Color in Images

This is a slide presentation I created for my chapter of Business Network International in 2009. "Pen and Brush Communications" is the name of my Graphic Design business.

Nancy A. Pickering

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Here's the Agenda for today's presentation so you can see the **direction I'm going to take**.

Actually, color is only one part of the discussion, as you see on the Agenda. There will be technical content included, both for print and web.

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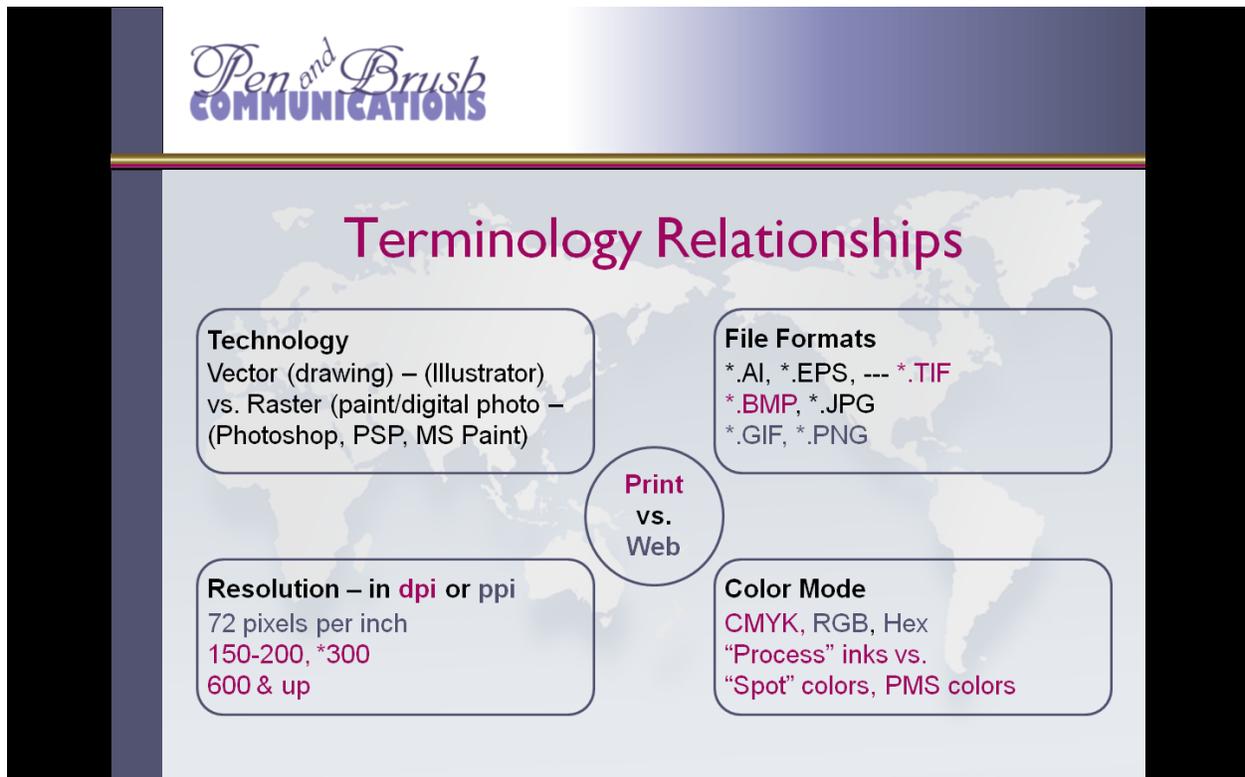

Terminology Relationships

    This slide categorizes the many terms you may have already heard used by graphic designers and others when referring to images and color.

    We'll talk about each rectangle in turn, but right now you can see there are four main categories to study. Each category could be a couple of lessons all by themselves, so in the time allowed I'll only be able to "hit the main points" about each. I won't be talking about the Color Wheel or Complimentary colors or Analogous Colors or Monochromatic Colors or anything about color theory or color schemes – that's another discussion and we don't have time.

    Notice also the color coding of the text on this slide. Those items which are characteristic of **Print** use are in a dark fuschia color, while those which are characteristic of **Web** use are in a dark blue color. But some characteristics are at work in both media, and so they stay black in color.

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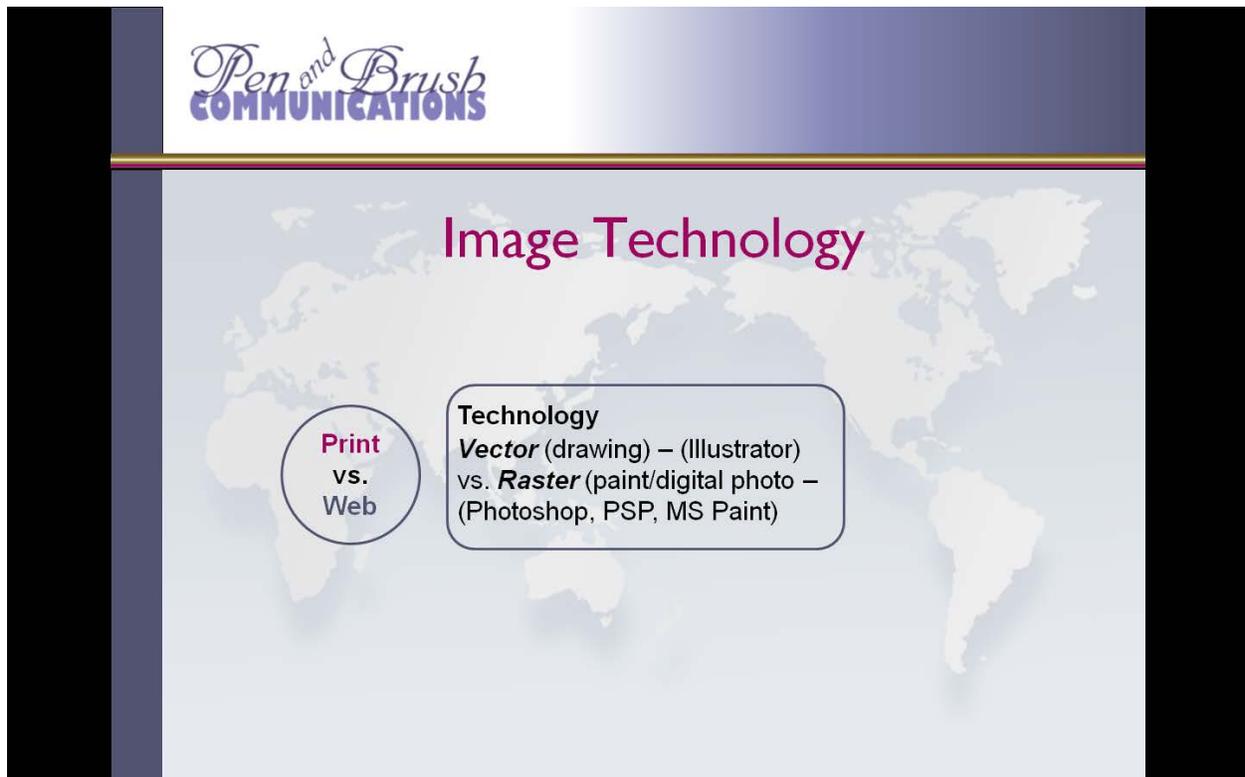
Image Technology

Let's define "image" for today. I'm not referring to a piece of art created using a real marker of some type on a real surface, such as an oil painting or a charcoal drawing.

The images I'll be discussing today are those which can be electronically created or altered in some way, and are either reproduced in print or posted for viewing electronically on the web.

<u>Vector</u> images are those created with Drawing programs on the computer. Using points and paths, they use geometrical building blocks such as lines, curves, shapes, or polygons, which are all based on mathematical equations, to represent images.

- So for example, a circle is defined as a point at a particular position, and a radius of a certain measurement, and the computer is told to create a circle with that information. And if you reduce the size of the radius, you still get a clear and crisp-edged circle, not one with "jaggies" or rough "stair step" edges along the arc of the curve.
- The most well-known computer software made for drawing is Adobe Illustrator, but there are plenty of others, such as Corel Draw. And there are simpler ones, too: When you create shapes in Microsoft Word or Powerpoint or Visio, for example, you're drawing vector shapes.

A **<u>Raster</u>** image is put together with a grid of pixels, or points of color. Raster technology is typically used for the representation of photographic images, such as with digital cameras.

- "Bitmap" images are a type of Windows raster image. A bitmap is technically characterized by the width and height of the image in pixels.
- Software programs which create raster images are called "Painting" programs, as opposed to vector <u>drawing</u> programs. If you greatly reduce or especially enlarge the size of the image in a painting program, you can compromise the clarity of the image – it may blur or the edges of curves may become "jaggy".
- The most well-known "paint" software made for making raster images is Adobe Photoshop, but Paint Shop Pro (PSP) and even the small program which comes with a new Windows PC, MS Paint, qualifies as another paint program. (Macs have such programs, too).

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Also note that vectors and rasters are both used in print and on the web. Vectors often have to be converted to another format before they're ready for final use, and rasters often do, too, depending on whether the final destination is print or web. The formats commonly used are on the next slide.

How about converting a vector image into a raster image, or vice versa? It is possible to import a vector drawing into a raster program and convert the file. And, some simpler raster files – but not all – can sometimes be converted to vector drawings. There are limitations to doing this, though.

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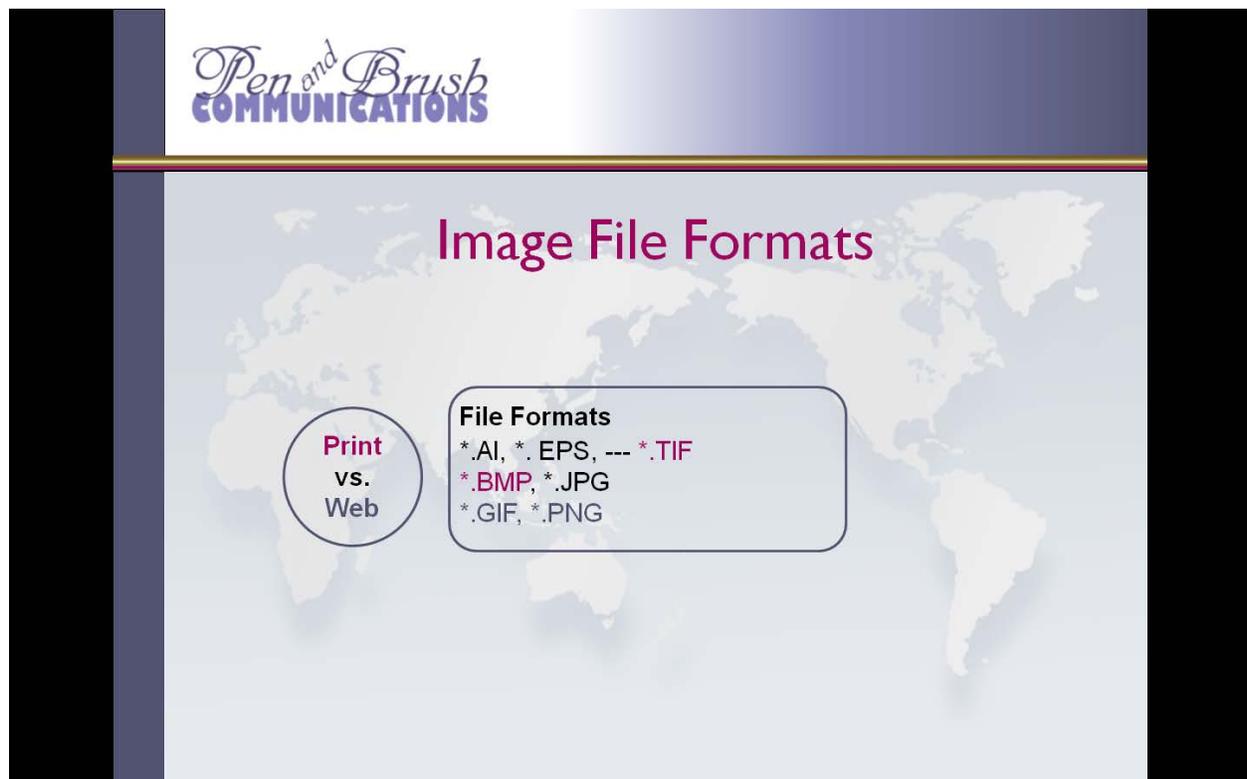
Image File Formats
What are the most common graphics file formats?

You see many of them here.

In the first line, AI stands for Adobe Illustrator, and it's a vector format.
EPS is another vector format used by Adobe Illustrator. It's a more universal format and can be read more readily by other programs, such as Photoshop. Professional Print houses like the EPS format because it is more generic.

I separated the TIF format on this slide. This format is for print, but you create it with a "save as" command in a paint program like Photoshop, converted from another format. It is usually a large file (in MB) because it generally is a high resolution format.

The next line are two variations of bitmap or raster formats. You already know photographs from your digital camera produces the JPG format. JPGs can be used for either print or web, but the resolution must be high for print, and lower for the web.

The last two are web formats. "GIF" has been the more common of the two. GIFs generally take up smaller amounts of space and therefore load fairly fast on a web page. They also can have transparent pixels, which is handy around the edges of a central object. But it has some limitations, such as a maximum color palette of only 256 colors. The PNG format is much newer (but gaining in popularity), and combines the best of both the GIF and the JPG formats, but it is not as universal— so it's not as common. Both formats, by the way, include compression features, which allow you to reduce the file size for faster downloads.

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Image Resolution

This is one of the most difficult concepts to understand.

Resolution is measured in dots per inch (dpi) or pixels per inch (ppi). The more dots or pixels per inch, the finer the detail, and the bigger the file in kilobytes or megabytes when saved.

An image only has a set number of pixels in width or height, called the physical dimensions. You can always reduce the physical dimensions of an image (such as reducing by 50%) without touching the resolution, and the result will be (almost) as clear and detailed as the original, even though it is a different physical size.

If you wish to create finer detail by cramming more pixels to the inch, though, then you'd be altering the resolution -- and your finished physical dimensions will be smaller. However, the clarity of the image will be much better.

Do be careful of trying to INCREASE the physical size of an image. Unless you have high resolution to begin with, you risk a poor quality result. This is called "upsampling" and requires that your software "invent" the in-between pixels needed to accomplish the increased size.

- The typical resolution on a computer monitor is only 72 ppi, sometimes 96 ppi.
- Newspaper printing is often at 150 to 200 dpi.
- Full-color print pieces like brochures and business cards, and most books, are at 300 dpi.

Some really excellent books – like a coffee table book of photographs, or pictures from an art gallery – can be 600 dpi or finer.

The biggest danger for Designers is trying to use a photo or image from the web (which is only 72 ppi) for a project that will be printed. Quite likely it'll look rather fuzzy in print. To look crisp, request that your source send you the image at 300 dpi if at all possible, even though the file size (in kb or MB) may be quite large. Some photographers use cameras set to 72 ppi to take photos that are as big as 8" x 10", but then they use Photoshop to change the size and resolution for print purposes in a newsletter.

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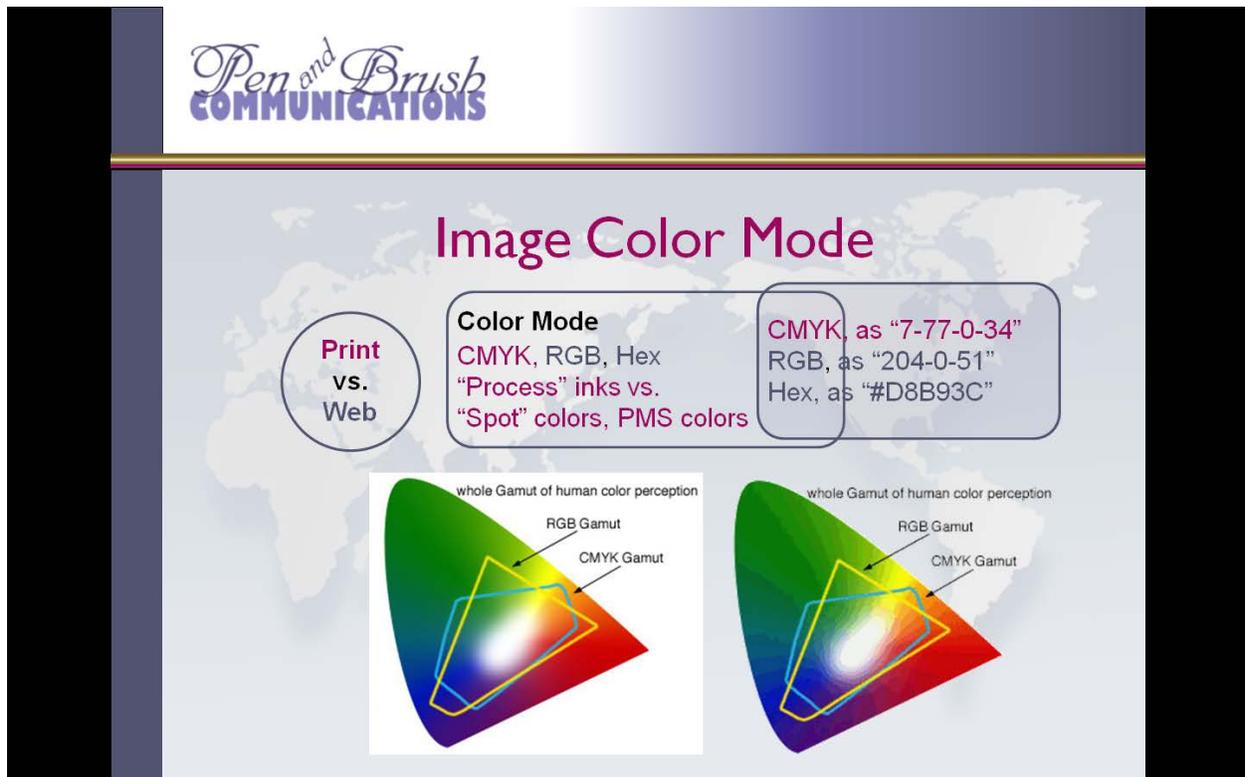
Image Color Mode
Now we finally get to a discussion of color.
The method of classifying color is different in the print world than it is in the web world.

Why?

Because the print world uses ink, which uses pigment, and the web world uses light. The physics behind the use of each can be rather daunting, and they happen to be opposite technology.

We don't have time to go into colors of pigment and "subtractive mixing" and mixing to black pigment, <u>VS</u>. colors of light and "additive mixing" and mixing to white light. But I will say that the primary colors of pigment are red, yellow and blue, while the primary colors of light are red, **green** and blue, or RGB.

Full-color printing is able to recreate thousands of colors, but it does so by combining or **processing** ("process colors") differing amounts of 4 main colors, each on its own printing plate in the printing press. This color model is called "CMYK". The "C" stands for a shade of **blue** called Cyan, the "M" is for a dark **red** called Magenta, the "Y" is for **yellow**, and the "K" is for **black**. Note that what you've actually got here are the pigment primaries of red, yellow, and blue, plus black. A CMYK color is expressed as "n-hyphen-n-hyphen-n-hyphen-n" – where each "n" can be a percentage number from 0% to 100%. So a maroon color on a logo might be "7-hyphen-77-hyphen-0-hyphen-34".

It's also possible to have a particular color of ink custom-mixed. An extra printing plate has to be used for the custom color, but sometimes it's more important to be exact, even if it does cost more money. This special color is referred to as a "spot color." Entire classifications of spot colors are available, the most well-known being the Pantone Matching System, or PMS. Those colors have an assigned color number.

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The CMYK color mode is not used for the web. The color mode your digital camera uses is RGB. The web uses RGB, at least for images. RGB colors are expressed as "n-n-n", where each "n" can be a number from 0 to 256. A typical RGB red color might be 204-0-51. Note 204 is rather close to 256, so it is a saturated red. Or 153-153-153, a medium gray.

Another way to classify color on the web is by HTML instructions, which is used for telling the web page what color the background, text, or some other element should be. HTML requires a programmer to take the RGB color mode and "translate" it for web use. Colors coded in HTML use the "hex system" (basically, this is the hexadecimal numbering system you learned in high school math, with all the digits from 0 to 9 and then ABCDEF – or 16 available characters). Hex numbers are expressed as 3 pairs of numbers without hyphens, and preceded by the # sign, such as #000000 (black), or #FFFFFF(white), or #000099(dark royal blue), or something really complex, like #d8b93c, which is a dark gold.

Can you change an image from one color mode to another? Yes, and I do it all the time, especially the RGB of photographs to the CMYK needed for printing on printing presses. I'll get an error in my software if I don't.

But the translation isn't always perfect. The color picture on the screen is an explanation of how the visible spectrum differs from one system to the next. And that neither the RGB nor the CMYK systems are as sophisticated as your own eyes. Although you can change the color mode from one mode to another, notice the two systems don't include all the colors of the other, especially in the greens and blues. Colors which fall outside the boundaries of a system are called "out of gamut."

How about the two versions of this picture? The one on the right is the same picture as the one on the left, without the white background. That's nice, but the gradient colors are awful. Well, on the left is a JPG file, and on the right is a GIF file.

I have a report which discusses the image formats used on the web, which is also available.

One other thing about color: Converting to Grayscale

Many newsletters are printed in black and white, not color (although a color PDF may be posted on a website for downloading).

When this is the case, the images chosen for the newsletter should be studied for how they might look in "grayscale."

Keep in mind that a saturated red color seen against a saturated blue or green color may look to be the same color after it is converted to grayscale. Contrast is doubly important in a case like this. The relative "lightness" or "darkness" of a color is referred to as its VALUE, and two colors of similar value side by side do not have enough contrast between them to look crisp in grayscale; the colors blend together.

You may not be able to make any changes to a photograph with this problem, but if you are designing a logo or other set of shapes, do keep in mind that it may be seen by your audience both in color and in grayscale, and adjust the value settings for each color to provide enough contrast to be pleasing.

There's more information about these topics at greater length in books and in articles on the internet.