Getting your Monitor and Prints to display correct Colour*

Graeme James

4 April 2011

Otherwise known as *'Colour Management'

"Most artists react very warmly to the word 'colour', and a bit more coolly to the word 'management'. Put the two words together, though, and you can clear a room in seconds."

-quote from chapter 17 of *Photoshop CS3 Bible*

Red, Green, Blue (RGB) Colour

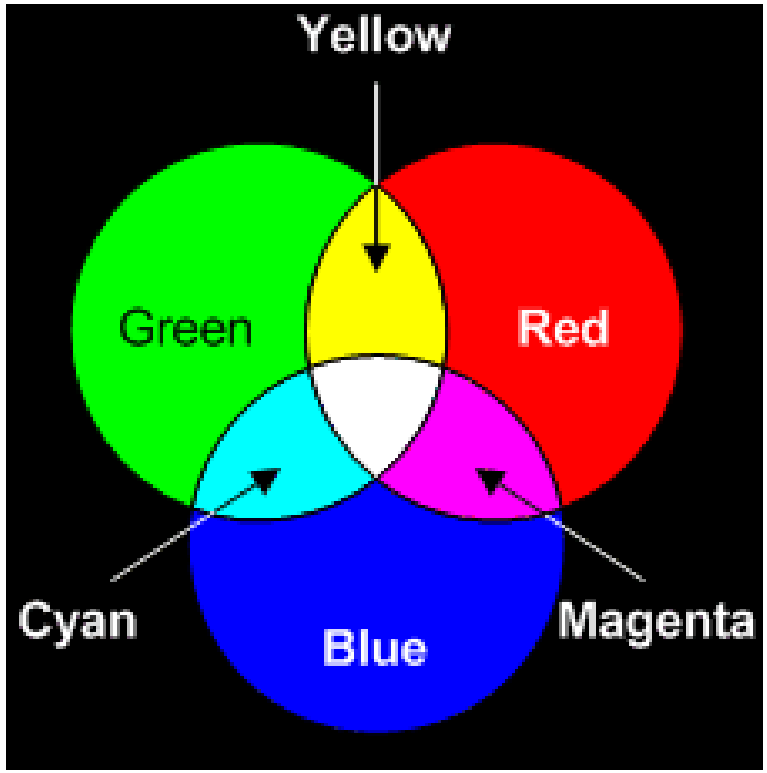
Primary colours:

RED

GREEN

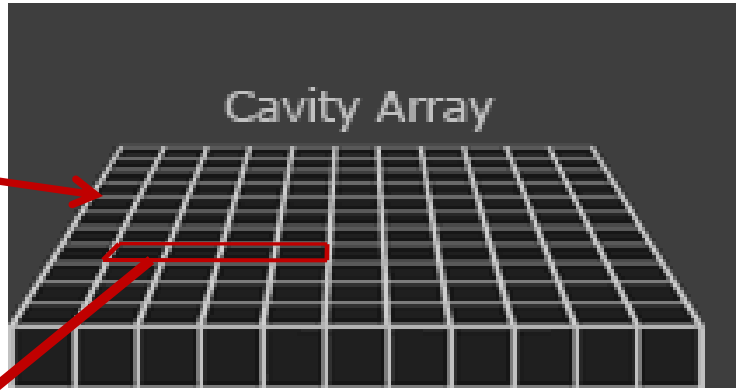
BLUE

Every other colour is
made up of a combination
Of the three primary colours



Camera basics

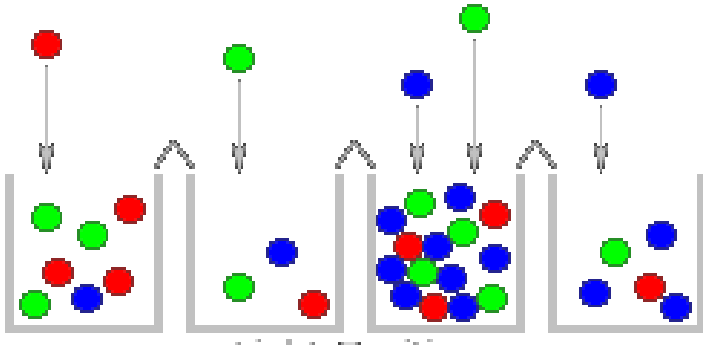
The sensor



Millions of tiny light sensing devices side-by-side on a rectangular grid

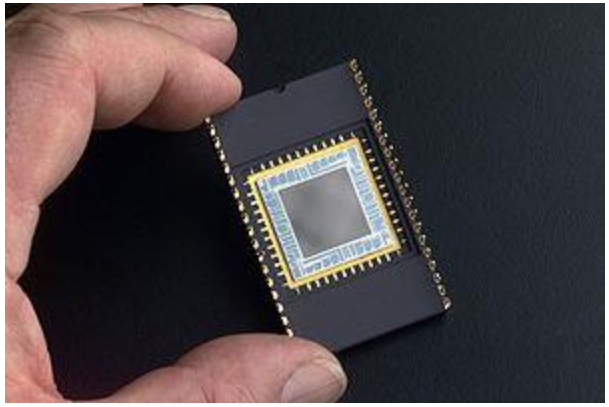
Light

(from subject)



Captures light intensity only

– limited to B&W image

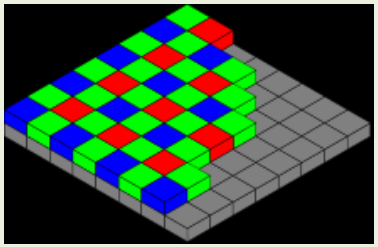


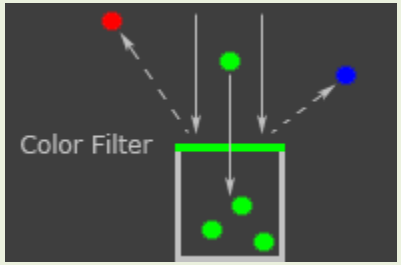
Example of a CCD sensor

Camera basics

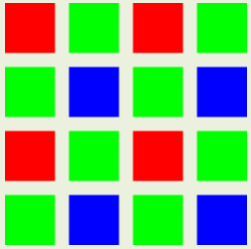
B&W-to-Colour

A colour filter array (*Bayer Array*) is placed on top of the sensor array to provide Red, Green and Blue channels.

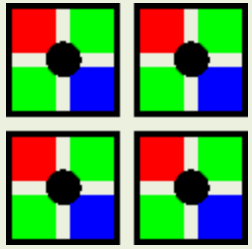




Green colour filter



Section of colour filter array



Four pixels

Without Bayer Array	With Bayer Array
Result is a B&W image	Result is a colour image

- Output from camera sensor in response to light is smoothly-varying (analogue)
- Converted into abrupt steps or values (digital)

A-to-D (analogue-to-digital) conversion

A side issue:

Choice of Camera

Small sensor

Compact

Pros:

Small; quiet; light-weight; RAW possible & high-quality images at ISO below 200

Pros/Cons:

Fixed lens but zoom up to 6x

Cons:

Slow; quality deteriorates Above ISO 400 with small sensor

Medium/Large sensor

DSLR

Pros:

High-quality images to high ISO readings (low lighting) with use of a larger sensor; fast; interchangeable lenses

Cons:

Large; heavy; noisy; expensive

Medium sensor

(no mirror)

Name?

(new from 2009)

Pros:

Similar to DLSR but without the cons of being heavy, large or as noisy

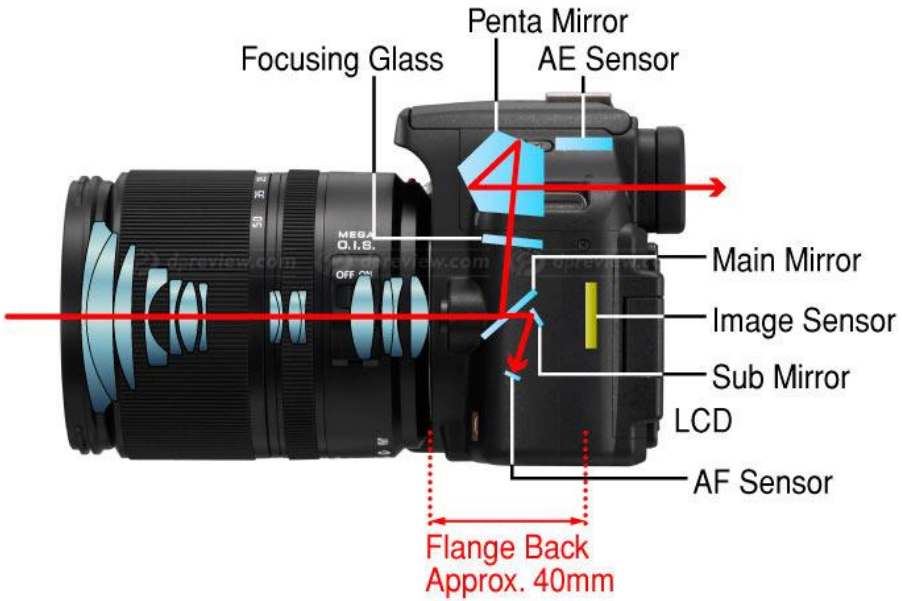
Cons:

Not as quiet & more expensive than compacts especially with interchangeable lenses

Is this the end of DSLRs?

(The mirror system a hangover from film cameras!?)

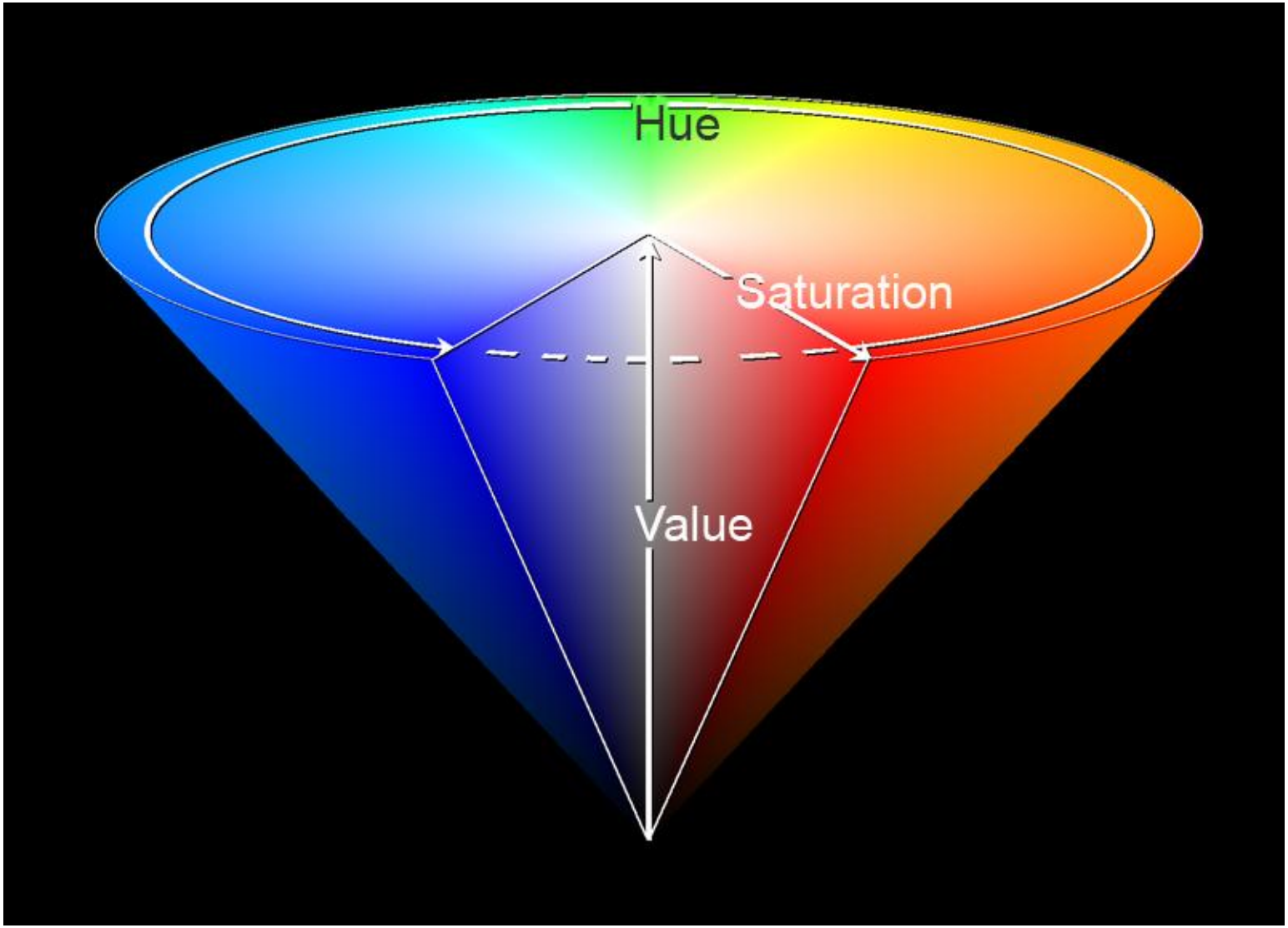
Mirror Structure (DMC-L10)



Mirror-Less Structure (DMC-GF1)

Returning to Colour Management

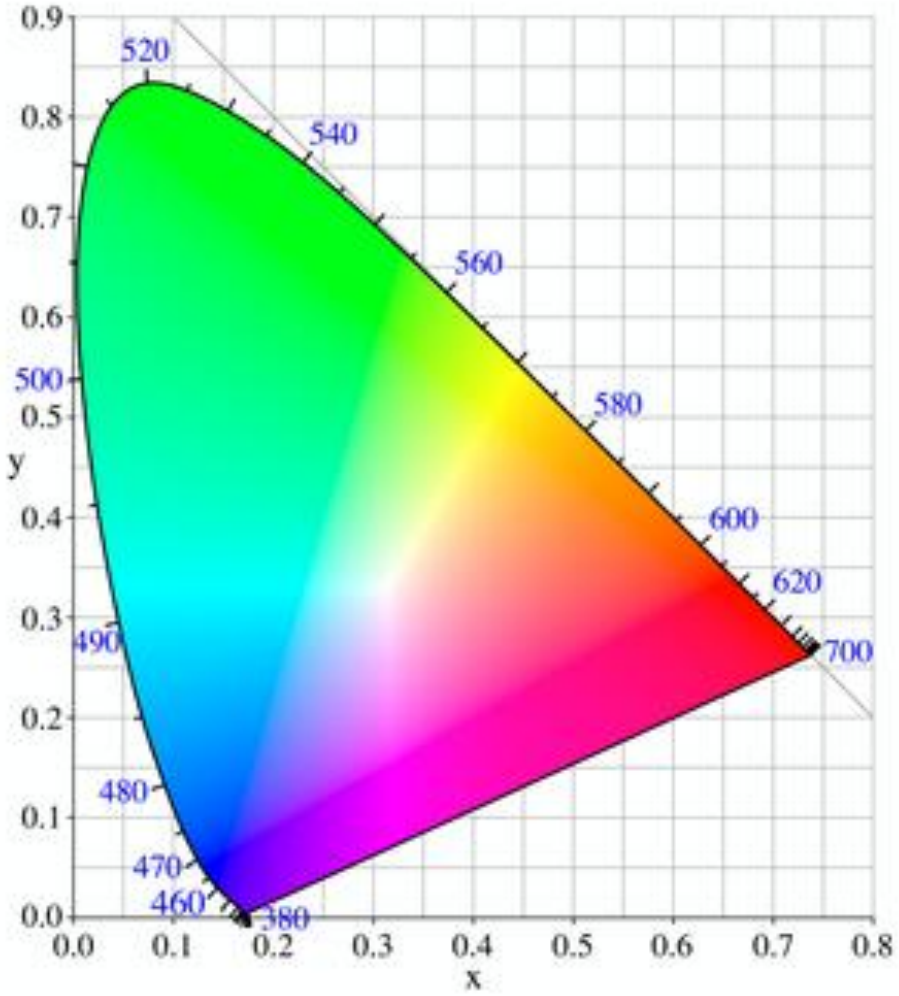
One representation of the complete colour space (gamut)



International Commission on Illumination (CEI) 1931 Colour Space

This is the commonly-used means of showing colour space or gamut.

Note: this is the ‘top’ view representing maximum brightness. Lower intensity values have the same colour distribution.



The limited colour space regions for camera, monitor and printer

Important Points!

- The camera, monitor and printer have **different** colour spaces so we need to have a common colour space for the accurate transfer of colour from one device to another.
- The ‘glue’ that holds the input and output systems together is via a common colour space or an “**ICC Profile**”. The ICC Profile transfer the critical information that maintains colour accuracy between devices.
- The ICC Profile is usually **embedded** into your image files so that it travels along and can get applied to every output device it is sent to.

Another side issue:

Your Image and File Formats

How your digital photographic image is saved is critical.
You need to be aware of three (there are many others) file formats by which means your image is saved. These are JPEG, TIFF and RAW.

JPEG

Widely used and the format available on all cameras.
Can be used for most printing jobs and sharing through e-mail and over the Internet. **Do not** use for editing. For editing simply save a copy of your file ('Save As . . .') and choose 'TIFF' as your format.

TIFF

Ideal for editing as no information is lost. Supports 16-bit files.

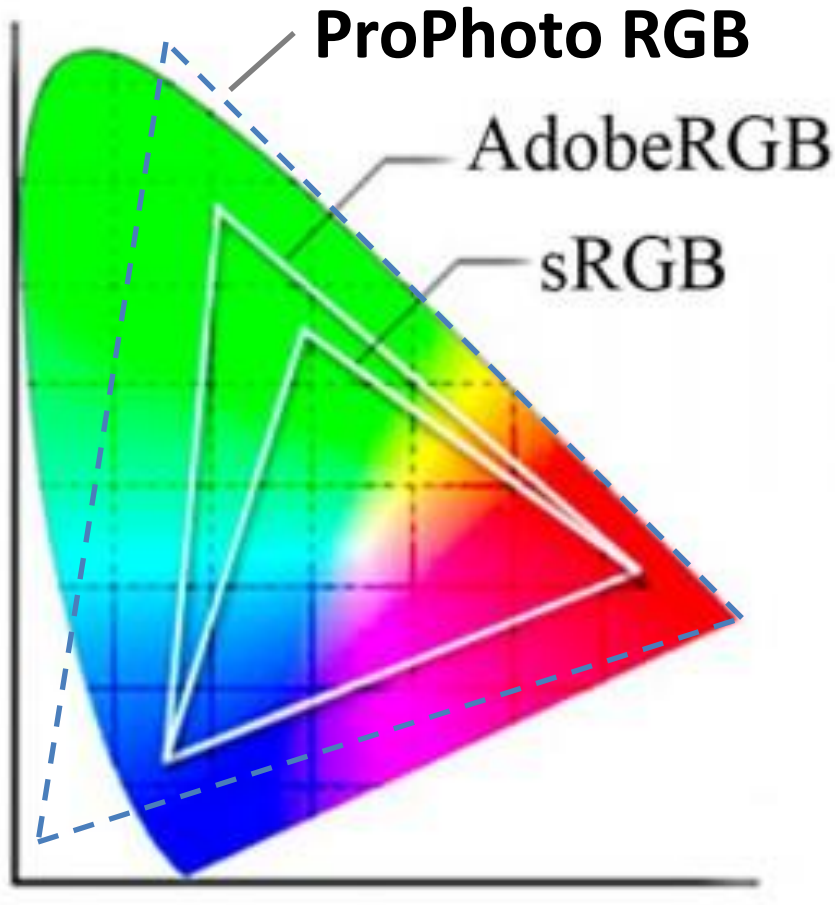
RAW

The 'Rolls-Royce' of camera files. It is the purest unaltered format available in retaining the most digital information. Many decisions can be left or adjusted after capture (e.g., exposure, colour balance, colour space, noise reduction etc). Preferred by all serious photographers!

Returning to Colour Management

Types of ICC Profiles

(International Colour Consortium)



From the camera

Embedded ICC Profiles
In the image file

JPEG

sRGB (most common)

Adobe RGB (not common)

RAW

any one of the profiles can be chosen as the preferred embedded profile at the time of RAW conversion

How to choose the correct ICC Profile

sRGB

The most common and default option for most people.

Adobe RGB

Choose this profile if at all possible, especially if you shoot in RAW and do your own printing.

ProPhoto RGB

For the future; leave well alone!

The Monitor

Initially set-up/check ICC profile assigned (either sRGB or Adobe RGB)

Windows XP: Control Panel→Display→Setup→Advanced
Vista/Windows 7: Control Panel→Colour management→Devices→(Add . . .)
Mac OSX: go to ColorSync panel and follow prompts

Calibration – most important!

Cameras and printers remain stable with time but —

monitors are not stable with time and require regular calibration.

Software-based calibration: now only available to Mac users but not recommended for accurate and reliable calibration.
Hardware-based calibration: a well-known calibrator is the Spyder 3 express ($150).

Advantages:

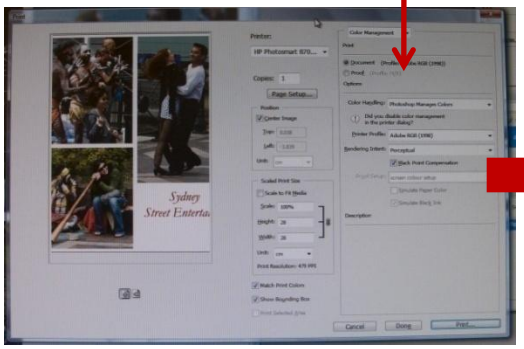
- easy to use
- takes about 5 minutes to recalibrate your screen
- provides a correction (automatically) to the ICC Profile to correct for errors in the colour drift of the monitor

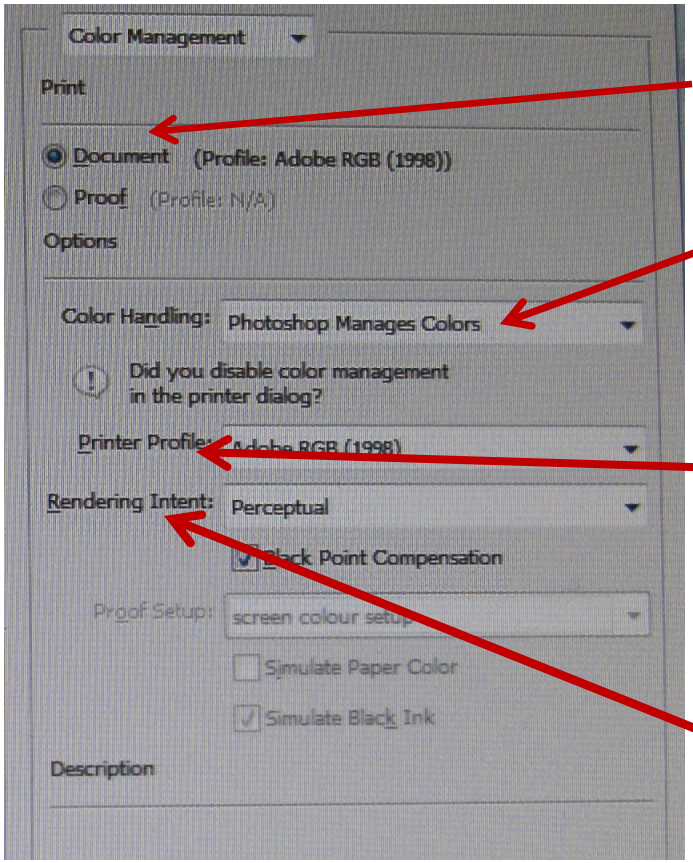
The Printer

In imaging software such as Photoshop, you need to set-up initially (and then forget about) your *RGB Working Environment*. In Photoshop CS3 Go to edit→color settings and you will find a number of parameters to set.

Printing

When printing the print page will have a Colour Management panel





Click 'document'

Click 'Photoshop Manages Colors'

Printer profiles: see comments on the next page

Rendered Intent: see comments on the next page

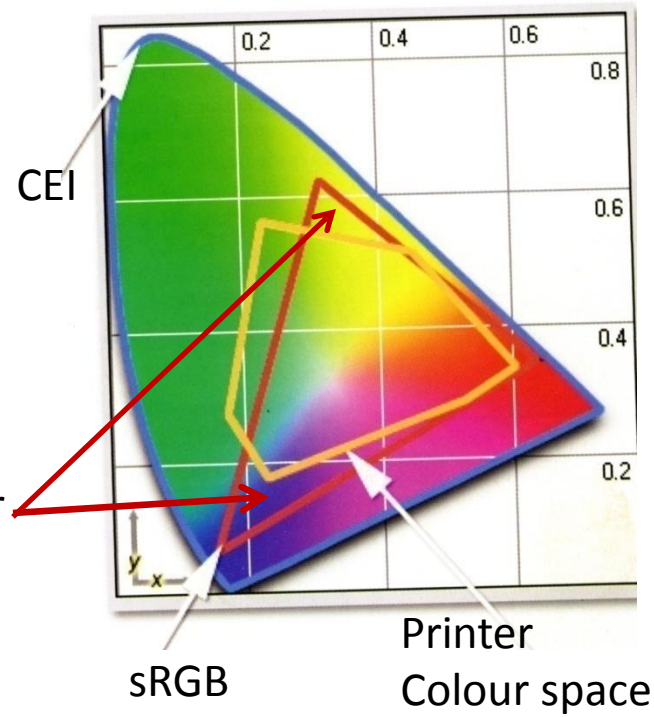
Important details on Printing

Printer profiles

This would be normally be set at your colour space (sRGB or Adobe RGB).
However for best results you should get an ICC Profile for your paper and printer (see www.imagescience.com.au or refer to data provided by the paper manufacturer) which will provide a correction to the ICC Profile you are using to account for printing colour errors. As printers, unlike monitors, are stable this is a one-off test. The image on you monitor (see next page) will then be as close as is possible to the printed image.

Rendered Intent

Rendered intents are ways to map colours in your image that are outside the colour space of your printer. They are essential for a good print. Of The four options choose 'Perceptual' as the best choice. (But don't ask me why!)



‘Softproofing’ and Printing

‘Softproofing’ is another example of unfortunate jargon that has crept into the digital photographic world. It refers to seeing on your monitor what you will get from your printer – at least as close as technically possible if you have calibrated your monitor and have custom profiles for the printer and papers you are using. With the printer and paper custom profiles to be of practical use they must modify the monitor display. In Photoshop CS3 and later versions this is found under View > Proof Setup > Custom . . .. A separate window ‘Customize Proof Condition’ will pop up and under ‘Device to Simulate’ menu list you will have listed your profiles with the names you have given them When first setting up the profiles. Clicking on the appropriate profile will modify your monitor viewing to match the printer and paper you are using. Always use this Softproofing option when doing any viewing or editing.

Conclusion

It is hoped that this set of notes will demystify colour management procedures and how to apply them. For any futher questions on these notes send me an email on graeme.james@iinet.net.au. A useful local web site is www.imagescience.com.au who also provide a custom profile service.

Graeme James
5 April 2011