format without the DCS option, choose Off. This method allows the RIP to process the file faster, because it is pre-separated.

## DCS 2

Same as the DCS listed above, except that it now supports more than four colors from Photoshop. DCS 2 also creates one file, instead of five separate files on your hard drive

## Web Formats

### PNG

PNG (Portable Network Graphic) has 2 flavors: 8-bit & 24-bit. The 8-bit format gives you up to 256 colors. The 24-bit format gives you all the colors of a JPEG (16,777,216) with the added bonus of transparency and animation. PNG can be larger or smaller than JPEG depending on the colors and the image itself.

#### Format benefits:

- Transparency
- Animation
- 16+ million colors (*in 24 bit*)

### JPEG (ok for print today)

JPEG (*Joint Photographic Experts Group*) is a **LOSSY** format that can greatly reduce the size of a file. If you do too much compression or save a JPEG many times you will experience **PERMANENT quality loss**. JPEG supports 24-bit color, grayscale, RGB, and CMYK. JPEG typically defaults to RGB color space (*and is the default format for most smartphones, tablets and digital cameras*). JPEG was designed for continuous-tone images, so it won't work well with line art (*logos & maps, for example*) or images that contain only a few colors. JPEG files cannot be transparent or have silhouettes, so they will **always** appear **rectangular** on a web page or device screen.

#### Format benefits:

- Millions of Colors
- Smaller file size with higher compression settings

### GIF

GIF (*Graphics Interchange Format*) is an older, highly compressed format that is dying off today and being replaced by PNG. GIF has three main benefits. The first benefit of GIF is interlacing. Interlaced images do not need to be completely downloaded before a user begins to see the image on a web page. GIFs start by showing a very low-resolution version of the image. Then, the image becomes gradually sharper as more of the image is downloaded.

The second benefit of a GIF is the ability to have a transparent background (*or silhouettes*). The last benefit of a GIF is animation. GIF images are stored in Indexed color space and should **NEVER** be used for print.

## Formats to Avoid

### PICT

The PICT (*Picture*) format is widely used among Macintosh® graphics and page-layout applications as an intermediary file format for transferring files between applications. The PICT format is especially effective at compressing images that contain large areas of solid color. This compression can be dramatic for alpha channels, which often consist of large areas of white and black. When saving an RGB image in PICT format, you can choose either a 16-bit or 32-bit pixel resolution. For a grayscale image, you can choose from 2, 4, or 8 bits per pixel. If you're using a Macintosh with QuickTime installed, you can also choose from four JPEG compression options for the file.

### BMP

The BMP (*Bit Mapped Paint*) format is widely used among office based PC users. BMP is typically in RGB (Red, Green, Blue) color space and low resolution (72 ppi). This should be avoided by people who want to print. It is acceptable for on-screen use only. BMP contains black&white, 16-color, 256-color and Truecolor image data. The palletized 16-color and 256-color images may be compressed with run length encoding.

### WMF

The WMF (Windows MetaFile) format is also widely used among office based PC users, it was developed by Microsoft. WMF is typically in RGB (Red, Green, Blue) color space and low resolution (72 ppi). This should be avoided by people who want to print. It is acceptable for on-screen use only. It file consists of a set of Windows specific instructions to draw a Vector (point-based) graphic. This is an nice format for image interchange between Windows applications, but is not very useful on other platforms.