



# Image Quality Basics

## Image Resolution

Image resolution is a term used to describe raster graphics. It measures the number of pixels in one linear inch of the image. Image resolution is measured in pixels per inch or ppi (sometimes referred to as dpi or dots per inch). The higher the ppi, the crisper and finer the image. When an image has low ppi, it can have jagged edges and the pixels will appear large and clunky. Web graphics are saved at 72-96 ppi because that is the best resolution that monitors can display. Professional print graphics are usually at least 250 ppi or higher.

## How Do I Know the Resolution of an Image?

The easiest way to estimate the resolution of an image is to look at its file size. A 4"x 3" image at 300 ppi (ideal print resolution) is roughly around 3MB (megabytes). The same 4"x 3" photo at 72 ppi is much smaller at about 182K (kilobytes). It's safe to say that most photographs under 1MB are ill-suited for printing, unless they are to be used at a very small size.

## What Happens when I Enlarge an Image?

Enlarging an image will cause its resolution to go down and the image quality will suffer. For example: when a 300 ppi image is enlarged 200% the resolution becomes 150 ppi.

## Here is an example of an image at 300 ppi (ideal print resolution)



## Here is an example of the same image at 72 ppi (typical web graphic resolution)



## Raster vs. Vector

There are two main type of image files: Raster and Vector. Raster images are created with pixel-based programs or captured with a camera or scanner such as a photograph. Vector graphics are created with vector software and are common used for logos.

## Raster Images

Raster images are made of pixels. A pixel is the smallest single element in a display device. If you zoom in to a raster image you may start to see a lot of little tiny squares. The pixel resolution is the amount of pixels within each inch called ppi (pixels per inch). A raster image has a specific number of pixels. When you enlarge the image file without changing the number of pixels, the image will look blurry.

Pixel-based images represent photographs and photo-like images better than vector programs because they can use an abundant number of different color pixels. By arranging pixels and slowly incrementing or changing the color or shade of the pixels adjacent to them, it creates a subtle gradation from one color to another: nice and smooth color blends.

How large a raster image can be printed - and maintain quality - depends on 2 things:

- the size of the image (e.g. 4" x 6")
- the pixel resolution: pixels-per-inch (ppi), how many pixels per inch are required by the particular printer (e.g. 300 ppi)

## Raster Summary

- Pixel-based
- Raster programs best for editing photos and creating continuous tone images with soft color blends
- Do not scale up optimally - Image must be created/scanned at the desired usage size or larger
- Large dimensions & detailed images equal large file size
- Some processes cannot use raster formats
- Depending on the complexity of the image, conversion to vector may be time consuming
- Raster images are the most common image format, including: jpg, gif, png, tif, bmp, psd, eps and pdfs originating from raster programs
- Common raster programs: photo editing / paint programs such as Photoshop

## Vector Images

Vector images are mathematical calculations from one point to another that form lines and shapes. If you zoom into a vector graphic it will always look the same.

When you enlarge a vector graphic, the math formulas stay the same, rendering the same visual graphic no matter the size. Because vector graphics are not composed of pixels they are resolution-independent. The vector shapes - also called objects - can be scaled and printed at any size without losing quality. It can be printed as large and at the highest resolution the printer or the output device allows.

Vector graphics are commonly used for logos, illustrations, technical drawings and for use with processes that require vector art such as specialty signs and printing, engraving and etching. Also used in CAD, Engineering, and 3D graphics.

## Vector Summary

- Mathematical calculations that form shapes
- Vector programs are best for creating logos, drawings, illustrations, and technical drawings.
- Can be scaled to any size without losing quality
- Resolution-independent: Can be printed at any size/resolution
- A large dimension vector graphic maintains a small file size
- Can be easily converted to raster
- It is not the best format for continuous tone images with blends of color or to edit photographs
- Common vector graphic file format: ai, and eps & pdfs originating from vector programs
- Common vector programs: drawing programs such as Illustrator and CorelDraw



**Raster Logo @ 300 ppi**  
shown with 290% enlargement



**Vector Logo**  
shown with 290% enlargement