# PRIN*tips*

# Bitmap or Vector Image... Which Do You Choose?

**G**raphic images – such as photographs, illustrations, drawings, logos, and clip art – are a great addition to any printed piece. When combined with text, images measurably increase reader comprehension, retention, and interest when compared to text only.

In printing and publishing, graphic images are two-dimensional (2D), while on the World Wide Web, images can be two- or three-dimensional (3D) or multimedia.

### How graphic images are formed

There are two ways to form graphic images: pixel by pixel in a grid (called a *bitmap* or *raster* image) or mathematically from geometric objects such as points, lines, curves, and polygons (called *vector* images). Digital photographs and all images that have been scanned are bitmap images; vector images originate primarily from illustration or drawing software programs or from plotters used in technical drawing.

Examples of bitmap file formats are Tagged Image File Format (TIF); Joint Photographic Experts Group (JPG or JPEG); Graphics Interchange Format (GIF), Adobe Photoshop (PSD); bitmap (BPM); Windows Paint (PCX); and pixel image format for Macintosh (PICT). Photo editing or image editing software such as Adobe Photoshop, Corel Paint Shop Pro or Microsoft Paint all work on bitmap files.

Examples of vector file formats are Encapsulated Postscript (EPS); Adobe Illustrator (AI); and CorelDRAW (CDR). Popular vector drawing software includes Adobe Illustrator, CorelDRAW, and Macromedia Freehand.

A *metafile* is classified as a vector file format, though it contains both bitmap and vector information (an object – the vector – is filled with a bitmap pattern). Computer Graphics Metafile (CGM) and Windows Metafile (WMF) are both examples of this graphics file format.

Both screen displays and graphics on the World Wide Web use bitmap image files, and GIF and JPG are the most widely used file formats in this application. Print projects can use either bitmap or vector images; the preferred file formats are TIF (bitmap) or EPS (vector).

### Characteristics of bitmap images

A bitmap image is a matrix of individual dots (called *picture elements* or *pixels*), each having its own color. Because pixels are so tiny, the human eye is unable to distinguish them individually, and so perceives the image as having smooth gradations. Only when a bitmap image is greatly enlarged are we able to see the individual pixels.

Although bitmaps images can be any color, there are four common categories describing how color is used:

- *Line art* images contain only two colors – black or white. The computer has to use only one bit to assign color to each pixel: on=black; off=white.

- *Grayscale* images contain various shades of gray as well as pure black and white.

- *Multitone* images contain shades of two or more colors. A well-know multitone is the duotone usually consisting of black and one other color.

- *Full color* images use a color space such as RGB or CMYK to assign colors to each pixel.

A bitmap does not need to contain a bit of color-coded information for each pixel on every row; it only needs to contain information indicating a new color as the display scans along a row. Thus, an image with much solid color will tend to require a small bitmap (and smaller file size).

Bitmap images are *resolution dependent*. (Resolution is a measure of the number of pixels used to create the image and is usually stated as *dots per inch* or *pixels per inch.*) Computer screens and the World Wide Web require fewer dots per inch (dpi) to render an image than a printing device; hence an image that has sufficient resolution for a screen display or web application may have insufficient resolution for printing.

In addition, because bitmap images are resolution dependent, it is difficult to alter the size without changing image quality. To make an image smaller, it is *downsampled* by throwing out pixels. *Upsampling* is used to make an image larger by adding new pixels through a process called interpolation. *Interpolation* assigns a color to the new pixel based on the color values of surrounding pixels. Interpolation, particularly when many new pixels must be created, often results in a blurry image.

## Characteristics of vector images

A vector image is created from many individual, scalable objects (lines, curves and shapes) that are defined by mathematical equations. Instead of using individual pixels, a vector image describes a series of points to be connected. There can be many points to be connected or just a few control points connected with *Bézier curves*. Bézier curves were widely publicized in 1962 by Pierre Bézier, a French engineer who used them to design automobile bodies.

The objects in a vector image may be assigned attributes (such as color, fill, or outline) without affecting the object itself. A vector image can be altered (enlarged, reduced, rotated, stretched, etc.) without losing resolution, and any object in the vector image can be altered independently of other objects in the image. Finally, an object can be modified by changing its attributes or by shaping and transforming it. A font is an example of a vector image.

All these characteristics mean that a vector image can be changed without affecting its resolution, making it *resolution independent*. This makes a vector image a good choice for logos which must be re-sized frequently. And because a vector image file consists of points rather than bits, it tends to be much smaller than a bitmap image file.

Despite its many advantages, a vector image has one disadvantage: it cannot create a photorealistic image. Compared to bitmap images, the objects and lines of vector images may look artificial.

## Which image file format is best?

Given the many choices for image files, what is the best choice? The answer depends on your application. If you are using images for screen display or for your company's web site, you may want to optimize on file size. In this case, GIF or JPG is the best choice.

*"Computer screens and the World Wide Web require fewer dots..."*

*"A vector image is created from many individual, scalable objects..."*

## Bitmap or Vector Image... Which Do You Choose? (continued)

But when you are selecting images to include in a document you are providing to us to print, we ask that you use either TIF or EPS. TIFF is the leading professional image file standard; is supported by Mac, Windows, and Unix platforms; supports RGB, CMYK, and other color spaces; stores data with bytes in either Mac or PC order; and offers several compression formats. EPS is a Postscript file that also satisfies some additional restrictions that are intended to make it easier for software to embed an EPS file within a Postscript document. EPS files may also include a preview picture of the content for screen display.

Checking the resolution of graphic images is one of the steps in *preflighting* any document you submit to us for printing. For more information about preflighting or graphic image files, contact us at 513-248-2121.

*"TIFF is the leading professional image file standard..."*

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# Suggestions for altering clip art

A clip art graphic image in vector format can easily be modified to better fit your document. Here are some suggestions for altering clip art for greater interest:

- **Reorient:** clip art that is facing the wrong way can be *flopped* creating a mirror image or rotated to achieve the orientation you need.

- **Use only a portion:** crop the clip art to reveal only the important part for your application. Remove elements you don't want or don't need. Disassemble the clip art and use a few pieces.

- **Combine two or more images into one:** Create a new image out of several other pieces of clip art, or pull out elements and combine them in a new way.

- **Change the color:** Convert colored clip art to gray scale or black and white, or add color to black and white clip art..



IDEA CORNER

*"... vector format can easily be modified to better fit your document."*

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**Q.** *Should I use TIFF or JPEG for my photo image files?*

**A.** Although JPEG files are much smaller, you'll probably be happier with your photographs as TIFF files. Uncompressed TIFF files for photo images are often very large, meaning the image contains much detail – lots of bytes per pixel. And a TIFF file compressed with lossless compression means no pixels are thrown out in the compression algorithm. Therefore you can always recover each bit of data without corruption.

The JPEG file format is intentionally designed as *lossy* to make the file compression efficient and produce relatively small files. To do this, JPEG modifies the color values of the pixel. Tiny detail such as minor color details are not retained – in other words, are lost. This produces a substantial file size reduction but also means that when you re-open the file it no longer contains the same data as before. Moreover, every time the JPEG file is compressed and saved again, pixels (and therefore quality) are lost. Before you exchange file size for quality, be sure the tradeoff is worth it.



Q&A
*questions and answers*

*"... you can always recover each bit of data without corruption."*

*June 2006*

# PRINtips

## Graphics Tricks & Tips

**W**hen purchasing a graphic image, it is generally best to get it in the form in which it was created. For stock photography, this will mean a bitmap file such as JPEG or TIFF; for clip art, a vector format such as EPS or metafile.

Even though we request a TIFF or EPS graphic image for your document, always archive the graphic image in the native format of the graphics software program you are using. Then if you later must edit the file – resize, resample, save in other formats – you can revert back to the native format to make the modifications.

If you are creating images for the web using JPEG format, it is also a good idea first to save a high resolution archival copy of the file. JPEG uses a lossy compression algorithm. Lossy means "with losses" to image quality, because pixels are thrown out every time the file is opened, edited, and resaved. A file compressed with a lossy method may be quite different from

the original file at the bit level. The best practice is to edit the original file in its native format, then export as a new JPEG.

Original EPS

Modified using the original



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Please Route to the Printing Buyer

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