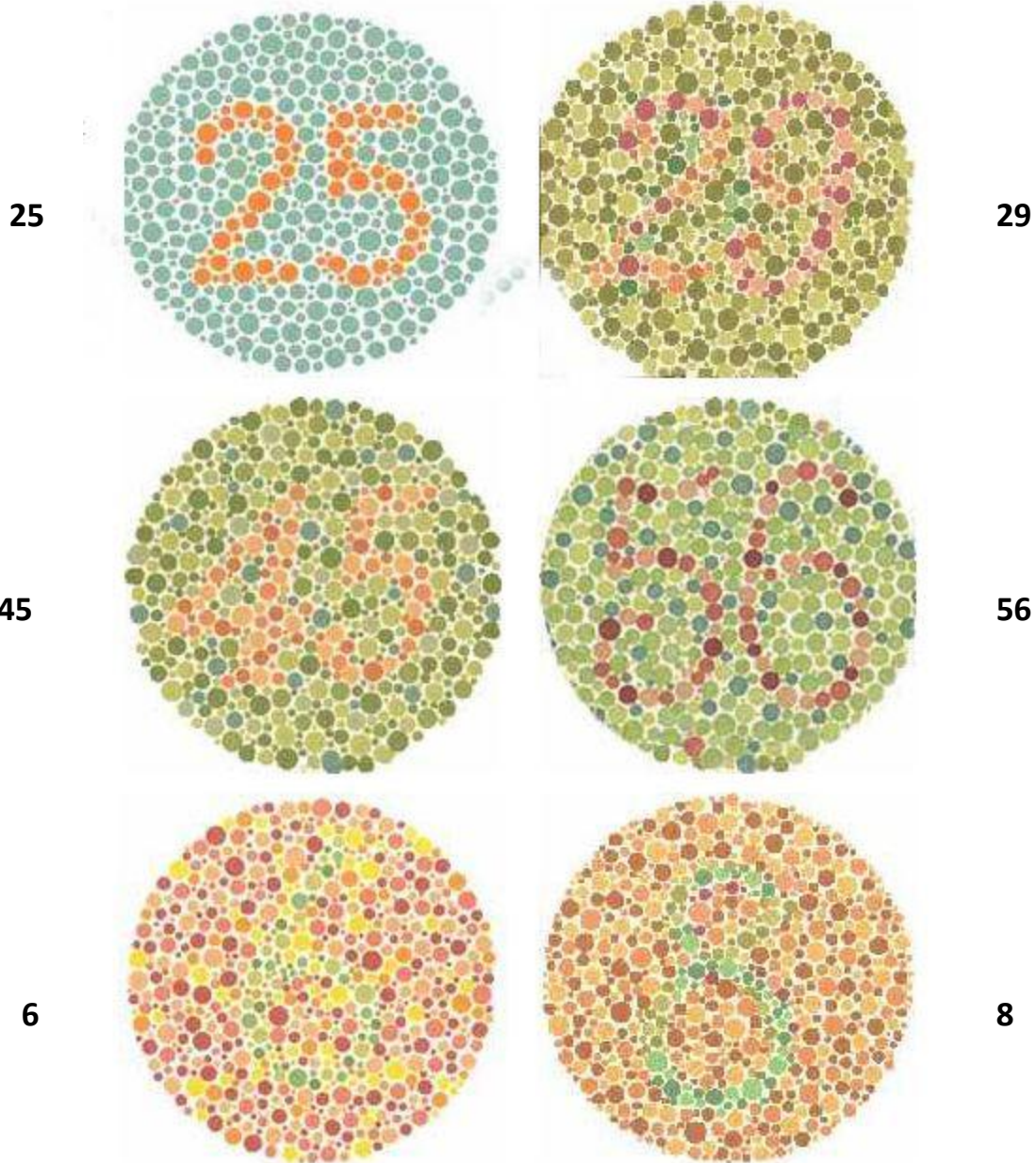


COLOR MANAGEMENT IN A DIGITAL DARKROOM

Before we begin discussing color management I want you all to look at this color chart. This is known as the “Ishihara” test and confirms the most common color blindness in people, the “red-green” problem.



If you have this condition you will see 25 in the upper left circle and possibly 56 in the right center circle but all the others will just be spots.

I am color blind, as is about 12 - 20 percent (depending on whose figures you want to believe) of the white, male population (I don't have the figures for other racial profiles) and a tiny fraction of the female population. In everyday life this does not pose a major problem but don't try getting a pilot's license, working as a train driver etc. and we normally can see red and green but in a different hue from people with normal color vision.

I have not had any problem interfering with color images such that people have commented on my color corrections or choices so I can only presume that despite my vision of red and green being different from yours the end result looks fine to both of us but in a different way! So this presentation is assuming we both will agree that the final images look good to everyone.

When a camera is used to take a picture the image produced shows the colors involved as close to the original as possible. This is governed by the technical limits of the individual camera.

This image is shown on a computer monitor, again as accurately as possible given the technical capabilities of the monitor.

This image can then be printed by a color printer as accurately as possible given the capabilities and settings of the printer.

As you can see there are a lot of variables for the image that you see before clicking the camera and the one produced by your printer. In order to get the closest possible reproduction of the original by the printer it is desirable to have all the components working as closely as possible using the same rules.

We have three different images in a digital darkroom, the downloaded image from the camera on the computer drive, the image on the computer monitor and the image produced by the printer. The goal of color management is to make the monitor image and the printer image appear the same as the image on the computer drive.

The first thing to consider is your camera. Today most cameras can faithfully reproduce an image to be a very close to the original unless you have a very low megapixel sensor (such as found in some cheap cell phones). Therefore it can usually be taken that the image saved to the camera memory card and subsequently downloaded to a computer is a good reproduction of the original.

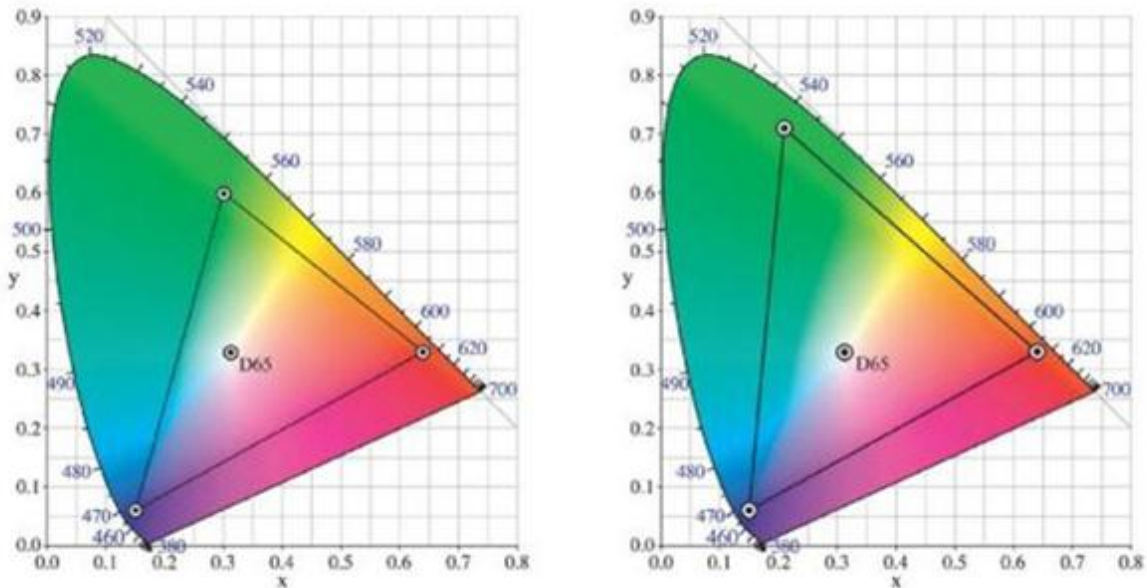
If you have a high end SLR camera it could have a "color space" setting with two choices, sRGB and Adobe RGB. If you are going to use Adobe Photoshop or Elements for adjusting images taken with this camera choose Adobe RGB.

The concept of the “color space” of a device is an important part of color management. A device color space simply describes the range of colors, or gamut, that a camera can see, a printer can print, or a monitor can display.

Problems occur when a color is in the color space of the camera but the output device (monitor or printer) has a different color space leading to the color being translated which can give some strange results! It is akin to asking someone to give you a number between one and ten and they answer 15.

It is therefore imperative that to get the best results you should try to match the color space of the image, Photoshop and the printer.

A comparison of the Adobe RGB and sRGB gamuts is below. As you can see, working with Adobe RGB allows you to see and print a larger range of colors. Adobe RGB was designed to contain the entire color gamut available from most CMYK (Cyan, magenta, yellow and black)



inkjet and color laser printers.

This is the D65 spectrum upon which many color profiles are based. On the left is the standard sRGB coverage (color gamut) and on the right the Adobe RGB. As you can see the right hand color gamut is larger meaning it covers a greater range of colors. As long as you are using Photoshop or almost any other image manipulation software using the Adobe RGB will give you truer colors.

At this stage I think we must add that the initial downloaded image on the computer drive is subject to being manipulated by some form of photo editing software such as Photoshop or Photoshop Elements and that any changes will be reproduced on the monitor.

For this presentation I am going to presume we would be using Photoshop Elements and showing the settings used with this program. However the settings in full version of Photoshop are very similar and you should set them accordingly.

Now let us consider the monitor. When photo printing at home or manipulating images with software was in its infancy most monitors were of the CRT variety. Today most people are using LCD flat panel monitors and a comparison of them compiled by Professor Alan Hedge of Cornell University is shown below.

Consideration	LCD	CRT
Visual performance	Faster than CRT	Slower than LCD
Image flicker	None	Prone to flicker
Image brightness	Bright, uniform	Variable, uneven
Image geometry	Uniform	Distorted
Image sharpness	High	Moderate to high
Screen viewing area	Full area, very space efficient	Partial area, space inefficient.
Screen size	Smaller screen for equivalent CRT viewing area	Larger screen for equivalent LCD viewing area
Specular screen glare	None	Prone to specular glare
Energy consumption	Low	High
Electromagnetic emissions	No	Yes
Heat emissions	Minimal	High
Space efficiency	High	Low
Flexible positioning	Highly	Moderate
Weight	Light	Heavy
Color range	Very Good	Excellent
Cost	Moderate	Low

As you can see the LCD is better overall except that a CRT has a better color range than an LCD. However that advantage is not enough to outweigh the superior performance of the LCD in image geometry, image sharpness and image brightness. Also the lack of image flicker which can reduce the risks of headaches and the reductions in specular glare problems with LCDs should reduce complaints of eyestrain. However monitors need and should be calibrated regularly. When CRT's were popular Adobe included with Photoshop a program called "Gamma" which used a profile of the monitor to calibrate it. However this was only suitable for CRT monitors and as LCD monitors gained popularity it was discontinued.

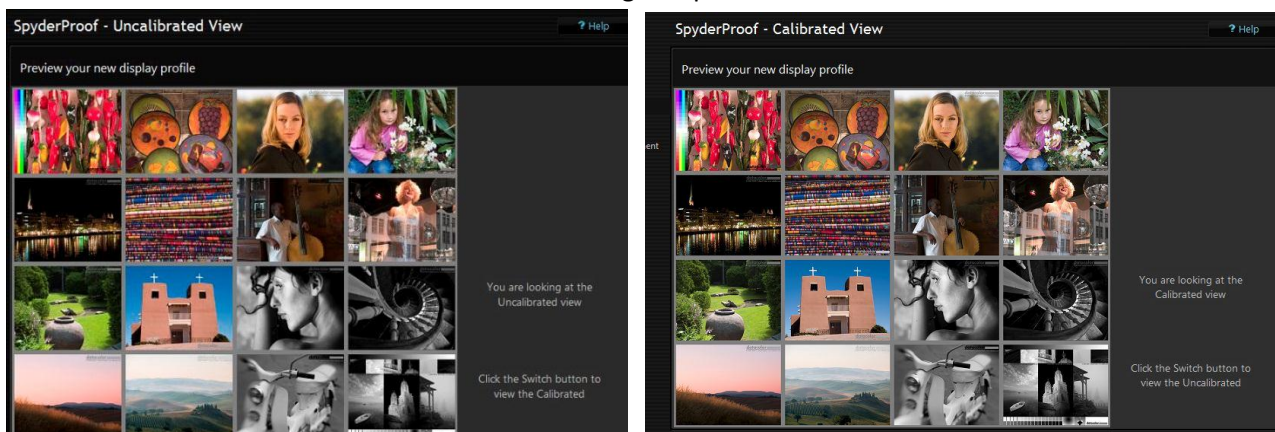
However there are several calibration tools available on the market today the most popular being the Monaco OptixXR, Eye-One Display 2 and the Spyder3 Xpress. Tests by various forums

have shown that the Monaco is very good and costs about \$250, the Eye-One unit is rated good and costs about \$150 and the Spyder3 is rated excellent and costs around \$90.

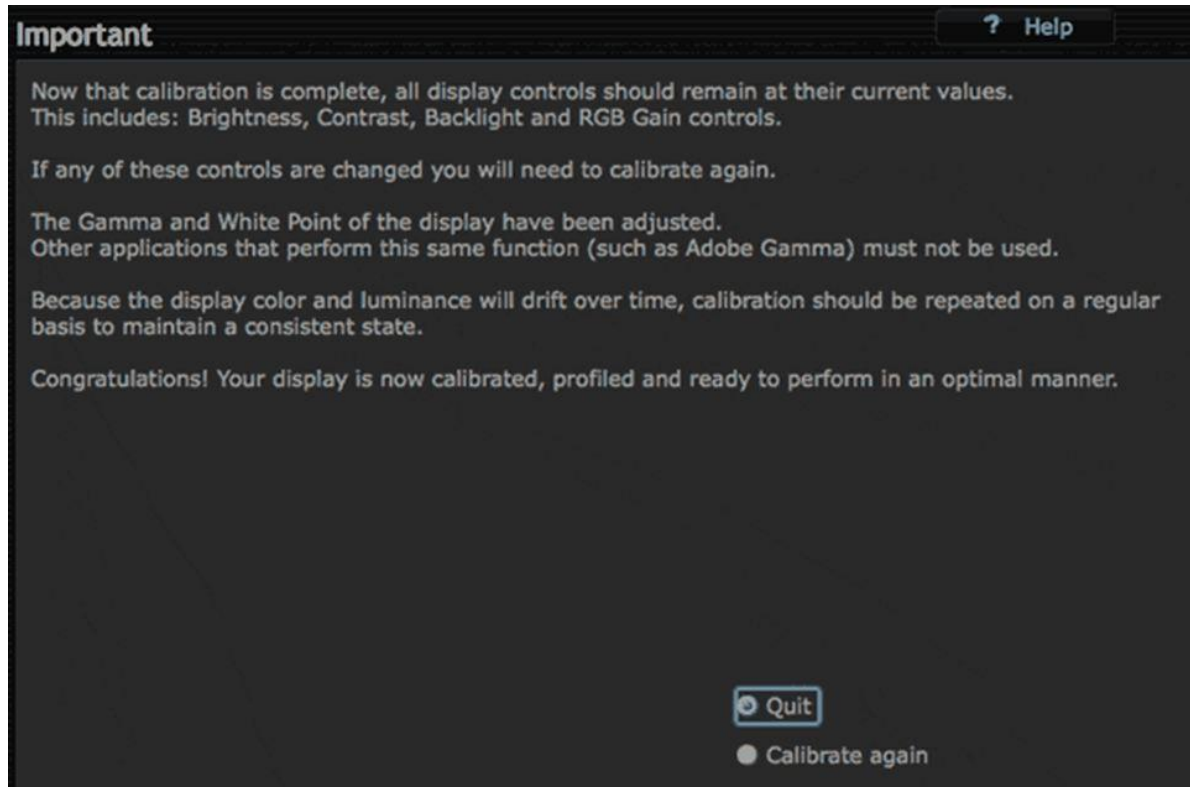
I use the Syder3 and have found it very good. Basically you put the sensor over the screen and start the software. The sensor detects the colors as shown on the monitor; the software compares this to a standard color profile. (See image below). You must be careful that the screen is not in direct light from either daylight or indoor lighting and it is recommended that you perform all calibrations as far as possible under the same conditions every time.



When the colors have finished being displayed the software writes a color profile for the monitor which is loaded into the video card and a test sheet of images is produced to show the before and after

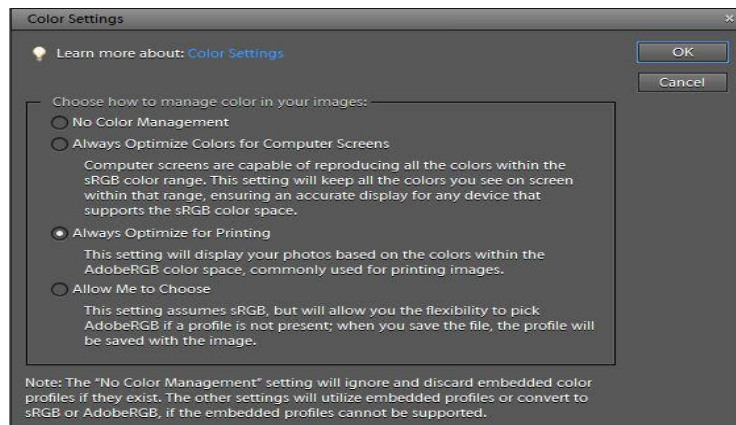


calibration. Note: Spyder 3 Xpress does not work for dual monitor systems, for this setup the “pro” version must be used.



Over time the calibration can drift (see image above) so the process should be repeated regularly. The profile can be set to remind you of this and it is recommended this is used. The calibration should always be performed under the same conditions as far as practicable, same ambient light, time of day etc. to ensure meaningful results.

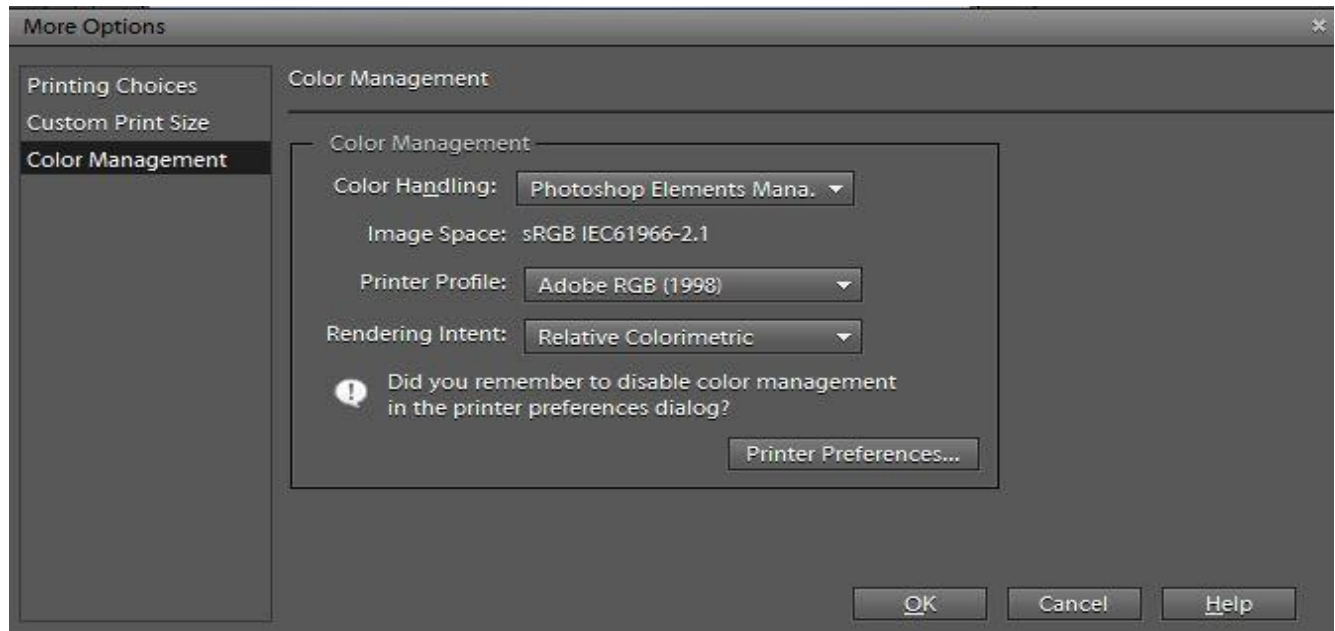
Adobe Photoshop and Photoshop Elements have settings for color management which should be set before doing any image manipulation or printing.



In Elements photos can be printed from the organizer or the editor but as there are more options available in editor I will show that scenario.

In Elements go to **Edit>Color Settings** and make sure that “**Always Optimize for Printing**” is selected. (See image on left).

Make sure you have a photo open in the work area and select **File>Print** to open the print dialog box. Confirm the correct printer is selected at the upper right corner if you have more than one printer and then click on the “more options” box at the bottom and select “color management” to open the box shown below.



Here you can set up the printer to closely match your other settings. First ensure that the color handling is set to Photoshop Elements from the drop down menu. Next check the printer profile. Some printers have a built in profile with the printer drivers you installed (most noticeably with Epson) but if your printer is not listed choose Adobe RGB as the profile. Notice the warning to disable color management in the printer preferences dialog. If you are not sure this is disabled click on the “printer preferences” and check.

Finally select from the drop down menu the “Rendering Intent”. This setting determines how “out of gamut” colors are handled.

Relative colorimetric attempts to map colors “relative” to the original. For most images this will be the best choice.

Absolute colorimetric is normally used in digital proofing to simulate paper color and is not recommended for photo printing.

Perceptual rendering is sometimes known as “photographic” rendering. Colors at or near the edge of the color gamut will be “pulled” into gamut. This can produce pleasing results especially with color transparencies.

Saturation will “pull” saturated colors thereby increasing the color strength or saturation. It is intended for vector graphics such as line art, logos etc. and should not be used for photographs.

If you are using the full version of Photoshop (version CS2 or later) you can take advantage of the “soft proof” feature which allows you to not only set the printer profile and rendering intent but paper type and color and then see the “proof” of the print prior to actually printing.

Finally if your printer has “print preview” capabilities (and most do have this) when you are going to print activate the preview and make sure that what the printer is about to print matches closely what you want. If there is a discrepancy and usually it will be that the preview is darker than your monitor image especially if you are using an uncalibrated unit, then it may be politic to use Photoshop or another editing software program to change the “brightness and contrast” until the preview is to your liking. To save money before printing a large image try printing a smaller version for proofing.

If you follow these simple guide lines the images you see coming out of your printer should be closer to the images you see on your monitor.