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Consistent Color in an Inconsistent Environment

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Color Management Systems have been developed because, as we discussed in "[Color Theory made Simple](#)", digital color exists in an inconsistent environment in which each device, whether creating or publishing an image, has its own unique characteristics.

To summarize the discussion in "Color Theory made Simple". Color perception can be an additive process of light- RGB as in monitors or a subtractive process - CMYK. as in printers. It is also influenced by the white point of the light source which is measured in kelvins. In an attempt to standardize the perception of color, standard color spaces have been determined, such as CIE Lab, which defines each color mathematically. This also means that when you are operating in this color space you are functioning on a mathematical level and are device independent, rather like using pantone color charts.

A Color management system aids other software programs in accurately transforming color between the different environments by creating a profile for each device which places each device's color perception accurately within a standard color space. The most common color space used, is CIE Lab but not it is the only one. However, the CMS of the common software platforms, ColorSync on the Apple and ICM2 on the Windows platform do use it. Many consider ColorSync to be ahead of ICM2 in development, fortunately for those who think that there are also good proprietary systems such as ColorBlind (ITEC) which can be used to calibrate your devices.

In this section we will primarily discuss creating a profile for the device we all use - the monitor

For a monitor its profile reflects the three areas which impact its color rendition.

- Gamma setting
- White pt.
- Color Gamut

Some of your devices will come with profiles. If you go into your monitor control panel you will be asked to select the type of monitor. Your color management system can then plug in the factory suggested device profile. It will do the same when you select the printer driver description. These profiles will be close, but not perfect. On newer operating systems, with more fully developed color management systems, you can create your own custom profile for your devices. This can be especially important as each monitor and its environment is slightly different

Gamma is one of those terms which every one uses without knowing what it means, which actually doesn't hinder anyone as long as they acknowledge its importance. For those who are more comfortable when they know what a term means; Gamma comes from TV technology and the CRT (Cathode Ray Tube). The CRT creates the image on a TV and a computer monitor. An LCD screen or projector is different. It was observed that in a CRT, the intensity of light produced was not directly proportional to the input voltage but rather raised to the power of Gamma with different CRTs having different gammas. A TV monitor's gamma is usually 2.5 while Apple monitor's are usually set at 1.8.

"[D]isplay gamma can have a major effect on the color hues of an image by changing the relative intensities of the red, green, and blue channels in a nonlinear fashion. Lack of gamma correction is probably the major cause of color shifts between different displays."

An Explanation of Monitor Gamma Robert W. Berger

The newer versions of many operating systems will also assist in adjusting the white point of the light of your monitor, but even on older operating systems you adjust your monitor's contrast and brightness to reflect accurately the desired gamma.. While it is important for uniform perception that the gamma be set accurately, when you are involved in image editing, it might be safer to use a gamma of 1. See AIM's paper on Gamma corrections for some amazing examples. Their site is listed at the end of this article. Again it is a matter of working in a device independent mode. Much as it is better to work in CEILab color mode, when preparing images for cross platforms and other environments. Just remember to keep track of your formulas for custom colors.

The main point of employing a CMS is to place your device in a known environment - a color space, to which other devices and their softwares can relate. Images can take this information with them, though few currently take advantage of it. This may be because few of us can benefit from this capability but the TIFF file format does have provisions for specifying the properties listed above, as does the PNG format which has been proposed as a replacement for GIF. If images distributed on the Web were tagged with the colorimetric model of the display the images were optimized for, the images could be displayed more consistently across a wide range of display systems. The Web viewer software would compare the colorimetric information of the file with a colorimetric model of the local display system and apply gamma and color corrections.

For us we will continue this discussion with how to use proprietary CMS to get at least all your devices into the same space. Spectrophotometers to hand.

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