

Scanning and Graphics

There are two fundamental types of computer graphic.

Type of Graphic	Made of...	Called...	Edited with...
Vector	Lines and curves, solid colors	Drawing	Illustrator, Freehand, Canvas, Powerpoint, Word
Bitmap/Raster	Photos, scans	Painting	Photoshop, Canvas, ImageReady, Painter, Fireworks

In this workshop, we'll be looking at bitmap graphics exclusively.

RESOLUTION has three meanings. It's measured in **PPI** (pixels per inch) on a computer screen or when scanning. Scanners can handle 600 ppi or more; computer screens usually display 72–100 ppi. When printing, we use **DPI** (dots per inch), referring to dots of ink or toner. Laser printers are about 600 dpi, while commercial printing presses are more like 2400 dpi. When printing photographs, called halftones, a third measure is used—the **LINE SCREEN**, or lpi. The different sized spots that make up a newspaper photo are arranged in lines diagonally across the page; hence, lines per inch. Newspapers print at 85 lpi, most magazines at 133 lpi, and high-quality books at 200–250 lpi.

You can **CHANGE RESOLUTION** in Modify > Image, but it's more important to know the final size you want to print the image, and how many actual pixels it contains. Resolution is just size divided by pixels. Scan things at the right size and pixel number from the beginning. For computer screens, base your pixel number on how much of the screen you want to fill (e.g., a 400-pixel-wide photo on an 1000 × 800 screen.)

How much resolution? It depends, but no more than necessary! For photos to be **PRINTED**, the rule of thumb is ppi = lpi × 1.5 (more if sharp-edged, less if fuzzy)—so a photo for a 150 lpi journal would be fine at 200–300 ppi. For black-and-white **LINE DRAWINGS**, use the dpi of your printer but no more than 1200 ppi. For Powerpoint or the **WEB**, anything much over 72 ppi is wasted, but scan higher if you want to tweak it first in Photoshop. For a **POSTER**, use a significantly lower resolution: people see it from further away.

BIT DEPTH is the number of different shades of color. **ONE-BIT** is two colors, black or white (yes, white is a color, and so is black). One-bit is used for line drawings, woodcuts, and the like. **EIGHT-BIT** is 256 shades of gray, as many as the human eye can discern; grayscale to computers, “black and white” photos colloquially. And **24-BIT** is 256 shades each of red, green, and blue, the primary colors on a computer screen (but not in print), which makes just over 16 million shades. The **RGB** model used on computer screens can generate colors impossible to print, and vice versa. What's on your screen will not match the printed output! A printing press can't handle RGB files: convert to **CMYK** before you send them out (Photoshop can do this, but some programs can't).

When **SCANNING**, work out the print size, resolution, and thus number of pixels you need, and scan just a little higher so you can edit and trim it down in Photoshop. Try to think in terms of pixels, not size. Resizing after scanning will increase or decrease the density of pixels and thus the resolution. Always scan originals; scanning printed photos (which have a line screen)

Most people use dpi when they really mean ppi.

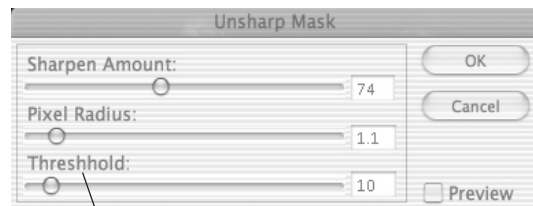
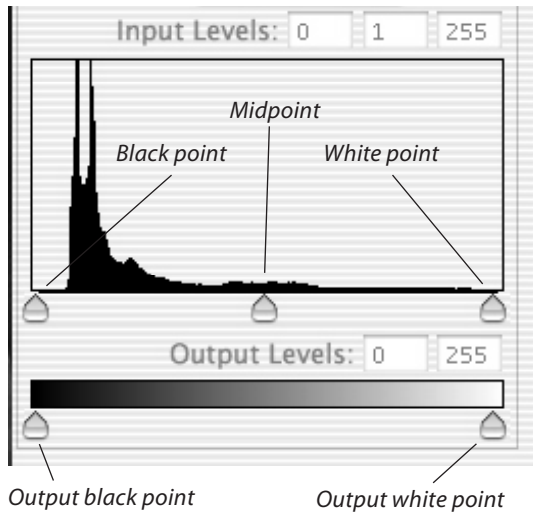
Reducing resolution is fine, but it's pointless increasing it; you can't get more pixel information for free.

$$\begin{array}{c} 800 \\ \boxed{\text{pixels}} \\ 500 \end{array} \quad \begin{array}{c} 4'' \\ \boxed{\phantom{\text{pixels}}} \\ 2.5'' \end{array} = \frac{800}{4} = \frac{500}{2.5} = 200 \text{ ppi}$$

The number one problem with Powerpoint and posters is a huge file size caused by needlessly-high-resolution graphics. More is not better.

Four-color in the printing trade, “full color” colloquially, means the primary colors cyan, magenta, yellow, and black, abbreviated confusingly as CMYK.

In Photoshop, Image > Adjustment > Levels:



Yes, they can't spell.

Further reading:

The Non-Designer's Scan and Print Book • by Sandee Cohen and Robin Williams • Peachpit

Real World Scanning and Halftones / Real World Photoshop • both by David Blatner et al. • Peachpit

Make Your Scanner a Great Design and Production Tool • by Michael J. Sullivan • North Light Books

Please feel free to email me comments, suggestions, questions, and complaints.

can cause nasty **MOIRÉ** interference patterns. These can be reduced by dithering, but it's iffy.

Desktop scanners almost always produce muddy, fuzzy images, which have to be fixed. Digital cameras are sometimes guilty too. You need to know how to brighten colors and sharpen edges for almost every photo you work with.

To bring out the dark tones of a photo, **ADJUST LEVELS** (Brightness and Contrast are too crude). Bring your left and right sliders in to the edge of the histogram so the darkest tones turn black and the lightest white. Move the midpoint slider left a little to bring out the dark tones, if it seems to help—about 1.2 is good. Bring in the left and right output sliders in a smidgen, because on most printers extremely dark and light gray usually revert to solid black and white.

The only non-hazardous way to sharpen is the strangely-named filter **UNSHARP MASK**. It has three settings. **AMOUNT** should be 50% to 150% depending on whether the has a few sharp edges or lots. Choose a **RADIUS** of between 1 and 2 to start; high-resolution images may need a larger radius, as may low-contrast ones. The **THRESHOLD** determines how large a transition needs to be before it gets sharpened. Try 10–20, with a larger threshold for photos with lots of skin tones, which suffer if sharpened.

LAYERS are useful when assembling a complex image. Photoshop generally has one thing per layer. Layers can be locked, made invisible, and shuffled into a different stacking order. They can be duplicated to make a basic image with one component that varies. Before you can save a file as a **TIFF** or for the web, you have to flatten the image (which merges all layers into one and throws out invisible data).

There are a number of file formats used with bitmap graphics. **PSD** is Photoshop's own format, and makes for large files but preserves miscellaneous information like levels—best to save backups and working copies in this. Don't forget to save all your original scans somewhere safe! **TIFF** is the best format for print publication. There are Mac and PC **TIFFS**, compressed and uncompressed; it's smart to ask your printer which they prefer. **JPEG** is the standard format for photos on the Web, because it compresses them so well (with a little loss of detail); for the same reason, digital cameras tend to use it too. For print publishing, it's better to convert to **TIFF**. **GIF** is a web-only format, for graphics with large areas of solid color (usually vector graphics). Usually low resolution, and not good for printing. In general, graphics you steal from the Web are only 72 ppi, far too few for printing, though they look good on screen. Google Image search will display pixel dimensions; by knowing the lpi, and thus desired dpi, you can choose one large enough. Generally, though, you will need to shoot or scan your own photographs.

Photoshop and ImageReady have numerous options for **EXPORTING** an optimised GIF or JPEG, ready for the Web. In other programs, you will usually have to make sure the resolution or pixel dimensions are correct, flatten the image, make sure it's RGB, and then save it as a JPEG, with a file name ending in .jpg (no caps). Make sure you have a backup of the original scan or photograph!

There are about one million fancy filters and effects that come with bitmap graphics programs, and plenty of books full of Stupid Photoshop Tricks, but 90% of your problems will be solved if you memorize how resolution, bit depth, and file type work. Have fun! ♣