UNDERSTANDING
IMAGE FILE FORMATS

There are hundreds of image file formats from the JPEGs and GIFs that make up much of the web to proprietary formats such as those used by Adobe Illustrator and Photoshop. This sea of formats is further complicated by the fact that many types of images can be embedded in other documents such as Adobe Acrobat files, Microsoft Word docs, and emails. All these possibilities make the process of providing usable artwork to manufacturers and printers confusing at best.

The good news is that although there are many file formats, there are really only two file types: raster and vector. Vector images are best for artwork such as line drawings, text, and logos where the objects depicted have clear, sharp edges, and the level of detail is relatively low. Raster images are best for things like photographs, where the level of detail is quite high.

Let's look at vector images first. Common file formats include SVG, some EPS files, font files, DXF as well as Adobe Illustrator AI files and Corel Draw's CDR format. The thing that they all have in common is that everything in the image is represented by a mathematical description of lines and curves. When a series of lines or curves outlines a closed shape, like a circle for example, there is also a description of the color or gradient that fills that shape.

Because the lines and curves are stored mathematically, they are scale-independent, meaning that you can make the image as large as you want and it will still be razor sharp. Vector files are also the only image type that can be used for computerized manufacturing equipment like laser cutters, vinyl plotters and router tables. The cutting tool literally follows the lines and curves stored in the image file.

A raster image deteriorates with magnification but a vector image retains detail regardless of size.

300 x 300 Pixels

100 x 100 Pixels

30 x 30 Pixels

Raster images, such as TIFF, BMP, JPEG and GIF formats however, are more like a mosaic made of square colored tiles. These 'tiles' are called pixels, or dots. The shapes and patterns in the image are just collections of similarly colored pixels laid out in the proper pattern. The more pixels in a given space, the higher the resolution and the better the image looks. Raster images are not scale-independent. The bigger you make the image, the bigger the pixels get, until smooth diagonal lines and curves start to look like staircases.

How much resolution is enough? It depends. Look at the cats to the left. The farther you move back from the images, the more similar they appear. How large an image will be printed, and how close the viewer will be, both affect the required resolution.

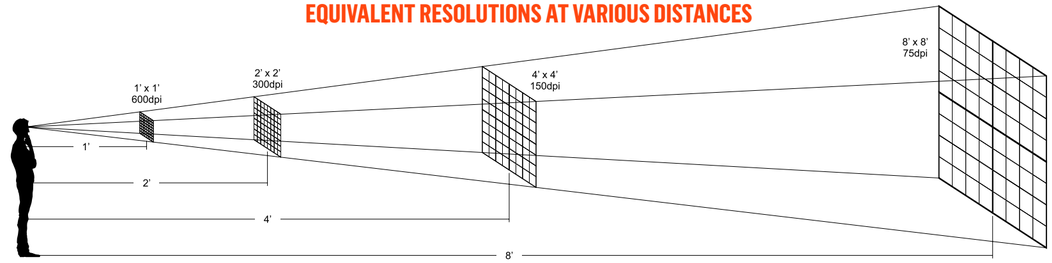
Resolution is described in a few different ways, but for any of them it is useful to think about an image as a grid of pixels. Any raster image can be described as so many pixels wide by so many high. When referring to TVs and DVDs people talk about 1080p and 4K as high-definition. These labels refer to the resolution of the image. A 1080p movie frame is 1080 pixels tall, a 4K image is (almost) 4000 pixels tall. Digital camera resolution is usually described in megapixels, sometimes abbreviated MP. Megapixels refer to the total number of pixels in the images the camera captures. A typical 24MP image, for example, is about 4,000 pixels tall and 6,000 pixels wide. 4,000 x 6,000 = 24,000,000.

Another term commonly used to describe resolution is dpi, or dots per inch. Dpi only applies to printed images. A digital file on a hard drive or memory card has no physical size as such, so the term "per inch" has no meaning. It is only once the image is printed that it has a definite size and dpi means something.

Think about it this way: Let's say you have a 24MP JPEG file. As we saw above, that image will be 4000 pixels tall by 6000 pixels wide. If you print that image as a standard 4 x 6 for your photo album the resolution will be 1000dpi (few printers could actually achieve that, but in theory...) Every inch of height or width has 1000 pixels, so 1000 dots per inch. If you print the same image as a 40" x 60" banner the resolution is only 100dpi. They are both 24MP, but one is very high resolution, the other might be kind of low resolution depending on how it will be used. Because of the importance of output size, dpi is the most useful measure when talking about printing.

How much resolution you need depends on how close the viewer will be. Like everything else, pixels appear smaller the further you get away from them. As long as the individual pixels are too small to see, the resolution is high enough. Having a resolution that is higher than you need is not a problem, but if your resolution is too low, the image will likely be unusable. If you have a vector image to print, the resolution is automatically high enough.

EQUIVALENT RESOLUTIONS AT VARIOUS DISTANCES



Objects at a distance appear smaller than closer objects, and there is a precise mathematical relationship between distance and apparent size. Doubling the distance to an object halves the size it seems to be. Since resolution in dpi appears twice as fine at twice the distance, only half the dpi is required for it to be just as sharp. A 600dpi fine art print viewed at 12" looks no sharper than a 10dpi billboard viewed at 65'.