Color Management for Digital Photography

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In the past, color management for digital photography was treated exactly like scanning. However, this approach has given poor results for almost all types of digital photography. Over the last several years it has become apparent that there are at least four different types of photography, each requiring its own approach to color management. These four approaches, named for their application areas, are "pleasing", "advertising", "reproduction with knockout" and "exact reproduction". They are presented in order from the least to the most exacting color reproduction situations.

1. Pleasing

Most of the images taken with digital cameras fall into this category. These are images made by amateur or non-critical professional photographers that simply want a pleasing image. Generally the images are made by using the automatic exposure modes of the camera. The photographer is less interested in color accuracy of the produced image to the original subject and more interested in getting a usable picture. The sky is blue, the grass green and flesh tones look good and healthy.

For this situation, the color management profile supplied with the camera should be attached to the image and used for subsequent color management. Many consumer cameras are optimized to produce their images in the sRGB system. If this is the case for your camera, attach the sRGB profile to your image. This situation is analogous to the perceptual rendering intent of ICC profiles. The user does not want to be bothered with the details of why it works, just the results; a good, pleasing image.

2. Advertising

This method is usually used for situations such as advertising photography where the photographer exercises his creative judgment and style to produce the image required by the client. Exact reproduction of the original object is not necessary. The image exposure, tone curve and other parameters are adjusted to give the desired effect as viewed on the camera or computer monitor.

For advertising photography, attach the monitor profile to the image. The master image the client wants is not on the set, but the version appearing on the monitor. The camera has been adjusted to give the desired image in color values for the monitor.

3. Reproduction with Knockout

Images made for catalogs need to have the color close to the original but are often shot on white surfaces to allow for "knocking out" the background. This allows the background to be removed from the image or to superimpose the subject with other images. To knock out the background, the image often must be made to produce neutral backgrounds although the background material itself may not be spectrally neutral.

The best way to accomplish this goal is to start by creating an ICC profile for the exposure situation. The ICC profile has the ability to make the background neutral while maintaining the color as accurately as possible. This mode is selected as the "relative colorimetric" rendering intent. Begin by setting the exposure, ISO, capture time to give a good exposure. Gray balance on the background to be "knocked out". Then make an ICC profile for this set of conditions. Attach the profile to the image and select the "relative colorimetric" intent to tell the color management system to keep the background neutral, but the colors accurate.

4. Exact Reproduction

Fine art reproduction, both commercially and for museums, needs exact reproduction of the original's colors. The images need to have the colors very accurate to the original for archival, historical, scientific and other purposes. Off-white colors need to be retained without neutralization. Imaging fine art for exact reproduction often includes using cross-polarization techniques to remove the specular highlights from oil and acrylic paintings which will require tone curve adjustments to compensate for the changes in tone from the polarizers. Controlling the observer metamerism issues with double filtration[1] will reduce the saturation of yellows and oranges in the image.

To compensate for the lights, polarization, filtration and to reproduce the colors in the most accurate way, a custom ICC profile must be made for the exposure situation. This profile is then applied to the image in an absolute colorimetric mode to achieve this goal. Absolute colorimetry insures that the colors are reproduced on the display, printers and other output devices as closely as the profile can capture the exposure information.

Summary

The different digital photographic situations are listed below with their associated profile and rendering intent.

Application	Profile	Rendering Intent
Pleasing	Generic camera profile (often sRGB)	perceptual
Advertising	Monitor profile	relative colorimetric
Reproduction with Knockout	Custom profile	relative colorimetric
Exact Reproduction	Custom profile	absolute colorimetric

There are, of course, some variations on these categories (e.g. using a custom profile for the pleasing appliction), but the basic categories and these ways of applying color management have proven very successful.