

Working With



IMAGES



Instructor: ____ David Welsh
Company ____ Explainamation
Phone: ____ (248) 548-7643
Fax/Data: ____ (248) 548-8959
Email: ____ david@explainamation.com

by David Welsh

The author retains all rights. Reproduction, other than as a PDF download from our Web site for personal use, requires the author's permission.

EXplainamation

Copyright 1995, 96, 2002 © by Explainamation

DIGITALIMAGING

Glossary

Aspect Ratio

The ratio of the width to the height of a picture. If a program maintains the aspect ratio it means that the width changes when you change the height or the height changes when you change the width.

Bi-level

A graphic file type in which each bit in the file is either a one or a zero representing either a black or a white dot in the picture. Pictures scanned as line art are saved as bi-level files. Halftone and dithered photographs are bi-level files.



*bi-level
bit map*

Bit

One memory cell, one binary digit. A bit is the smallest piece of information a computer can handle. A bit is either on or off.

Bit Map

An arrangement of bits into a picture in which each bit represents a pixel (picture element). The pixel is white or black depending the state of the bit that represents it. Grayscale and color files are often called bit maps even though they are really pixel maps and not bit maps.

Bits Per Pixel

The number of bits used to record the brightness of a pixel. The more bits per pixel, the more shades of gray or the more colors a pixel can have. A bi-level file has one bit per pixel. A grayscale file can have four or eight bits per pixel. A four bit file can store 16 levels of gray; An eight bit file 256 levels.

BMP

The file format used in Windows and OS/2. BMP files can be 1, 4, 8, or 24 bit formats.

Bytes

Memory is organized into bytes which contain eight bits. A byte will store one character of text or a value from 0 to 255.

Contrast

The degree of difference between the light and dark areas of a picture. A picture with low contrast looks soft, washed out, weak or muddy. A high contrast picture looks hard, with few tones between black and white.

Crop

To crop a picture is to eliminate parts of the picture that are not considered important or that distract from the main subject.

Deskew

A software feature that straightens images that have been scanned at an angle.

Dither

The simulation of shades of gray by mixing black dots with white dots in different proportions. The term is also used to indicate the use of two colors to create a third. This is done by mixing dots of each of the colors to create the appearance of a third color.



Double Exposure

In photography, exposing two images on the same section of film, or exposing the same image or two images together onto photo paper. In computer imaging, combining the tones of images to simulate a double exposure.

EPS

Encapsulated PostScript (EPS) is a graphic file format that can be sent to a PostScript device. An EPS file can contain text, vector graphics, or images. Generally, PostScript files can only be used with PostScript output devices.

Equalization

A software feature that distributes the gray levels in a picture to equal intervals between white and black.

GIF

A file format used for both color and black and white images; the standard format for CompuServe graphics.

Gray Level

A percentage of gray between white and black. While photographs can have "continuous tones" of gray, a computer image must express gray as a specific percentage. A computer screen, file, or output device has a specific number of gray levels it can handle. The more levels of gray, the more realistic the picture appears.

Digital Imaging Glossary

Grayscale

A range of gray levels from black to white.

Grayscale Scanner

A scanner that can scan a continuous tone original and create a grayscale file.



An 8-bit GIF grayscale

Halftone

A halftone is an image created by mixing black and white to create the illusion of grays. The term halftone comes from the printing trade. Since black and white pictures are printed using only black ink, grays must be obtained by a pattern of dots that vary in size to simulate shades of gray.



Course halftone

Imagesetter

A PostScript output device which produces a higher resolution output than most laser printers and can produce a photographic negative for making offset printing plates. Generally, imagesetters can produce 1200 DPI or higher output.

JPEG (Joint Photographic Experts Group)

An industry standards committee working on file compression standards and the set of standards they have defined. JPEG files trade off some image detail for data compression of up to 50 to 1

Moiré Pattern

An unwanted pattern that appears when you resize a halftoned or dithered image. The pattern is caused by one pattern being superimposed on another pattern of nearly the same size and distribution (frequency). During resizing, this happens because the software doing the resizing has to remove or add bits according to a computed pattern that interferes with the dither pattern.



Moiré Pattern

MPEG (Motion Picture Experts Group)

A motion picture group working on file compression standards for digital video.

PCX

An image format that can be black and white, color or grayscale; the native format for PC Paintbrush.

PEL

IBM's term for pixel.

PIXEL

A picture element. A pixel is the smallest element of a picture that is recorded in an image file. A pixel can be a black or white dot, a color, or a shade of gray depending on the type of image file. The resolution of a picture is measured by the number of pixels per inch.

PostScript

A page-description language, created by Adobe Inc., used by laser printers, imagesetters and other PostScript devices. PostScript printers are able to use grayscale information directly to create a halftoned image at the output device.

Resolution

A measure of the level of detail in an image or a measure of the capability of a device to represent detail. For an image, it should be expressed as pixels per inch (PPI); for bi-level devices such as laser printers, as dots per inch (DPI). In practice, many people use dots per inch for in both cases.

Scale

In graphics programs, to change the size of an object in a uniform way so that width and height change together and in proportion.

Sharpen

A software feature that sharpens edges in a grayscale image by increasing the difference between the gray levels of adjacent pixels.

Smooth

A software feature that works the opposite of sharpen.

Stitch

A software command that let you join two small images into a big one. It is used to join separate scans of a hand scanner into one large picture.

TIFF

A file format that stands for Tagged Image File Format. It is technically a metafile format but is used widely as an image format.

David & Theresa Welsh

Voice: (248) 548-7643

Fax: (248) 548-8959

EXplainamation

Email:

theresa@explainamation.com

david@explainamation.com

Technical Publishing • Presentations • Photography • Digital Imaging

Copyright © 1995 by David Welsh

Working with Images - Notes for Presentation

Two Type of Graphics

Vector - picture stored as a set of instructions to an output device as to how to draw a picture made up of lines and shapes and shadings.

Image (bit map/pixel map) - picture stored as pixels. Each pixel contains gray intensity or color intensity information for one dot in the picture. Pixels are "picture elements" and are arranged in rows and columns. Ideally, the pixels that make up the picture are too small to see individually.

Image Sources

- Paint (image editing) programs
- Digital Cameras
- Scanners
- Fax machines
- Screen captures
- Video frame grabbers
- Ray trace and fractal image programs
- Conversion from vector drawings

Types of Image Files

- Bi-level bit maps: black and white, no grays or color.
- Halftones: Bi-level bit maps arranged to produce a halftone screen when printed to provide an illusion of grays (not easily resized).
- Gray scales: Each pixel contains a number between 0 and 255 or between 0 and 16 representing a shade of gray between black and white. Most commonly used for scanning and storing black & white photographs.
- Color palette (8 bit): Each pixel contains a number between 0 and 255 that represents one of 16 million colors contained in a "palette". Also called "indexed color" because each byte is an index value pointing to a palette color. Based on the original IBM VGA specs.
- RGB True Color (24 bit): Each pixel is represented by three bytes that contain red, blue or green intensity levels between 0 and 255. True color files can represent all the colors that humans can see.

- Truer Color (24+): Color formats in which more bytes are used to represent each color for greater color latitude. Not generally found in desktop computing environments except internally in some scanners. Most common color file produced by color scanners.
- Metafiles: Files that can contain either vector of image information
- CYMK color files. Each pixel is represented by a byte containing an intensity level between 0 and 255 for the colors cyan, yellow, magenta, and black. These files are used as final output files to make and cyan, yellow, magenta and black plates needed for four color printing. RGB true color files need to be converted to CYMK files when preparing documents for the four color printing process.
- "Lossey" compressed files: Files that use a compression system that throws out some color information in order to get smaller file sizes. These files could be gray scale or true color files. When loaded into applications, they are decompressed to gray scale or truecolor. Lossey files include JPEG, fractal, wavelet and MPEG compression.
- files

Image formats

Formats are somebody's idea of how to arrange bytes in a file. Each format has header information telling programs the type of file, byte arrangements, compression method and other such information, then a string of bytes containing the image data.

- TIF (Aldus format)
- BMP (Windows)
- PCX (PC Paintbrush)
- JPG (JPEG)
- PCD (Photo CD)
- XWD (UNIX)
- GIF (CompuServe, WWW)

Image Output Devices

Output devices are either halftoning devices or continuous tone devices. Halftone devices use black or white dots to produces a pattern

of varying density to simulate gray. You'll get the best results outputting to a continuous tone device.

- Halftone devices
 - Laser printer
 - Wax transfer color printers
 - Inkjet printers (**modern inkjets vary dot size and density directly to some degree and so fall between halftone and continuous tone.**)
- Continuous tone devices
 - Video Monitor (onscreen presentation)
 - Dye sublimation printers
 - Film recorders (35 mm slides)

What is a Bit Map?

A bit map is an arrangement of picture elements in rows and columns to make a picture. In the case of gray scale and color pictures, they should be called "pixel maps" but are still widely referred to as bitmaps

What is Image Resolution?

Image resolution is the number of discrete picture elements per some distance measurement. Twice the resolution produces four times the quality. Devices usually measure resolution in dots per inch (DPI). File resolution is widely referred to as dots per inch but writers are beginning to use "pixel per inch" PPI.

How Does Resolution Relate to File size?

(Resolution x Width) x (Resolution X Height)
= Pixels (100x5) x (100 x 2) = 100,000

The more pixels, the bigger the file. File compression can reduce file size.

What is Color Depth?

Color depth is how much color information each pixel contains.

- Color Depths
 - Bi-Level (black & white): 8 pixel per byte
 - Gray scale (shades of gray): 1 byte per pixel
 - Palette color (4 bit 16 color): 2 pixel per byte
 - Palette color (8 bit 256 color): 1 byte per pixel
 - True color (24 bit 16 million color): 3 bytes per pixel, one byte per color

Scanning Concepts

What is TWAIN? - A protocol that allows scanning from within image editing (or other) software. It usually works from a menu item on the File menu called "Acquire." To use it:

- 1 First find a menu item called "select source". Sometimes this appears when you select "Acquire" but sometimes it's off the File menu. Sometimes it's found elsewhere (in New Jersey maybe). Look under "Scanners", "Setup", etc.
2. Select the scanner that you want to use. Usually, there will only be one or two to choose from.
3. Select "Acquire". The TWAIN driver for your scanner will start, giving whatever options it provides.
4. Set scanning options and scan. When the scan is complete, you will return to the application form whence you came. (Or in some cases, you click "OK" or "DONE" or something to return to your application.

(Windows 3.1 OCR packages and Windows 3.1 TWAIN drivers may not work with Win 95 applications. Older scanners may not work with Windows versions later than 95. Download the latest drivers.)

What is OCR? Optical Character Recognition — Software that scans a page and translates the image of the page into words — text that can be edited by a word processor. OCR packages usually control the scanner directly so setting scanning parameters is automatic or handled within the OCR package. Many OCR packages add themselves to word processor menus and can be started from that word process and insert the text into the word processor.

Scanner Settings - Most scanning software lets you do a preview scan and allows you to set resolution (DPI), contrast, tonal range/ color balance, cropping or sizing, and gives a choice of output file types and formats. Some software provides automatic scanning based on your choice of output device and what it thinks the image is, based on the preview scan. Like most intelligent automated processes, it's wrong a good deal of the time but often does the job if you are in a hurry.

Making a Smaller File - to make a file smaller:

- Save as JPEG, compressed TIF or other compressed format to save disk space. JPEG decompresses the file when it is loaded in an application.
- Reduce the size of the picture while keeping the resolution the same.
- Reduce the resolution of the picture.
- Reduce the color depth of the picture.

Of the above choices, using JPEG is the most effective.

Image Manipulation

Simple manipulations:

- Rotating
- Cropping
- Adjust the contrast
- Inverting the colors

Advanced manipulations:

- Shifting/Expanding tones
- Sharpening images
- Retouching flaws (painting out spots, cloning good areas to bad, eliminating scratches)
- Erasing parts of an image
- Adding Text or textures
- Masking images or combining image objects

Special Effects

- Posterize
- Warp
- Emboss etc.

Converting Formats

Most image editing software (Picture Publisher, Image Assistant, Photo Shop etc.) allow saving in different formats. An alternative is using a file conversion program such as Graphic Workshop, Hijaak, etc.

What do I need to know about converting image types?

Converting a 24 bit color image to an 8 bit paletted image or gray scale image throws away information that cannot be regained.

Converting an 8 bit or 256 paletted color image to a gray scale image throws away information that cannot be regained.

Converting a gray scale image to a bi-level bit map throws away information that cannot be regained.

Can I convert a black & white image to color?

Yes, but you will not gain any color information, only the potential to store it. One reason to convert gray scale to color to combine it with another color image. If it is a bi-level, you can substitute another color for black and/or for white. If it is a gray scale, you can tone the whole picture in one shade (as in sepia-toning a black & white photo) or add several tones. You can fill gray tones with various colors to produce a false color image.

Can I convert an image to a vector-based format?

You can make a vector drawing from an image (bit map) only by "tracing" it. An illustration program like Designer or CorelDraw will have a "trace" feature that will try to find the edges of an image and "draw" it. This works best if the image has simple clean lines. Trace programs don't always produce a vector drawing that's easy to edit even when they do produce something that looks like the original. If it works, the advantage is that the resulting drawing is device and size independent as far as resolution is concerned.

Can I work with an image in my illustration software?

Yes, you can import images into programs like Designer and CorelDraw. You cannot edit the image, but you can combine it with draw elements to create something new or to add it to a slide show. Images can also be "mapped" as textures into a drawing.

Can I convert a drawing produced in my illustration software into an image?

Yes, draw programs provide an "export" command, but you will no longer be able to edit the resulting export in the draw program (save a copy in the original vector format).

How do I catalog and keep track of my images?

Use a "thumbs" package that makes little thumbnail pictures you can view in a "file manager." Or get more sophisticated image data base software.

How do I add images to my applications?

In Microsoft applications (PowerPoint, Word, Excel), from the Insert Menu, choose *Picture*. Select the file type and highlight your file. It will be inserted on the current page. Other applications use *Import*, *Place*, or *Load* to bring in images. When using OLE2 enabled applications, you can often drag and drop an image from a "thumbnail" or "media manager" program into an application.

How do I get images on the World Wide Web?

Most web browsers can read GIF and JPG formats. You must size the image to fit in the space you want at a typical screen resolution (about 72 DPI), then reference it in the HTML code used on the Web.

TIP: screen resolutions are typically quoted in absolute terms rather than dots or pixels per inch. For example, standard VGA resolution is 640 pixels across by 480 pixels down. SVGA resolution is 800 by 600. If your image editor will give resolution information directly in pixels rather than pixels per inch, it's easy to see what the size of a picture will be in relation to a given screen size and resolution.

Some Web editing packages, such as Front Page, have resample features that make resizing easy.

Scanning tips

Scan at higher color depth: Sometimes you can get better results by scanning at a higher color depth and then reducing the color depth in an image editor. For example, scan color originals in color to get a gray scale result. Some color scanners scan through a color filter when scanning gray scale. This can lead to a distortion of the gray values. If the color filter used by the scanner is red, the reds will be too light in the black and white gray scale image.

Scanning in color and then converting to gray scale avoids this problem. (Downside is that it takes longer.)

Scan gray scale to get a black & white bitmap: You can scan a line drawing black and white image as a gray scale. The trick here is that it is easier to determine what

portions of the image will end up as pure white or pure black by experimenting with the image editor's "threshold" command or effect. When you have exactly what you want, convert it to a bi-level bitmap. (The downside is that it will take longer to scan, but this trick can save a bad original. Be sure and scan at a high resolution).

Scan at higher resolution for descreening:

Normally, you need only scan at 1.5 to 2 times your target image output device resolution. A 600 DPI resolution laser printer has an image resolution of about 80 so scanning a gray scale image at 160 PPI is more than enough. However, the use of certain algorithms while scanning might require more resolution. For example, descreening software functions do better at high resolutions. So scan at a high resolution using the descreening function, then resize to a lower resolution in an image editing package.

Resizing works best if you size to half the resolution or half the size of the original. Even so, resizing tends to soften the image. Use a little sharpening effect after the resize to restore some of the sharpness (don't overdo it).

A last tip: a screen capture function has been built into Windows since version 3.0 (at least) and continues in Windows 9x. Just press the "Print Screen" to copy the current screen to the clip board, then paste as a new image into an image editor and there's your screen capture.