CM Theory

Devices are different

All digital devices are different. Most people know that monitors and printers are not alike, but even similar devices of the same brand can, and often will be, different from each other. Even when brand new. They intepretate or reproduce colour differently. The easy way to see this for yourself is to visit a large TV shop and have a look at their wall of TV's. Even if all are showing the same program, with the same input for all devices, none of the screen images will be exactly alike.
The same thing frequently happens with identical image data on two different printers, scanners, digital cameras or monitors. Same data, different device characteristics.

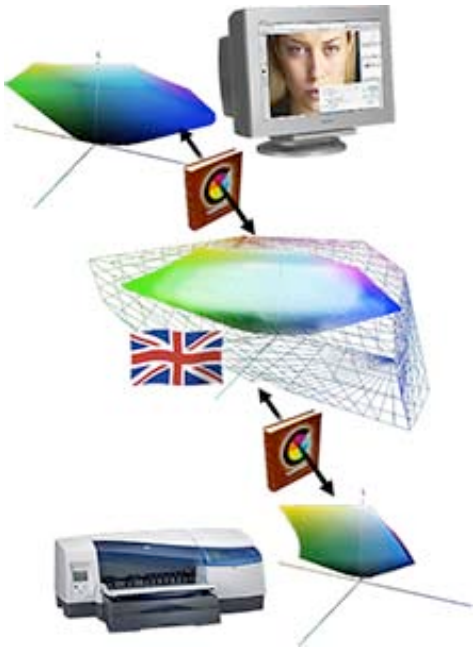
Colourspaces and ICC profiles

The reason devices are different is because they all have different colour spaces or gamuts. That means that the devices aren't all able to display the same colours. They have no concept of which colours they can or can't display, and have no idea of how the colours will actually look when reproduced.

RGB devices like monitors are superior at displaying Red, Green and Blue colours, because they work by projecting light on a dark surface (sort of anyway).
They are, however, not too good at reproducing pure Cyan, Magenta and Yellow.

Printers, on the other hand, are very good at reproducing Cyan, Magenta and Yellow, since they use pure inks of those exact colours. When it comes to reproducing, say, a blue colour, then the printer can only render this, by mixing Magenta and Cyan ink on paper, and this can't possibly render a blue which is as bright and clear as the blue the monitor can display. The same problem persists with Red and Green colours.
Alas, there is a great deal of difference between the colours which monitors and printers can show. To be able to predict how a colour will look on a monitor (or a printer, or other devices), we have to make a characterization of each individual device, and save this as a profile. This profile describes exactly how each device reproduces colour, compared to a known standard (Lab colour is the standard).

Colourspaces and Language



As an analogy colour spaces can be compared to languages. One could argue that each single device speaks a different language or dialect.
If we stick with that analogy, and the job at hand requires us to translate text from one language to another, we need 3 things:
1). We need to know which language the text is currently in.
2). We need to know which language the text should be translated to.
3). We either need a dictionary that translates directly from one language to another,
Or, 4). We need two different dictionaries, one that translates from our original language to a reference language and one that translates from that reference language to the destination language.
Nr. 4 is how ICC profiles work, using the Lab colour space as the reference "language".

So in order to know exactly which language our monitor scanner, camera or printer "understand" or "speak" we need to characterize each device.
That is, we need to create a dictionary between our reference language (Lab colour) and our monitor, so we can translate colour between our reference space and our device. This characterization or dictionary is saved as an ICC profile.

If we have a "monitor profile", a profile describing the characteristics of a particular monitor, we can easily translate colour data from our source colour space (say, Adobe RGB (1998)), via the reference space [Lab] to the monitor space. If the monitor profile is accurate, we will see a true representation of our image content on screen.

Source to destination

Thus to be able to rely on our monitor we require two profiles. One that describes the colour space our image is in, (workingspace to Lab), and one that describes our monitor (Lab to monitor). When we have these two profiles, the computer is able to make colour data conversion and the colours we see on the monitor will be correct. if we don't have an accurate monitor profile and a profile defining our source, there is no way we will ever see anything correctly on the monitor.

If we have another ICC profile which describes how our printer (inkjet, laser or even a printing press) prints colour, we can be pretty sure that whatever we print, will bear a close resemblance to what we see on the monitor.

An ICC profile is nothing more than a descripon of how a single device displays colour.

WYSIWYG

If you have ICC profiles which describes all your different digital devices, and CMYK printing processes, then you can easily convert between devices, limiting loss of colour to a absolute minimum, and with great reliability. Just think about it as if you need to translate text from, say Danish to German. All you need is a dictionary. In an ICC workflow the system would use say, Danish to English and English to German, thus making English the reference language.
With the proper ICC profiles you can do some very interesting things:

• When working in (coloursync savvy) camera or scanner software, you can use ICCprofiles (of workingspace, monitor and source) to give you continuity of appearance between the way the camera or scanner software displays an image, and the appearance of that image in Photoshop. This means that you can use the colour and tonal editing tools in the scanner or camera software. And do so confident in the knowledge that what work you have done on image optimisation will still be correct when you later open the image file in Photoshop.

• In your scanner, camera, or image manipulation software you can preview or "Softproof" a CMYK printing press output, by restricting the colour space of your monitor to that of an offset printer, as long as you have a good profile of the printing press and monitor.

• On your desktop printer you can simulate or "proof " how the final printed image will look, by restricting the gamut of your desktop printer to that of an offset printer.

• On your monitor you can simulate or softproof your desktop printer output.
As mentioned earlier you can't reproduce the exact same colours on a monitor as you can on a printer, but with the proper profiles, you can get very very close.

»Now you know how colour management works - Really! Implementing it, is simply a question of obtaining profiles for your devices, and setting up your applications correctly«

Monitor Calibration & Profiling

Monitor calibration and profiling is a two step process. Calibration involves setting various parameters usually on the monitor itself, so the monitor will yield the best possible result for our purposes. We call this optimising the hardware, a bit like tuning a guitar before playing. Profiling is the process of describing exactly how the calibrated monitor actually displays colour, alas recording exactly how the guitar sounds when tuned.

While it is possible to make a fairly good visual calibration of

some monitors with software utilities like Adobe Gamma, it does leave a lot of room for error. Certain monitors can never accurately be calibrated, and validating a monitor profile is no small task (see information of Pixl's Profile Verification Kit at www.pixl.dk). And you need to KNOW the calibration/profiling has been done just right… If you want to make sure that what you see on your monitor is correct, there is no substitute for a good hardware calibration/profiling solution and a good test print to verify the calibration.

There are many hardware devices and applications available. I personally prefer Eye One Monitor with BasICcolour display software or ProfileMaker Pro for best possible quality. Alternatively, an eye one display with Eye One Match which is possibly the cheapest, most easy operable, resonably good quality monitor profiling combination currently avaliable. You can of course purchase this equipment through Pixl.

The only thing you'll need to set with Eye One match are Gamma and White point. For 99% of all monitors use these settings.

Calibrate your monitor whitepoint to *6500 Kelvin* (D65) and Gamma 2.2, only A monitors produced by Apple (and labeled with an Apple on the front) should be calibrated to Gamma 1.8. Apple LCD monitors should be calibrated to Gamma 2.2.

Just follow the on screen instructions, keeping in mind the settings we've recommended. These settings hold true for almost all monitor calibration applications.

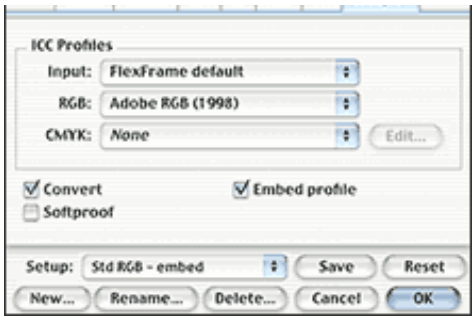
Choosing a monitor profile

On OS X and most PC's the monitor profile is automatically selected upon profiling. On some OS 9 systems as well as PC's running something else than Win 2000 or XP, it's worth checking after profiling (and restarting the computer). When you open the Monitors control panel (Mac OS 9.x), under colour, make sure the correct profile is selected here. IN Mac OS X you select the monitorprofile under system preferences > display. On a PC you right click the desktop > properties > settings > advanced > colour management and make sure the profile is the one active. If not selest the newly created profile and associate it with your display. All colourSync aware applications will check with this control panel to ascertain which monitor profile to use to display your images.

colour settings in Flexcolour

(Many other scanner and camera software is set up in a similar manner so try to transfer these settings to your own software)

colour management in Flexcolour is very easy to overlook.



Under File > Setup click the colourSync tab (ICM on PC's) at the far right. You already have all the input or source profiles you need after doing a standard install of Flexcolour, and you will have a number of Imacon CMYK profiles too. If you have Photoshop 6.x or later installed you'll have the most common RGB working spaces as well.
Remember that the input profile is supposed to describe the colourspace of your input, so you will need different input profiles for different sources.
Please note that when you select a standard setup, the correct input profile is automatically selected for both the FlexFrame camera and the various scanners, regardles of what you scan.

First of all click the *New* button at the lower left corner of the dialogue, and name your setting with a logical name of your choise, like "My FlexFrame RGB" if you use the FlexFrame camera.

In the ICC profiles field you need to select Input, RGB and CMYK profiles.

Input

is the input profile or source profile. For scanning transparencies on a Flextight scanner you should use the profile called Flextight and then the name of your scanner. So for a Flextight Precision scanner you would use the Flextight Precision profile under input.
A Flextight Photo scanner would require a Flextight Photo profile for transparencies and so on.
If you scan either colour or B&W negatives you should use the Flextight Input profile, no matter what scanner you use. If you use the FlexFrame digital camera you should use the FlexFrame Default profile (or whetever the default profile for you camera is called) or even better a custom profile if you have access to one.

RGB

is where you select an RGB profile that corresponds with your Working space of choice in Photoshop. So for example if you have chosen to use the Adobe RGB (1998) working space in Photoshop, you should choose this under RGB in the Flexcolour software as well.

CMYK

is where you can select which CMYK profile you want to to convert your images to, if you want to scan/shoot directly into CMYK. If you decide to convert your images to CMYK in Flexcolour, you should set the CMYK profile here as your default CMYK Workingspace in Adobe Photoshop. See details on how to do this later.
A warning though, if you decide to "scan" directly into CMYK you better make sure you know what you are doing. Using the wrong CMYK profile can be devastating to you image (and costly). Now you only have to check a few checkboxes, before you are done.

Convert

is the one to check if you want to convert your raw image from your input space, to your RGB or CMYK space. Which of the two is used, depends on which mode you have chosen to use (RGB or CMYK). We recommend that you convert your raw scans to RGB, rather than leave them in the original colour space [that of your scanner or camera].

Embed will embed the correct ICC profile in all your images. This should always be checked, so that other applications down the imaging chain will be able to recoignize which colour space the file is in.

Softproof

should only be used if you if you want to convert your images to CMYK. If this is checked you will have the best possible simulation of how your image will look, when printed on the device (printer) that your CMYK profile describes. You should only use this option, however, if the CMYK profile you have chosen is generated on the basis of the exact paper stock your offset will be printed on! In reality this means leave it turned off for most things...

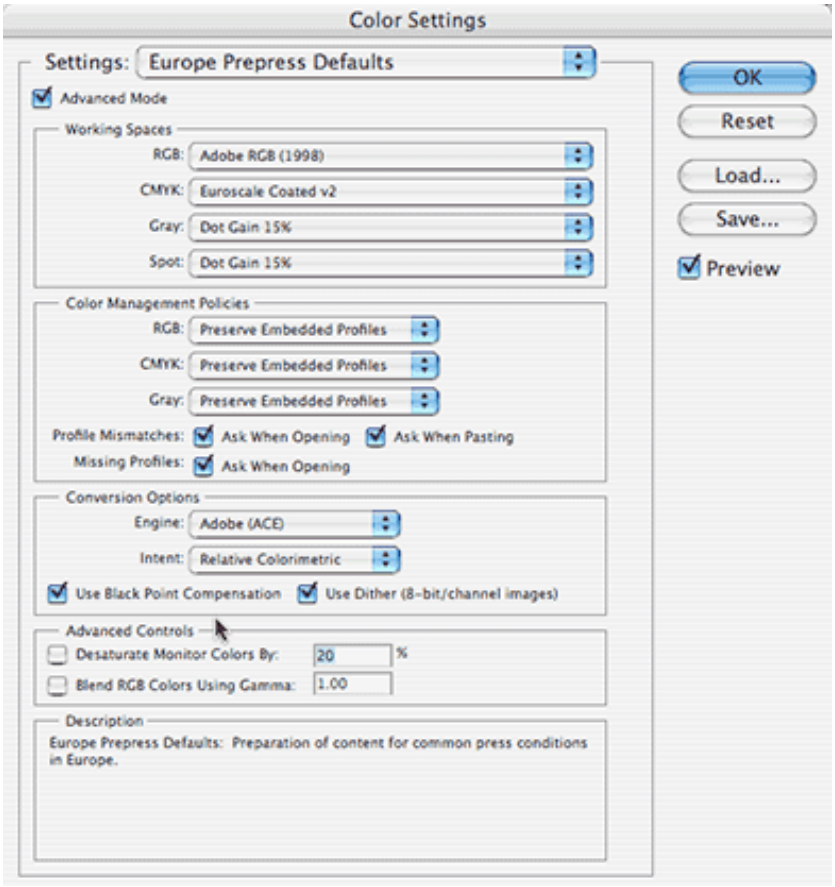
At this point when having set up everything to your liking, you should click Save to save all the settings, so you can easily pick this entire set of profiles/settings, either under the Setup field, in the primary software interface window, or here in the colourSync tab. This setting can be copied to other computers using Flexcolour, so other workstations easily can be set up to use the same settings that you do.

Colour management setup in Adobe Photoshop 6/7/8(CS)

When you are working with both a scanner/camera application and Photoshop, it makes sense to set up both applications alike, so they are in "sync". Based on the way we set up Flexcolour before, we'll go ahead and set Photoshop in a similar manner.

The easy way is to select one of the Prepress Default settings (Europe-, US-, or Japan Prepress Default).

Under Edit > colour settings you will find all Photoshop's colour settings. First off you need to check the advanced Mode checkbox at the top left corner. If you don't do this, you won't be able to select any other CMYK profiles the the recommended Adobe profiles, or your own custom ones.



Under Working Spaces set RGB to the same space you set RGB to in Flexcolour. We recommend using Adobe RGB (1998) since this workingspace practically encompasses all the colours you will need for later reproduction.

Under CMYK you need to select a CMYK profile that describes the printing process you ultimately want to use.

Under Gray (for grayscale) you can choose whether you want your grayscale images targeted for print, or for monitor display. If you work with images which will be printed, and you can't obtain accurate information from your printer, you'll need to estimate how much dot gain the printing process has, and set this. If I'd say, for offset work in Europe, 15% would be a good start and in the US I'd recommend 20%. If you target grayscale images for monitor use, I'd choose a gamma setting of 2.2 if the images will be displayed on a colour managed monitor, or

an non colour managed PC monitor (like the majority of the internet), or gamma 1.8 for non colour managed Mac CRT monitors (of which the last was built in 2001.

Under Spot (for spot colours) you need to estimate how much dot gain the printing process has, and set this. For offset work in Europe I'd say 15% would be a good start and in the US 20% would be my recommendation, if you can't obtain accurate information from your printer.

Colour management Policies

This is the place where you set up, in general, how Photoshop should treat images when opening them. We'll recommend choosing Preserve Embedded Profiles for RGB and CMYK, and Convert to Working Gray under Gray.
Underneath there are a few check boxes, that allow various warning dialogues to pop up when you open images. We recommend you to check all these.
In Conversion Options under Engine you should choose the Adobe (ACE).
Under Intent you should ordinarily pick Perceptual, as opposed to the default if you choose a custom profile, and relative colourimetric if you use one of the Photoshop supplied CMYK profiles. (rendering intents is a big subject. Please investigate what rendering intents actually do for optimum quality.
The check boxes Use Black Point Compensation and Use Dither should always be checked.
In Advanced Controls nothing should be checked.
Now hit the Save button and name this entire group of settings to your liking. You can also write a description that explains what the settings do. This group of settings can be copied to other computers using Photoshop 6.x or later, so other workstations easily can be set up to use the same settings that you do. Incidentally the same setting can be used for setting up Acrobat, Illustrator and In-Design as well. You simply selecting the entire saved setting under Settings at the top of the window, or by clicking Load and navigating to wherever the previously saved setting currently is.

If you have been following our advice so far the following will happen:
1) You are shooting/scanning and converting to your RGB workspace [we suggested Adobe RGB (1998)] in Flexcolour. When this image is opened in Photoshop, you won't get any warning dialogues as your image data has been converted on the fly, during capture, to your RGB workspace. The monitor image in Photoshop, will be identical to the one in Flexcolour.

2) You are shooting/scanning in RGB in Flexcolour, and have chosen not to convert to your RGB Space, but only to Embed a profile. When opening this image in Photoshop you will be presented with a Profile Mismatch, telling you what profile is embedded (what colour space the image is in), and asking you what to do. There are two sensible to routes to go:
A. You can convert to your working space.
B. You can choose to Preserve the Embedded Profile.

Both routes will give you a monitor image in Photoshop, which is identical or near identical to your preview in Flexcolour.

However, because of issues with making edits to the colour or tone of images in non linear colourspaces [like certain scanner spaces] we would recommend you make the conversion to your Photoshop workingspace.

3) You are shooting/scanning and converting to CMYK in Flexcolour. When this image is opened in Photoshop you won't get any warning dialogues as your your image data has been converted on the fly, while saving, to your CMYK workspace. If you have clicked the softproof check button in Flexcolour, the on screen image in Flexcolour should be virtually identical to the one in Photoshop.

Printing in Photoshop 6.x+7.x using ICC profiles.

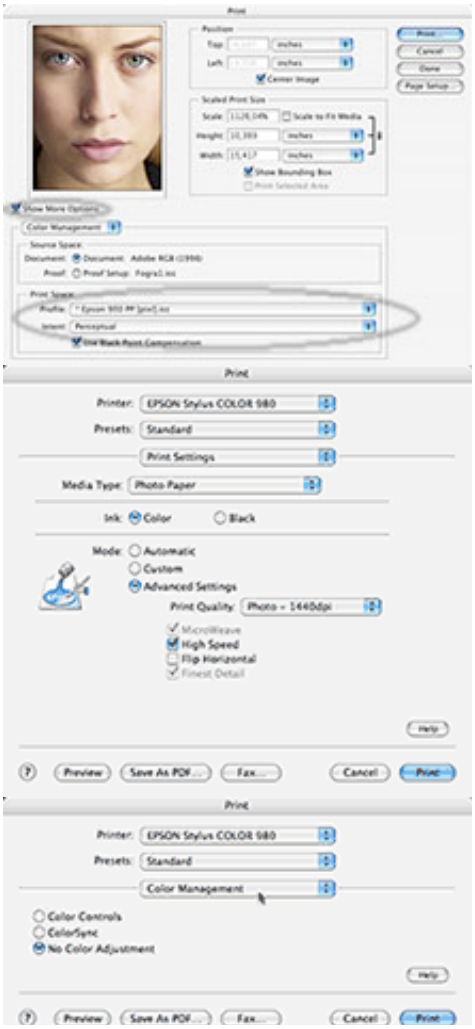
To be able to print using colour management you will need a custom ICC profile for your desktop printer. A good hardware and software bundle for generating professional ICC profiles can easily cost $6.000 or more. Unless you need to generate a lot of profiles yourself, you might want to use a remote profiling service for generating the printer profiles you need. One such service (the best there is in our own humble opinion) is avaliable at http://www.pixl.dk.

You can basically print in two different ways from Photoshop, when using ICC profiles. You can make nice looking prints, utilizing the full gamut of the printer. This is what you usually do when printing RGB images as aim prints or for portfolio use.

Or you can choose to simulate your final destination printer, perhaps using an Offset printing profile, or to simulate Contract proofs like Cromalin® or MatchPrint®. This is achieved by restricting the gamut [the ability to reproduce strong colours] of your desktop printer to that of the final device. This will only work correctly if the colour space or gamut of your desktop printer contains all or nearly all colours that can be reproduced on the final device.

The Printer Driver

When printing your image from RGB, you need to set up a few things the first time you are printing. This example is from an Epson SC980 printer. First open up the image you want to print. Then choose File > Print with preview which takes you to the main Photoshop printer window.
Here you select your printer profile under print space - your source is already selected.



When you hit OK/Print you get to the Epson printer driver. This unfortunately have slightly different appearence depending on your operating system. These screen shots are from OS X.

You need to have all theese settings set up exactly as they were when you had your custom profile generated. Generally this involves setting media type, resolution, high speed, and colour management (to no colour management).
Then you shouold save this setting so you easily can select it in the future.

If you don't have a custom profile try using Photo Realistic or Automatic in the epson driver, and "same as source in the Print Space window in Photoshop's first print with preview screen, and keep your fingers crossed...

Aimprints

When you want to produce aim prints from RGB you open your RGB image, and choose File > print with preview.
In Source Space your current colour space is shown under Document, so check the document button. In Print Space you choose the custom profile that describes your printer, say Pixl Epson 900. Intent should be set to Perceptual to utilize the full potential of the printer. Choose your saved settings for the printer driver, and then print.

Producing Proofs (Simulated Offset print)

If your image is in CMYK, the procedure is almost exactly as above, except that under Intent, you should choose Relative colourimetric, to restrict the gamut of the printer to that of your CMYK space, or Absolute colourimetric to simulate the paper colour of the reference. Select your saved settings and print

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