PRINtips

Graphic Design for Print and Web: A Study in Contrasts

First we thought the PC was a calculator. Then we found out how to turn numbers into letters with ASCII – and we thought it was a typewriter. Then we discovered graphics, and we thought it was a television. With the World Wide Web, we've realized it's a brochure.

— Douglas Noel Adams,
author of *The Hitchhiker's Guide to the Galaxy*

As digital technology evolved from graphic design to page layout to web design, graphic artists adapted software tools and design principles to work in the new discipline. Initially, many designers with roots in graphic design for print migrated to the less controllable and more fluid design environment of the World Wide Web while retaining skills in design for print.

Today the situation is different. A graphic designer may train only for web design and have no experience with print. And even though design for print and design for web both must consider how to display text and graphics, how to use color and typography, and how to guide the reader around the page, the two design environments are very different. To be successful, today's graphic designer must either understand the requirements for design in each, or limit their activities to web or print.

In this issue of Printips we'll discuss three primary differences between the two environments and explain why what works in one may not work in the other.

Color space

A very important difference between design for print and design for the web is the color space of each. *Color space* refers to a *color model* and *color mapping function* that uses mathematics to describe the way colors are represented.

The color model for the web is RGB: the red, green and blue phosphors of a computer screen. Offset print uses a CMYK color model, where the colors are created using the primary colors of pigment: cyan (C), magenta (M), yellow (Y). Black, represented by the letter *K,* is added in printing to compensate for the fact that a combination of CMY produces an unattractive, muddy black.

The two color models – CMYK and RGB – can each be represented mathematically in three dimensions using an X, Y and Z axis. If the two models are superimposed, they do not match exactly. This means that some colors produced with RGB cannot be produced with CMYK. For example, certain shades of blue and green that appear luminous and vibrant on a computer screen either cannot be matched in CMYK or appear much more subdued.

Another difference in the two color models are the way the colors are produced. CMYK is a *subtractive* color model. The four ink colors are applied to the *substrate* (paper, label, canvas, etc.). Because the ink is opaque, light is reflected through it from the substrate, and each ink color subtracts color from white to create an image. RGB uses *additive* color mixing – the red, green and blue light phosphors combine to create the color that appears on the screen.

A final difference between printed color and color viewed on a computer screen is the range of contrast and color intensity. A computer screen displays *transilluminated* images, meaning the colored light passes through the images. Printed pages depend on reflected light which limits the amount of contrast and color intensity.

Resolution

Resolution is the measure of how sharply an image is rendered. Resolution is expressed as the total number of pixels (*picture elements)* or dots per inch comprising the image.

Most computer screens are limited to a resolution of 72 to 92 pixels per inch (ppi), while a printed image is typically 150 dots per inch (dpi). Since resolution is measured over area – 72 ppi x 72 ppi = 5,184 ppi while 150 dpi x 150 dpi = 22,500 dpi – a resolution of 150 dpi is four times greater, not two times greater, than 72 dpi. Forming an image with 22,500 dots means that the dots are much smaller and therefore much less visible to the naked eye. It also means that as the image is enlarged, there will still be enough dots to create the image without the individual dots becoming visible.

The difference in resolution means that photographs and graphic images optimized for web display can appear *pixelated* (*i.e.*, individual pixels will be apparent to the naked eye) when the image is rendered in print. Conversely, the file size of photographs and graphic images optimized for print might be so large that they might not load fast enough when used on a web page.

"Resolution is expressed as the total number of pixels..."

"The size and number of pixels determines resolution."

The issue of resolution has implications for text as well as photographs and images. Because text displayed at a resolution of 72 ppi on a computer screen will never be as clear and detailed as text in print, there are limits to how fine the shape of letters of the alphabet can be and how narrow a line can be. This has led to the development of some fonts specifically for use on the web. Verdana, Georgia and Trebuchet MS have exaggerated x-heights and heavy letterforms to improve legibility on a web page. However, these characteristics compromise the font in print by sacrificing subtlety and grace.

Unlike print, the font used on a web page will only render if it is also installed on the viewing computer. To avoid the resultant font substitution, web designers often limit their use of fonts to a few that come with most computers, such as Helvetica, Arial or Times Roman. This limitation does not exist with print.

Image file formats

Despite the ubiquity of JPG (Joint Photographic Experts Group) as a file format for images, EPS (Encapsulated PostScript) remains the standard for printing. EPS is a vector file format, meaning it uses geometrical figures such as points, lines, curves and shapes based on mathematical equations to describe the image. This means that an EPS image can be enlarged without pixelation and reduced without losing detail. This characteristic is very important for a graphic image such as a logo that needs to be small enough to fit on a business card, and enlarged to perhaps a billboard or vehicle wrap.

In contrast, JPG is a raster file format meaning the image is represented as an array of pixels. The size and number of pixels determines resolution. The smaller and closer the pixels are to each other, the better the quality of the image and the larger the file size. As a raster image is enlarged, the pixels become larger and spread out, eventually enabling the eye to see individual pixels. Photographs, which are typically in JPG format, can be enlarged so much that they become grainy and indistinct.

GIF (Graphics Interchange Format) is a bit-mapped file format that supports up to 256 colors (8-bit) and is useful for almost all web graphics except photographs. (Photographs require the broader range of colors available in the JPG file format.)

PNG (Portable Network Graphic) is a bit-mapped file format developed as a nonproprietary alternative to GIF, specifically for the web. As yet, PNG is not widely supported, and not all major web browsers support all PNG graphics features.

JPG, GIF and PNG files are appropriate for web pages but are not meant for print. An exception can be made for photographs in JPG format that are at a resolution of 300 dpi in the size they will appear in print. EPS files can be edited using Adobe Illustrator, Macromedia Freehand, or Corel Draw. JPG and GIF files can be edited with Adobe PhotoShop.

Other differences

Here are a few other differences between design for the web and design for print:

- The unit of measure for web design is a pixel; for print, it is an inch.
- Web design uses text and images reversed out of a background color to enhance readability. In print, black text on a white substrate provides good contrast and legibility; on the web, readability is best when text and images are reversed out of solid background color. This is because on a computer screen, the color white is produced by mixing red, green and blue phosphors at full intensity. This means the screen displays the maximum amount of light and luminosity which can interfere with reading.
- Web designers use Photoshop as their primary design tool. Print designers use page layout software like InDesign or Quark XPress. When print designers use Photoshop, they use it differently than web designers.

Design for the web may not work in print – and vice versa

All these differences add up to one thing: a design optimized for the web may need to be partially or completely re-worked to be successful in print. Before you ask your web designer to prepare files for print, determine whether the designer is familiar enough with print to accomplish the task. We will be happy to meet with you and your web designer to work out the best way to proceed.

"...a design optimized for the web may need to be partially or completely re-worked to be successful in print."

Repurposing Your Documents

One popular use of a web site is to make a version of a company's printed documents available there, either printable from a PDF or as online text. The term for this transition from print to web is *repurposing*. Repurposing can require some planning as well as text editing and some redesign because web readers read in different ways and for different purposes than print readers.

If the printed piece is rich in photographs and graphics, or if it is text-heavy (such as an instruction manual), it may be better to offer it as a print download rather than repurpose the printed piece into online content. In this case, we can provide you with a PDF version of your printed piece. We can deliver the PDF as part of the job on the first printing, or we can retrieve the native application file from our archives and create a PDF of something previously printed. Contact us at 513-248-2121 for assistance.

IDEA CORNER

"Repurposing can require some planning as well as text editing..."

Q. *I am putting together a brochure and want to include pictures of products from several man- ufacturers. Why can't I copy pictures from their web site to use in my brochure – the photos look great on my computer screen.*

A. You are certainly right about photographs looking great on a web page. The phosphors on the computer screen lend a brightness to the color that is visually appealing.

But color created by light shining through red, green and blue phosphors cannot be exactly reproduced with the cyan, magenta and yellow colors of printing ink. Even more importantly, the digital photo files have been optimized for fast loading on the web page by reducing the file size through file compression. And for photographs in JPG format, a lossy compression technique was used.

This means that the original high resolution photograph had pixels permanently removed to make the file smaller. If enough are removed, the remaining pixels will be visible to the naked eye instead of smoothly blending in to one another. In specific circumstances (such as taking a very large photograph and using it in a much smaller size) the pixelation may be less apparent though still visible.

Compressing Digital Photos

If while working on a web page or a document for print you need to compress a digital photo or image file to make it smaller, it is a good practice to save the photographs or graphics in their original uncompressed file format. Likewise, it is a good practice to create new compressed files every time a photograph or image is changed significantly (such as resizing or changing the file format).

This recommendation is the result of the compression technique used for JPG files (the most common file format for photographs and images). There are two data compression techniques: *lossy* and *lossless.* The lossless technique makes the file smaller by squeezing out inefficiencies in data storage so does not permanently delete any information from the

file when the file is compressed. Accordingly, all original information can be completely restored when a lossless file is decompressed. Lossless compression works best when compressing images with large fields of homogeneous color.

In contrast, the lossy compression technique permanently eliminates what it determines to be redundant or unnecessary information in the file during compression. While this can significantly reduce file size, it does mean that upon decompression, the file will contain much less information than prior to compression. With the lossy technique, every time a file is decompressed then recompressed, greater and greater amounts of information is lost and eventually there are too few pixels to properly render the image.