There are two different color systems being bantered about in the output side of the electronic publishing world… RGB and CMYK. The two systems are based on two different interpretations of the same colors. Remember the fable that described a number of blind Indian men presenting their perceptions of an elephant? Each man described the elephant from his own point of *view* (sorry). While all presented their case as accurately as possible, each described a slightly different critter… none of which sounded much like any elephant I've ever seen!

While the subject of color has little to do with pachyderms, it has a lot in common with perceptual expression.

The Eyes Have It

Basically, RGB (red, green, and blue) color perception is the method the human eye uses to recognize the differences between colors. The human eye and brain can detect subtle differences between colors. Light passing through the eye's lens is projected onto the retina. The retina is the flesh and blood equivalent of a CCD array containing millions of light sensitive cells called rods and cones. Rods are only activated in dim light while cones function in daylight and contain light-sensitive chemicals called photopigments which render each cone sensitive to red, green, and blue light.

The brain receives impulses (via the optic nerve) from the different rods and cones and assembles them into the images we "see."

Different Appetites for Different Devices

Image capture and display devices use this same RGB space to represent color. The most obvious device is the *RGB* computer monitor. Other devices that utilize the RGB version of color expression include scanners, traditional and digital cameras, and projection systems . In short, all visual perception is based on RGB.

Contrary to some claims, virtually all cameras and scanners capture images in RGB color space. As a matter of fact, it's impossible to capture color in CMYK because all projected color travels in RGB space.

Printing devices and printing presses, on the other hand, *all* print images using CMYK colors. As discussed in ImageXpress' UnTechnical Bulletin "Why Seps Are Necessary"…

"Printing color pictures presents [a] conversion problem. If you want to go from an RGB-based color system (like a computer monitor) to a CMYK-based color system (like a printing press), the "currency" of your picture will have to be converted from RGB values to CMYK values. There are no RGB presses, and few RGB printers. CMYK printing presses simply can't comprehend RGB."

CMYK Output

Since light is perceived and transmitted in RGB but printed using CMYK inks, it only seems logical that all electronic files should be converted to CMYK color space before being sent to the printer. Logical or not, this isn't always the case. While it is true that all output inks/dyes/toners are based on CMYK, there are some times when your file should *not* be converted to CMYK *before* the file is sent. Some printers prefer to do the conversion from RGB to CMYK all by themselves.

If you've ever tried to send a CMYK file to an inkjet or bubble-jet printer, you know the horror of the result. Why do these CMYK devices deliver such disastrous results from CMYK files? The answer is shockingly simple.

The reason CMYK files sent to inkjet printers produce such bad results is that the inkjet print driver, presuming that all files are RGB files, treats all CMYK files as RGB files and mindlessly re-separates them. Yuck! Nobody will ever accuse these printers of over-intelligence, though given the correct files, they deliver stellar results.

File conversion from RGB to CMYK must happen before the image is printed. The only questions that remain are *where* shall the conversion take place (in the CPU or in the printer's RIP), and *who* is responsible for making the color conversion happen?

The *Where* and *Who* Of It

Color files can be sent to almost any printing device in RGB mode. When this is done, the color conversion takes place in the RIP (an acronym for *raster image processor*, which is a way-too-technical term describing the part of the printer that turns pixels into marks on the paper). While RIP conversion is most common with desktop printers, it is also available in some imagesetters. Separation tables and device profiles can be downloaded directly to the RIP to convert files from RGB to CMYK on-the-fly.

Some devices are switch-hitters, not insisting on either RGB or CMYK files, but willing to accept anything you throw at them. Color laser printers fall into this category, leaving it to the user to decide which way they send the files. One of the most critical factors in the decision is whether other graphics on the page (produced in page make-up applications) which are printed from RGB mode will appear consistent with colors in the CMYK image.

As stated before, inkjet printers *always* prefer RGB files. The reason being that all conversion tables/profiles are resident *within the printer*. Separation tables are (unwittingly) determined when the user chooses the paper type and print quality from the printer driver. Usually, the driver also offers a ColorSync selection which consequently converts the file using provided ICC profiles.

CMY Versus CMYK

Once in a while you will notice a printer designated as a CMY printer instead of a CMYK printer. CMY is a pretty good indicator that the file to be sent to the printer should be an RGB file, and that the conversion will take place inside the printer. CMY indicates that the conversion from RGB will be represented by cyan, magenta and yellow, as opposed to cyan, magenta, yellow and black. CMY files are almost always indicative of dye sublimation type printing processes. Incidentally, "k" stands for black. The reason the industry uses "k" instead of "b" is to avoid the potential confusion with the color blue. Lame but true.

When electronic printing devices print composit separation files, the necessity of the black (k) color being added to the process is largely to accomodate black type. Toners, and dyes reproduce photos quite nicely using only CMY inks, and solid cyan, magenta and yellow *can* simulate black type if registration is not an issue.

Oil-based printing inks, on the other hand, require full CMYK separations. Solid CMY inks produce muddy brown, not black. Press separations include black ink to enhance the range and neutrality of images. (See Color Separation UnTech Bulletins for more details)

The (Sort of) Exception To The Rule

While most printing systems use CMYK (cyan, magenta, yellow, and black) inks, there is a class of photographic printers that use RGB light to produce their images. Unfortunately, this hybrid technology confuses many by parading as an RGB printer. As stated before, *all* hardcopy printers ultimately use CMY(K) colorants.

These printers are typified by the Fuji Pictrography, which provides near continuous-tone output. The Pictrography printers use a combination of photochemical and traditional laser-printing technologies. The printer requires no liquid chemicals or toners; instead, it prints on a photosensitive media (paper) that is "primed" by a laser before CMY dyes are transferred to it using heat and pressure.

Obviously, these printers prefer RGB files and convert the information into their proprietary CMY process, producing the closest possible electronic version of continuous-tone photographic prints.

Output Color Modes and ScanPrepPro/AutoPilot

ImageXpress' software packages (ScanPrepPro for Macintosh and AutoPilot for Windows) prepare images for particular output devices and systems "intelligently." Each output device/process has been carefully defined and categorized for best production results within each software's databases. The user indicates the device or process to be used for output and the software produces the file in strict accord with the output device's preferred mode and form.

ImageXpress, Inc. P. O. Box 465867, Lawrenceville, GA 30042
770-995-6644 (voice), 770-995-7497 (fax), untechbulletin@ixsoftware.com (e-mail). For a free 7-day trial of any of our software titles, please visit our website at: http://www.ixsoftware.com