Scanning Tips

Principles of scanners

Scanners are similar to copy machines. An image is placed on the scanner surface (bed), light passes over the image and converts the information to digital data (pixels, or picture elements, in most cases). Most scanners use *charged-coupled devices* (CCD) to capture the changes in the light of the scanner. The more sensors in the scanner, the higher the possible resolution of the scans. CCD scanners create RGB files.

Drum scanners are high end scanners that do not use CCDs, but use *photomultiplier tubes* (PMT) instead. Drum scanners create CMYK scans.

Original images

Reflective scanners accept images that appear as light reflects off of them, such as photographs, paintings and objects.

Transmissive scanners accept images that are transparent, such as film, slides and acetate.

Some scanners scan both reflective and transmissive originals.

Bit depth

Bit depth refers to how much color information the scanner can capture. The higher the bit depth, the larger the size of the file.

1-bit:	captures only line art
8-bit:	captures grayscale in continuous tone, or 256 colors (not continuous tone)
24-bit:	captures RGB with continuous tone (8 bits for each channel—red, green and blue)

Resolution

The resolution of bitmapped images is measured in dpi (dots per inch) or ppi (pixels per inch). The higher the resolution, the larger the size of the file.

The *optical resolution* of a scanner refers to how much detail the scanner can truly capture. The optical resolution is expressed by 2 numbers, such as 600 x 1200. The first number is the number of pixels per inch of information that the scanner can capture in a horizontal direction. The second number refers to the number of steps the scanner head moves along the vertical direction. The actual resolution of the image is the first number (the pixels per inch).

You may see scanner resolution expressed as the *interpolated* or *enhanced* resolution. This means that the scanner software tries to create an image with a higher resolution than it can optically. This does not increase the actual resolution, but might allow scaling of the image with less noticeable degradation to the image. In general, stick with the true optical resolution for best results.

Knowing the printer output resolution (DPI, for laser and inkjet, or LPI (lines per inch) for printing presses) will determine the optimum resolution for the input file. The rules of thumb: 1/3 DPI and 2 x LPI are industry standards. The TB-112 printer is a 600 dpi laser so 1/3 of that is 200 ppi which is roughly the best input image resolution for that printer. If you have greater than 200 ppi resolution the printer will take more time processing the file due to its size and may begin decreasing the quality of the print because it resamples the file to "fit" its output resolution.

It is best to scan at the resolution needed for the final output (or higher). Resolution cannot be increased after the initial scan without losing image dimensions (height and width) or losing quality (the image will become fuzzy). Resolution can generally be decreased with ease after the initial scan, so it is better to start high, rather than low.

For the printers in TB 112, the minimum recommended file resolution is 200dpi. If your final image print size will be letter size (8.5" X 11") or smaller, then a final image resolution of 300dpi or even 600 dpi is a good idea. Professional printers may recommend files at 300dpi. The larger the file, the slower your editing process will be and the longer it will take to print.

Screen resolution refers to the resolution of a monitor, generally 72dpi. Graphics for the web are typically 72dpi and therefore are too low in resolution to print well. Web graphics have also been saved as JPEG or GIF, so they have compression—another reason not to use web graphics for print. They do not look good in print.

Scaling/Image dimensions

The best way to scale (resize) an image without losing quality is to select the desired size when making the initial scan. If an image is scaled after the initial scan, the editing program, such as Photoshop, will resample the data (add or throw out extra pixels), and loss of detail will occur. Scaling down is not as noticeable as scaling up. Enlarging the dimensions always results in visible degradation to the image.

Scaling with the proportion box checked will scale the image proportionally so that the width and height ratio remains constant and the image does not get distorted.

File Formats

Bitmap files (also called *raster*) sort pictures as matrices (rows and columns) of pixels, each pixel having a particular gray or color value (color or bit depth). These include TIFF, Tag Image File Format (.tif); BMP, Windows Bitmap; MacPaint and PCX, PC Paintbrush.

Some bitmapped formats have *compression* (an algorithm used to lessen the size of the file). JPEG, Joint Photographic Experts Group (.jpg), and GIF, Graphics Interchange Format (.gif), are two such formats, both created to transfer files quickly across networks and to be viewable in web browsers.

The compression on JPEG files is considered *lossy*, meaning that once a file is compressed as JPEG, the original quality can never be recovered. In fact, each time a JPEG file is resaved, more data is lost, forever.

GIF is an 8-bit file format, meaning that it saves files with continuous tones of grayscale, or a limited palette of 256 colors. Once the color data is discarded as an image is saved as GIF, it cannot be recovered.

Vector files contain sets of mathematical instructions for drawing objects—usually geometric shapes, such as lines, ellipses, polygons, rectangles, and arcs. These include DXF (Dynamic Exchange Format) and EPS (Encapsulated PostScript).

Native files can be read usually only by a particular program, such as Photoshop (.psd), or Illustrator(.ai).

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The low down: NEVER EVER EVER EVER save original scans or other graphic work as JPEG. Always save original scans as TIFF (.tif), a file format that works well for print, or save as PSD if scanning into Photoshop. Always save original artwork in the native file format, such as PSD or AI. This is the file that can continue to be edited and changed because it contains the layers and effects, etc. When a scan is first opened to be worked with, ALWAYS save the file under a new name, most likely in a native format (such as PSD). NEVER save over your original scans. Treat them like negatives and work from them, but do not save changes to them. When a file is completed, use File > Save As (or File > Save for web) to save a *copy* of the original file in the required format for output.
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Sharpening

Sharpening is an effect that compensates for slight blurring in an image by adding contrast to the edges within the image. This effect will cause the image to look pixilated if overdone. In general, sharpening while scanning is not recommended because there are no available adjustments to control the amount of the sharpening. After the scan is created, it can be opened in Photoshop and the following filters can be applied:

Filter > Sharpen > Sharpen
Filter > Sharpen > Unsharp Mask (this one allows the most control, try a setting of 50, or 100 for lower contrast images)

Contrast and color control

Most scanning software offers contrast and color control. In general it is best to get the scan to look closest to the original and to make the contrast and color adjustments later in an editing program, such as Photoshop.

Preparing to scan

1. Make sure the scanner bed is clean (or use some glass cleaner and a soft cloth to clean it)
2. Use the best original (free of dust and fingerprints) (Use glossy originals over matte originals)
3. Straighten the image (any adjustments after the original scan, to straighten the image, etc., will degrade the quality of the original scan)
4. Avoid any vibrations or motion to the scanner as it is scanning

Scanning

1. Place the original on the scanner bed
2. In Photoshop, choose File > Import > *name of scanner* (Note: In TB 112 you will be scanning with the EpsonScan Utility, not in Photoshop)
3. Choose preview
4. Choose the bit depth and resolution (based on the final output requirements)
5. Choose the color mode (such as grayscale or RGB)
6. Choose the scaling (remember you can only scale up from the original image when you scan, so if you are going to need the image to be larger than the original size, now is the time to determine dimension size and to set the proper scaling)
7. Make sure that sharpening is not selected (see note on sharpening above)
8. Drag a marquee around the area to be scanned (Note: Use option-delete to remove previous marquees)
9. Choose final (the scanner will scan the image and open it in Photoshop)
10. Save the original scan as a TIFF by choosing File > Save as, write a descriptive name (such as *beach.tif*) and choose the file format TIFF

Moiré patterns

When scanning from a magazine, newspaper, or any printed image, moiré patterns are often inadvertently created. One method to get rid of a moiré pattern is to open the scan in Photoshop and choose Filter > Noise > Despeckle. If this filter is applied to each channel individually (by choosing each channel individually in the Channel palette), there is more control of the effect and less blurring of the image as a result.

Another common way to deal with a Moiré pattern is to scan at a higher DPI (say 300dpi) and then reduce the image to a lower DPI (say 200dpi).

Copyright

Copyright gives a creator exclusive rights to profit from creative work that he or she created for a set period of time. After this time, the work becomes public domain. Just because scanners are readily available (and there are many images on the web that are easy to download), you do not have the right to use work that was created by others (and others do not have the right to use work you have created).

An Image does not have to have a copyright notice to be protected by copyright. Just because someone made it, it is protected by copyright.

The low down: Images created prior to 1978 become public domain 28 years after their creation, unless the copyright is renewed, which would entitle them to 47 additional years of protection. Images created on or after January 1, 1978 are protected for 75 years after their creation. Unpublished works are protected for 50 years after a copyright holder's death.

When using images for completion of educational projects, one generally does not need to obtain/purchase copyright permission for reproduction as is necessary for commercial use of imagery, art and design work. Still, it's good practice to credit the maker as if you paid for use of the image.

For more information:

http://www.law.cornell.edu/usc/17/overview.html

Dettig, Ronal. *Intellectual Property in the Information Age*. Boulder, CO: Westview, 1996