

Colour Management - A Practical Start

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Introduction

This advice is intended for beginners. Many people make colour management too complicated before learning and using the basics properly. Do not try to go too far too fast with digital colour photography. You will just end up in confusion and you will waste a lot of money in poor quality results.

The manufacturers of cameras, image processing systems, screens and printers do go to quite a lot of trouble to test their products so that they work for the typical user. Only when you have enough experience, and only then if you understand how and why you need to change, should you experiment.

How Do We Measure Anything

A measurement must include:

- What has been measured
- The scale of units used
- The result, usually a number.

For example:- Length, centimetres, 5

How Do We Measure Colour

We can measure a quantity of light, and repeat that at many points across a scene. Colour photography relies on the biology of the eye. By making colour measurements in the red, green and blue, and by presenting the image mixed in those colours, the eye will see a fair colour representation of the image.

What has been measured:

- When we measure in each of red and green and blue, the 'Mode' is RGB, and the data has three 'Channels', one for each colour.
- NOTE. Photographers sometimes use other modes, including Grayscale with one 'K' channel (black).

What is the scale of units:

- The scale is the 'Colour Space', which is a definition of the range of available colours, and how those colours are matched to the numbers in the result.
 - The sRGB colour space is an industry standard, matching the typical gamut of cameras and scanners for detection, and monitors for display.
 - The AdobeRGB colour space is a proprietary standard, defining a wider gamut than sRGB.
- NOTE: Do not confuse the mode of RGB with the colour space called sRGB, which is one possible colour space used in the RGB mode.

What is the result:

- The result for colour measurements is most commonly given as a whole number in the range 0-255.
 - The number range 0-255 requires storage of 8 computer bits, and this number 8 is called the 'Bit Depth'.
 - Other bit depths are available, with cameras typically recording RAW format data files in 12 or 14 bit depth, and with scanners recording in up to 16 bit depth per colour.

- NOTE: The bit depth may sometimes be described as the number of bits per pixel, which for three channels would be 24, 36, 42 or 48 using the above examples.

To summarise: The individual numbers in an image file can only be properly interpreted by knowing the mode and colour space descriptions. Although it is nearly impossible for an image file to lose its mode description, loss or misapplication of the colour space description means that the colours displayed or printed will not bear a correct relation to those captured or processed by the user.

What is Meant by Colour Management

Colour management has just two requirements:

- We ensure that the correct mode and the correct colour space remain attached to every image file. If, for some reason, we decide to convert the mode or the colour space, then the new descriptions must replace the old ones with the file.
- When a file is used, we examine the mode and colour space of the image file, and interpret the data numbers correctly according to those settings.

Taken together, these two requirements ensure that every step in the chain between image capture and image display will maintain colours as correctly as possible.

The chain between capture and display may be very short, such as plugging a camera into a home printer. Or the chain may be very long and involve the photographer with other users such as a processing laboratory or an exhibition organiser. Only if we know the colour management policies of all the links in the chain can we ensure correct colour processing from start to end.

There is a default policy to adopt in case of doubt. Because sRGB is the industry standard space for RGB mode files, we can assume that other users can at least implement sRGB processing. Therefore files being sent to other users are best left in the sRGB space, or if necessary first converted into the sRGB space. This particularly applies to all images put onto the internet, because the policy for most internet browsers is to assume sRGB even if that is untrue.

What Colour Space Should I Use?

All cameras can record in the sRGB colour space. That is, the camera creates numbers, as defined by sRGB, in the JPG image file, and tags the file to show that sRGB is used. Overall, sRGB is the colour space I would recommend as the best starting point for all your photography.

Some cameras have an option to record in the AdobeRGB colour space. Often this does not apply to all pictures, and the user ends up with a mixture of JPG files; some in sRGB and some in AdobeRGB. This can cause difficulty or confusion with image processing further down the chain. The advocates of using AdobeRGB say that the larger colour range must be a good thing. The detractors say that the extra colours defined by AdobeRGB rarely occur in typical photographs. Decide for yourself whether the complexity of working with files in a variety of spaces is worth the extra effort.

Camera RAW files contain the luminance data from every separate detector cell. While each cell does have a colour filter over it, the RAW file data does not have a colour space. The pixel result, in RGB mode, from RAW file processing is a 'demosaic' calculation from adjacent separate R, G and B detector cells. The user chooses the colour space when saving the result of RAW file processing.

Advanced photographers may process their images extensively. In this case, it can be helpful to convert the captured image into a very large colour space, such as

ProPhotoRGB, and use 16-bit depth editing. This is not because any extra colours magically appear in the image, but because processing the image does not allow any colour numbers to hit the end of the available range, and 16-bit data is less subject to noticeable arithmetic rounding during the calculations.

Photographers sometimes convert images into the Grayscale mode. For this it is best to set the space to Gamma 2.2 as this reproduces fairly closely to sRGB if the grayscale image is viewed with an unmanaged application such as an internet browser.

Converting between Colour Spaces

Interconversion is easily done, but is not exact and some image quality is lost for each conversion.

The main choice to be made when converting is the rendering intent, which manages any data from the source space which cannot fit into the destination space. For photographers, the choices are 'Perceptual' and 'Relative Colorimetric'. Again, there are different opinions. The differences are slight and most users can choose either.

Calibrating Your Screen

Although screens work quite well out of the box, any serious photographer needs to do better, and get their screen calibrated. Only a calibrated screen is good enough to judge critical colour adjustments in image files.

Laptop screens often give a different appearance as you move the screen forwards or backwards, or move your head from side to side. Any screen showing these effects is really not suitable for photographic work, and calibration is no solution.

Suitable calibration devices can be purchased eg, from the Spyder range. There are different models for calibrating screens, projectors up to calibrating printers. Before buying, check the facilities for alternative makes and models. Alternatively, borrow from a friend, or use one of the available call-out services.

The screen calibration process creates a profile. The profile is loaded into the video driver of the computer where it adjusts the colours sent from the application, such as Photoshop, so that they display correctly on screen.

Screen calibration should be repeated regularly, although not as often as some people suggest. An LCD monitor may be checked every 6-12 months. A projector with little use can be checked annually. The amount of drift at these intervals is usually small.

Calibration does not make your screen perfect. No screen is capable of being perfect, and displaying every possible colour. Calibration adjusts the screen software so that the highlights, shadows, and colours in between are as good as possible. Some people spend enormous sums of money to buy screens which are reputedly better.

Printing Colour the Simple Way

Your printer is a display device just like your screen, and it needs colour control via a profile. But you don't need to do anything special to get good prints the simple way.

The printer manufacturers will not release a model onto the market until they have worked out how to spray all their many and various inks onto paper to get the right result from an image file. But, they will only do that development work for their own inks and for their own paper types.

Printing colour the simple way means using only the printer manufacturer's inks, and only the printer manufacturer's papers. Make sure that all colour management is done by the printer driver, and not eg, by Photoshop. Choose the correct paper type in the printer control box, and you will get a very adequate result.

Where people start to go wrong is when they are persuaded to buy from a cheaper source of ink, or another source of paper, or both. The printer driver has no specific settings to use either the ink or the paper, and the results may be disappointing.

But, there are occasions when your printer manufacturer does not supply a particular type or surface of paper which you do want to use. In that case, you must use the method for advanced users.

Printing Colour for Advanced Users

For advanced users, the printer, combined with a particular ink and a particular paper, needs calibrating to create a profile, just like a screen. The profile then adjusts the colours so that the printer can lay down the correct amounts of ink to produce the correct result.

Unlike a screen, making a profile for a printer is not really something you can do at home: or not without some very expensive equipment. What are the realistic options.

If your aim is mostly economy, and you have bought some cheap inks and cheap paper, then you want a cheap solution. The first and free option is to try all the different paper settings in your existing printer driver control box. One of them may give good results. Maybe your 'glossy' paper works best with the 'plain paper' setting.

If your aim is to use a specialist paper, but you are still going to use the printer manufacturer's inks, then the paper manufacturer may have created a profile for your printer and ink, and with their paper. It helps them to sell their paper! These profiles are usually available as free downloads, and they will come with installation instructions. They will also come with instructions on exactly which settings to put in your printer driver control box when printing. For example, the entire range of Permajet papers, when printing on an Epson 1290 printer, requires the 'Glossy Film' media setting and 1440dpi whatever the Permajet surface used. Those were the settings used when the profile was created, and that is what has to be repeated with every use of the profile to make a print.

If there is no free profile available for your combination of printer, ink and paper, then you can use a postal profiling service. The service sends you an image file of colour patches, with instructions on how to print it with no colour corrections. You post off the print; they measure it; and they create a profile for you. Again, the profile will come with instructions for installation and use.

To use a specific profile for printing, the colours are adjusted before the data gets to the printer driver. Colour control is turned on in the application eg, Photoshop, and is turned off in the printer driver. The printer driver is given some standard media settings as instructed by the profile supplier. A note of warning. Photoshop remembers your last settings, and those settings remain in use. Don't go back to using Print with colour control in the printer driver. The results may be unusual!

Sending Your Files to Someone Else

One of the great advantages of digital photography is that image files can be exchanged with others, and can be converted between media (view, print) with ease. The time will come when you want to send one of your files to someone else.

Following the principles of colour management, you need to know what the recipient is able to do with your file.

Photobooth & Laboratory: Many shops have machines which will make a print from a file on your camera storage card. They are unlikely to tell you much about their colour management policies. You would be wise to assume they will think your file is in the sRGB colour space, and you should make sure that it is. The better laboratories publish their colour management policies, and maybe you can submit files to them either in sRGB or in some other colour space.

Projected Competitions & Exhibitions: Reputable event organisers understand that they must give guidance to authors about colour management. Almost always they will require files in the sRGB colour space. Use any other space at your own risk.

E-mail & Internet: The main point about colour management on the internet is that you cannot assume anything. You must use the default policy for colour management, which is to ensure your file is in the sRGB colour space. There are other issues such as file size which are not covered in this advice.