Kwik 'n' Dirty Color Management

Thanks to Chief on DPReview for pointing me towards the final pieces that got everything to fall into place.

Color management isn't something the amateur or even professional photographer has had to worry about -- or even the darkroom wizard. It was the province of the graphic designer, art director, and printer -- the guy who took the rap if the skin tones came out green even though they looked fine on the slide. However, with digital cameras in every pocket, Photoshop in every computer, and high-quality inkjet printers on every desk, it easily becomes a real issue. More so if you take the leap to RAW processing. However, like most things, it's not rocket science either -- once you understand what's going on and what can go wrong, it becomes fairly... manageable.

Color management is a bit daunting, and very frustrating if you don't know what's going on -- and there's a lot of nonsense about colorspaces, profiles, Adobe RGB, and sRGB floating around discussion boards. However, the basic concepts are actually pretty simple, and nowadays both Windows computers and, of course, Macintoshes are well equipped to deal with it. Unfortunately not yet Linux systems, though, but now that digital cameras have gotten nerds interested in image processing, I have high hopes that we won't have to wait long.

In this essay, we'll take a quick and dirty approach to understanding color management and knocking together a system that gets the job done reasonably well. It'll be the poor and lazy man's approach, and won't get you the hi-fidelity results you can achieve using professional monitors, IT8 targets, colorimeters, spyders, and other widgets like that -- but it'll be good enough to get the job done, most of the time.

There are a few basic concepts [?page=4#concepts] we need to get our head around before going to the nitty-gritty of color managing your system. These are **color gamut, color space, working space,** and **profile.** Once we understand what they mean and how they relate to each other, we'll look at what your computer does with them. Then we'll get to the specifics: a step-by-step guide [?page=5] for color managing your own computer -- including profiling your monitor [?page=6] without special hardware like spyders or colorimeters (although these will certainly make things easier). Finally, we'll look at a simple way to test [?page=7] your color managed workflow, and finish up by shooting some trouble. [?page=8] But there's one thing we need to address before all this.

*When **not** to color manage*

As I mentioned above, color management is a bit tricky, and it can be frustrating if you're doing something wrong. Messing with the color management of your system without seeing it through will probably make things a lot worse. This means that there are situations when you might not *want* to color manage your system.

If you're pretty happy with your prints and display. Profiling your stuff correctly *will* get you a little more accurate colors, but the eye is really good at adapting to minor shifts: so, if you're happy with what comes out of your system as it is, stop reading now -- it's almost certain that attempting to color manage will only make things worse. Color management is a bit like rigging up a sound system -- if you do everything right, the sound will be pretty good out of the box, and you may not want to get drawn into the color managment equivalent of audiophilia. It's almost as frustrating and as expensive, and it's unlikely to impress anyone as much.

If you shoot in JPEG and do little post-processing besides maybe correcting exposure with Levels a bit, resizing, and sharpening, and your prints look more or less OK, it might be best not to try to fix it when it ain't broke.

If you use no color space aware image editors, profiling will only make pictures look a little bit better on your screen. In other words, it's probably not worth the bother.

Nevertheless, even if you don't "seriously" color manage your system, do make sure that all your drivers (including the one for your monitor) are installed and configured correctly -- often all it takes to correct really weird color on printouts is just to check that all of the factory-supplied stuff is working as it should. If you have obvious, major weirdnesses, skip the rest of the article and go directly to Troubleshooting [#trouble] below.

And, **very importantly:** shoot in sRGB if you're not on a color managed system. Adobe RGB will *guarantee* you incorrect, flat colors.

*When you **must** color manage*

OK, nobody's holding a gun to your head, but there still are a couple of situations where you're unlikely to get anywhere near accurate color if you don't lend some attention to color management.

If you're shooting or converting to Adobe RGB. Adobe RGB pictures displayed on a non-colorspace-aware application or badly color-managed system will look *wrong, wrong, wrong.* The colors will be flat and gray. If you like them that way, fine -- but remember they'll come out bright and vivid if you send them to a competently run photo lab that prints from digital originals. To ensure flat and gray prints, use sRGB and make them flat and gray in your image editor instead.

If you're scanning color film. It's almost impossibly frustrating to get color right on scans, especially scanned slide, if your scanner and monitor aren't correctly profiled. To make it worse, scanners are individuals -- the factory profiles may not work all that well. So, if you have a scanner, profile it -- unless, of course, you're lucky enough to get great color out of the box. Unfortunately, I can't think of a workable way to profile a scanner without an IT8 target, which will cost you a few tens of dollars. See your scanner's manual or Hamrick Software, [http://www.hamrick.com/vuescan/html/vuesc6.htm] the home of VueScan, the end-all be-all of scanning software, for more on profiling scanners.

If you're shooting RAW. This means you'll be tweaking white balance, correcting color shifts, doing all kinds of stuff to the tone curve, and so on. In other words, it's very important that your screen accurately represents the image as God and the camera manufacturer intended it -- otherwise, you'll get prints that look very bizarre, and you'll have a hard time getting the color looking "right" even on-screen.

If you're doing heavy post-processing. Same thing: while you can trust your camera to get the color mostly right by using the pre-set white balances in the conditions that match them, if you do major tweaks to color and tone in post-processing, all that work will go to waste if the color gets screwed up by bad profiling.

What is color management?

Before we go any further, let's clear up the mystique about a few concepts related to color management: namely, **gamuts, color spaces, working spaces,** and **profiles.** Note that what I'll explain here is something of a simplification: the big picture is correct, but some of the details aren't. If you want to find out the gory detail, stop surfing the web for pre-chewed, unreliable information and buy a good book

http://www.amazon.com/exec/obidos/ASIN/0201773406/ref%3Dnosim/afewscannitips/002-3886417-7384026]
instead.

The problem

We people have very good color vision. This means that we can distinguish a pretty wide range of colors, from the deepest, reddest red to the deepest, most violet violet, with the most intense greens, fluorescent oranges, and whatnot in the middle. The machines we build are a lot more limited. No display or printing medium available to the general public is capable of reproducing anywhere near the full range of color that humans can perceive. For example, you simply can't reproduce "fluorescent" colors on your computer screen or with your inkjet printer -- you'd need special pigments or phosphors for that.

Different devices can capture or reproduce different ranges of color. For example, a good inkjet printer can print somewhat greener greens than a good monitor can display. Generally CRT monitors can display wider ranges of color than LCD ones. Different scanners and different digital cameras can capture different ranges of color.

We run into trouble when we transfer images between these devices. We photograph a scene with a digital camera that sees a certain color range. Then we view and edit it on a monitor that may not be able to display all of the range. Then we print it on a printer that can maybe do a bit greener greens than the monitor could display, but still less than what the camera could capture. So, how can we get the devices talking to each other in such a way that color is anywhere near consistent?

Gamut, Color space, Profiles

To make sense of the chaos, we'll introduce a few concepts: **gamut, color space, working space,** and **color profile.**

The first concept is pretty easy: **gamut** simply means *the range of color a particular device can record or reproduce*. If we say that a gamut is "wide," it means that the device can record or reproduce comparatively more different colors than one with a "narrow" gamut. So, for example, we can say that the healthy human eye has an extremely wide gamut, a good inkjet printer has a gamut that's wider in the greens than an average monitor, and a poor LCD screen has a pretty narrow gamut.

So, to rephrase the problem described above, *we need to find a way of converting images between different gamuts* in such a way that we can get reasonably consistent color reproduction.

First, in order to get a computer to understand about color, we need to find a way to represent it as numbers. This is pretty easy (although, if you do buy that book, you'll find there are a quite a lot of complications under the surface). Basically, we'll assume that every color can be represented as a mix of three primary colors: red, green, and blue. So, all we have to do to represent any color is list the proportion of red, green, and blue in it, along some arbitrary scale we've invented. Suppose we decide to use a scale of 0 to 100. So, red would be (100,0,0), blue would be (0,0,100), and yellow would be (100,100,0).

However, here we can already see a problem. Since the brightest green a device can represent varies, *what do these (r, g, b) values really mean?* Basically, (0, 100, 0) means one shade of green if we're talking about what we can see, another shade if we're talking about what our monitor can display, and yet another if we're talking about our printer. Trouble!

Color space

The next piece in the puzzle is **color space**. This concept is a bit trickier than plain ol' gamut, and to keep things understandable, I'll fudge the details somewhat in this section, so once you get the gist of it, forget about the numbers and specifics about the space, and look the real thing up if you still care about it.

Let's represent all the colors the healthy human eye can see as a three-dimensional blob suspended in space. First, we'll make a triangle, with the reddest red, greenest green, and bluest blue in each corner. Then we'll add the whitest white and the blackest black floating above and below the triangle. When we connect the dots, we get a weird shape like two triangular pyramids stuck together by their bases, with the top vertex white, the bottom one black, and the three horizontal ones red, green, and blue, with all of the colors and shades blending, mixing, and flowing together inside it. So, all of the colors we can see are inside this blob. Moreover, we can point to any color in it with an (r, g, b) triplet, where 100 represents the purest red, green, or blue we can see. Anything outside it we can't see or distinguish from the closest point inside it. We'll call this blob in space **color space H** (for Human), or C(h).

Now things are beginning to clear up. We can represent the gamut of our monitor as a three-dimensional chunk inside color space H. We'll call this C(m). We can do this for all of our color devices -- digital cameras, scanners, printers, the works. We'll use the same system for locating colors inside C(m) as for C(h): 100 means the brightest color that the monitor can display. What's more, we can represent these color spaces mathematically: therefore, if we mark a pixel as (90,0,0)C(m), we can see where it falls within C(h) -- it could be, say, (65,5,3)C(h). We have solved the problem in principle... but not yet in practice.

Working spaces

Now, how should we represent *images?* Of course, one way to do it would be simply to let each image be represented inside the color space of whatever device created it. This isn't entirely satisfactory, though: for one thing, the image would have to carry information about its color space with it, or otherwise it wouldn't display correctly on a computer that didn't know about the device that created it -- and it would get displayed totally wrong on a system that doesn't understand color spaces. Therefore the concept of "working space."

A working space is an "imaginary" color space. It's a chunk of C(h) that's been cut out purely for convenience -- it doesn't actually represent the gamut of any particular device. There are lots of working spaces in existence, but two are by far the most common: **sRGB** and **Adobe RGB.**

"Standard RGB" or sRGB is something of a "lowest common denominator" color space: it's designed to be a pretty good match for the gamuts of most CRT monitors. This means that an image represented in sRGB will look more or less OK on most computer screens. It's also a fairly good match with most inkjet gamuts. Therefore, it's often the path of least resistance: if you use sRGB, things won't go awfully wrong.

Adobe RGB is a wider color space: it's a bit wider than the gamuts of most monitors and printing methods. This ensures that if your image contains a really vivid green, what you'll see in the print or on-screen is the greenest green that device can manage. However, you'll need to juggle the colors more to get them to fit on the narrower gamuts of the reproduction devices: this will shift them around somewhat. The colors will also look flat and desaturated if you look at the picture on a program that doesn't understand color spaces.

Above, a photo converted to Adobe RGB, below the same photo converted to sRGB. If your browser is color space aware (I understand Apple's new one is), they should look almost identical. If your browser isn't color space aware, the top one will look flatter and less saturated than the bottom one. In Photoshop, the two will look nearly identical. The bottom one is "more correct" (meaning, closer to the way I intended it -- it's not exactly right, because my monitor doesn't exactly match sRGB; when I look at it in Photoshop, it looks just a tiny bit warmer than in Netscape.)

Incidentally, this is the source of the common misconception that shooting in Adobe RGB will yield flatter and "more realistic" colors than sRGB: in fact, the opposite is true -- the vividest colors will be recorded as more vivid (and therefore more accuratetly) than with sRGB. In other words, Adobe RGB is capable of producing *vivider* rather than flatter color than sRGB. However, if you're looking at the pictures on anything but the best professional monitors, you will see almost no difference on-screen -- simply because your monitor's gamut will be hardly wider at all than sRGB. And, of course, if you look at it with the wrong profile or with a non-color-managed program, it'll just look flat.

Profiles

The color management house of cards is missing only one more card: the **profile.** Think of a profile as simply a mathematical mapping of a device color space to C(h) -- something that tells your computer how a camera, printer, monitor, or scanner records or represents color.

Converting between color spaces

Okay, now we've built our system for representing different gamuts. We have color spaces, profiles, and working spaces. However, one problem remains: *how to convert between them?* We can, of course, simply calculate where a particular value in our source space falls in our destination space, but this can lead to all kinds of trouble -- in particular, colors that are **out of gamut** for the destination space cannot be adequately represented -- they would get **clipped.** So, there must be other ways of doing the conversion -- and there are. The method described above is called **absolute colorimetric,** and it only yields satisfactory results if no colors are out of gamut in the destination space.

There are a bunch of others that you can look up in the book or in Photoshop's documentation, and you might even need them for troubleshooting. They're called **intents.** Most of the time an intent called **Perceptual** gets the job done well enough -- it will shift the color values, but will keep the relations between the colors somewhat constant, and since the eye is really good at adjusting to minor changes, this will usually look "right."

To recapitulate

- Different devices have different gamuts.
- The gamuts are represented as color spaces.
- Working spaces such as sRGB and Adobe RGB are "compromise" color spaces for representing pictures without reference to the devices used to display them.
- A profile represents the relation of a device colorspace to the imaginary, "human" colorspace. (Sort of. Look it up in the book if you want to know the real deal.)
- A computer system consisting of a computer, software, digital camera, scanner, monitor, and printer will display more or less consistent color if all of the devices are correctly profiled and the software used to record, display, and print them can use these profiles.
- A system like the one described above is a **color managed system.**
- A color managed system converts between color spaces using one of several **intents,** such as absolute colorimetric or perceptual. Most of the time, **perceptual** will give the best results.
- This conversion happens whenever an image is displayed or printed: for example, Photoshop actually converts from sRGB or Adobe RGB to your monitor color space when it displays an image on-screen, and again to your printer color space when you print it.
- A system that has problems with any of the above (software that doesn't understand profiles, inaccurate or missing profiles for some of the hardware, misconfigured profiles etc.) will not display or print accurate color, except by accident.

Whew.

How to color manage

So, you're not quite happy with the color you're getting from your system, you have a handle on what gamuts, color spaces, and profiles mean, and you want to make things better. What to do?

1. **Collect your profiles.** Before you do anything else, make sure that you have all the factory profiles associated with your devices. Most of the time, these come with the devices. Sometimes you have to download them from the manufacturer's site. Search for "ICC profile." Note that for printers, you will even need different profiles for different papers!

2. **Install your profiles.** On Windows XP, right-click on the profile (something.icc) and select **Install Profile**. On other flavors of Windows, you might have to copy them manually to C:\WINDOWS\system32\spool\drivers\color\ (friendly, innit). On Macs, this is even easier, although unfortunately I don't remember the 1-2-3 of it anymore; sorry, folks; I wish I could still afford a Mac, but Apple priced itself out of my reach.

3. **Check that the profiles are associated with the right devices.** On Windows boxes, find the control panel that controls the device (e.g. **Display,** or right-click and select **Properties** on the printer under **Printers and Faxes**). Find the **Color Management** tab (sometimes behind the **Advanced** button). If the correct profile isn't listed and the default, click **Add...** to add it and **Set As Default** to... well, you get the picture. Again, on Macs this is much nicer, if memory serves me right...

4. **Check that the profiles aren't applied twice.** For example, Photoshop understands profiles. If you tell Windows to apply a profile to a printer, and Photoshop to do the same thing, the colorspace conversion prescribed by the profile will be done twice, resulting in seriously whacked-out colors.

Once this is done, take a deep breath, fire up your colorspace-aware photo editor, open up a correctly white-balanced photo (preferably shot in Adobe RGB), and fire off a print. If the print more or less matches what you see on-screen, and both match what you remember of the scene, congratulations -- you can stop reading now: any further mucking will probably only make things worse. However, things aren't always so peachy. In particular, scanners and monitors can give you considerable grief. If you're not sure how well it worked, test [#testing] your color managed workflow, and then come back to this essay.

Profiling your monitor

So, you've installed all the profiles, associated them with the devices, and things still don't look right -- your prints come out fine, but they don't match what's on-screen. What now? Only one thing to do: profile your monitor.

The "proper" solution to profiling your monitor is simple: shell out for something like a ColorVision Spyder, [http://www.colorvision.com/] follow the instructions, and enjoy your scientifically accurate color. However, if you're a cheapskate like me, you'll find it annoying to spend hundreds of dollars on something you'll basically only need once. Fortunately, there is a way of getting reasonably accurate color even without a spyder or colorimeter. Here's how.

Note: These instructions are based on the full discussion by Norman Koren: [http://www.normankoren.com/makingfineprints1B.html#Gamma_wizi] if you get stuck, please read his page before asking any questions.

1. **Download and install PraxiSoft WiziWYG.** The free version will get the job done fine. You can get it from PraxiSoft [http://www.praxisoft.com/pages/products.wiziwyg.html]. Note that you need to restart your computer before it works correctly.

2. **Check the Ultimate Monitor Test pattern** on Norman Koren's site [http://www.normankoren.com/makingfineprints1A.html]. If either of the test patterns looks solid gray when viewed at a distance, *stop here and do nothing further*. Unless, of course, your profile is broken, as mine was.

3. **Set your monitor's white point to 6500 K.** With my Samsung 959NF, I did this from the menus accessed from the front of the monitor; your mileage may vary, though, so consult your manual. (If your monitor doesn't allow you to do this, consult Mr. Koren's instructions.)

4. **Leave Mr. Koren's Ultimate Monitor Test Pattern on-screen** and drag the WiziWYG panel so that it doesn't obscure it. You'll need it later.

5. **Fire up WiziWYG,** then select **Monitor,** and **Visual.**

6. **Adjust Contrast and Brightness as instructed,** but *ignore the white and pale gray squares (and step 4 of the WiziWYG instructions).*

7. **Adjust Red, Green, and Blue.** If in doubt about the blue, set it to the same level as the green.

8. **Select Monitor Type.** If your monitor type happens to be on the list, more power to you. If there's something like it on the list, use that. I used Generic Trinitron, because that's pretty much what my Samsung is. Seems to work OK.

9. **Set White Point and Gamma.** For Gamma, use 2.2 if you're on a PC, 1.8 if you're on a Mac. However, the white point is trickier: Norman says that if you've set your monitor to 6500, setting it to 6500 again will make things look yellow. However, the only way I could get neutral color on mine (set to 6500 from the front of the monitor) was to set the first panel to 6500, and the second to 65D (also 6500). I have a feeling these settings may depend on your hardware, so experiment. Luckily if you get it wrong, it'll be *really* wrong -- either looking like it was soaked in urine or like you were looking at it through John Lennon's sunglasses. In any case, color temperature is somewhat a matter of preference, so don't sweat it too much.

10. **Look at the Ultimate Test Pattern** which you left hanging on-screen.

11. **Does the pattern for the gamma you selected look a uniform gray** with no color banding or "waves" when seen at a distance? If not, repeat the above four steps. If it does, continue.

12. **Name the profile and save it.**

13. **Open up your Display control panel,** click on **Advanced,** the **Color Management** tab. Is the profile you created listed and set as default? If not, add it with the **Add...** button and set it as default.

14. **Check Norman's Ultimate Test Pattern again.** If your gamma still looks a uniform gray, congratulations -- you're done: your monitor is pretty well calibrated!

Testing your Workflow

The ultimate test for your color managed workflow is simply this: *does it work?* If you're getting consistent color from capture to print, great -- it works. If not, you have an issue. Note that you can't get *completely* uniform color -- that's just the nature of the beast. Your prints will shift in color somewhat due to metamerism, your monitor will take on subtly different looks depending on whether your eyes are adjusted to daylight or incandescent, and the different gamuts of your printer, monitor, and camera will introduce some variation. This is the case no matter how scientifically precisely you profile your stuff -- therefore, the by-eye method described above isn't as sloppy as it may seem. Here are a few simple, common-sense tests for checking whether your workflow works.

Norman Koren's Ultimate Monitor Test

Before you go any further, surf to Norman Koren's site [http://www.normankoren.com/makingfineprints1A.html] and look closely at his Ultimate Monitor Test Pattern. If the gamma you've chosen looks an even gray, your monitor is OK. If not, calibrate your monitor as described above. Also, make sure you've installed all the factory profiles for your printer, monitor, and scanner.

Simple workflow test with digital camera

1. **Find something colorful.** It should contain the primary colors in different shades, plus some skin tones. Paint samples from a hardware store work great, if you're a cheapskate and don't want to shell out for a real target. Crayons, colored pencils, or daubs of finger paint work too, as long as there's enough variety to cover the full rainbow of color. Plus the skin tones. Us whiteys are unlucky to have our complexion look terrible if the color balance is off, so if you're what the Americans call Caucasian, use your hand; otherwise, use a Caucasian friend's hand or just a patch of color that's the correct vaguely sickly shade of pink. People with darker complexions have much less of a problem with this. Don't burn in the sun either, the lucky rascals...

2. **Wait for an overcast day.** Then set your digital camera to Cloudy white balance, take your colorful target outside, and shoot it in the color space you usually use. Adobe RGB will show up errors more easily, but if you never use it, don't bother: it might just make you stress unnecessarily.

3. **Fire up your colorspace-aware image editor, and print it.** Like Photoshop, to pick an example at random.

4. **Take the print and the original outdoors, and compare them.** If they're a fairly good match, great -- at least your printer is profiled more or less correctly.

5. **Compare the print and the original to what you see on the screen.** If possible, get the overcast daylight into the room, too, and get your eyes accustomed to it. Otherwise it won't look right. If the on-screen version is roughly similar to the original and the print, your system is working better than most. If not, see Troubleshooting [#trouble] below.

Simple workflow test with film and scanner

1. **Find something colorful.** It should contain the primary colors in different shades, plus some skin tones. Paint samples from a hardware store work great, if you're a cheapskate and don't want to shell out for a real target. Crayons, colored pencils, or daubs of finger paint work too, as long as there's enough variety to cover the full rainbow of color. Plus the skin tones. Us whiteys are unlucky to have our complexion look terrible if the color balance is off, so if you're what the Americans call Caucasian, use your hand; otherwise, use a Caucasian friend's hand or just a patch of color that's the correct vaguely sickly shade of pink. People with darker complexions have much less of a problem with this. Don't burn in the sun either, the lucky rascals...

2. **Wait for a sunny day.** Load up your film camera with daylight-balanced slide film (Fuji Provia 100F is probably the best choice), take your target outside, shoot it, develop, and scan it in the color space you normally use. Adobe RGB will show up errors more easily, but if you never use it, don't bother: it might just make you stress unnecessarily.

3. **Fire up your colorspace-aware image editor, and print it.** Like Photoshop, to pick an example at random.

4. **Compare the transparency and the print.** If they're a fairly good match, great -- at least your printer and scanner are profiled more or less correctly. If not, one of them (probably your scanner) needs profiling.

5. **Compare the transparency to what you see on the screen.** It will never be *quite* right, because whatever light source you use to view the slide won't have the same color temperature as your monitor. If the on-screen version is roughly similar to the transparency and the print, your system is working better than most. If not, see Troubleshooting [#trouble] below.

Troubleshooting

Many things can go wrong when juggling profiles. Here's some trouble I've shot personally.

"I shot my pictures in Adobe RGB/sRGB, but Photoshop says there's no profile associated with the picture. What gives?"

This is some stupid and obscure issue related to the EXIF-JPEG standard: apparently, camera manufacturers aren't *allowed* to tag an image with a color space and be compliant with the standard. The solution is simple: just assign the color space you used to shoot it to the picture, and everything will be A-OK.

"My picture looks OK on-screen, but the color goes totally west on prints."

There are two likely causes for this: either you don't have the right profile associated with your printer, or you're applying it twice. Note that different papers and inks need different profiles. See the guide [#guide] above for more on associating profiles with printers. So, first look on the CD that came with your printer or the printer or paper manufacturer's website, and try to find an ICC profile for the printer and paper/ink you're using. Do a web search if that fails to turn up anything.

However, if you already have the profile you want and you've set it as default, the problem is probably that it's getting applied twice. If you're using Photoshop or another color managed application to print your pictures, make sure that you haven't set the profile both at the application and at the printer driver: one of them must be set to "do not color manage." If you can color manage at the application, it's probably better not to color manage at the driver.

"I can't get my scans to match my transparencies, and white balancing the scans is a royal pain in the proverbial."

Uh-oh, sounds like your scanner needs profiling. I put off getting a target and doing this for way too long. If you find yourself struggling with getting your scans to match your trans, get an IT8 target and profile your scanner *now*. See the information at Hamrick Software [http://www.hamrick.com/vuescan/html/vuesc6.htm] for one way to do this.

"OK, I've calibrated my scanner and my film. My scans still don't match my trans. What gives?"

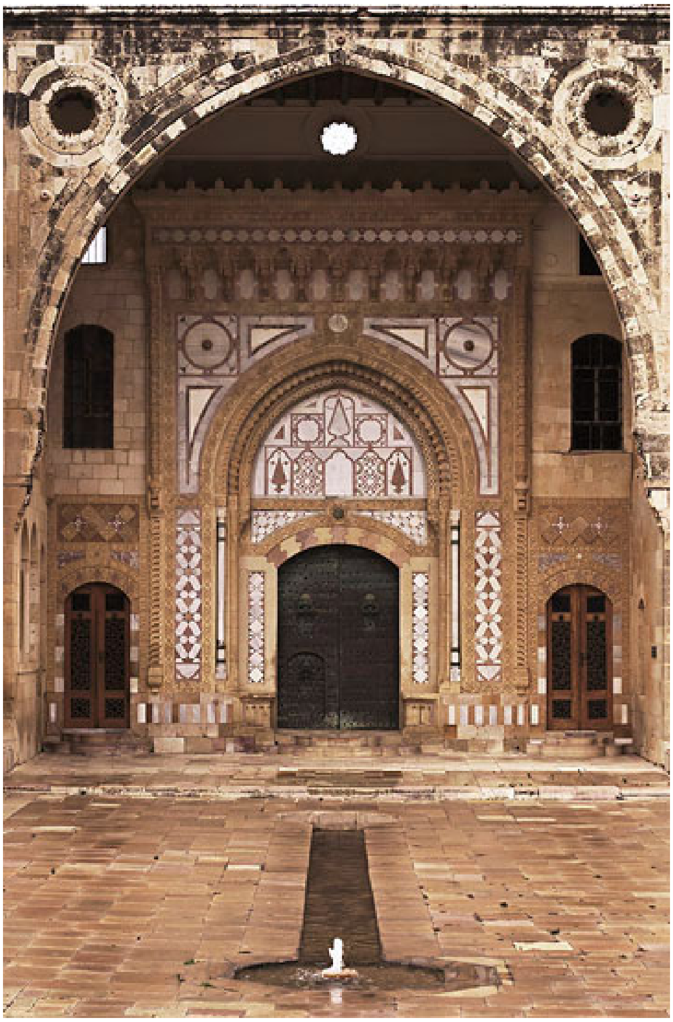
You're probably applying the profile twice. If your IT8 target was on Provia 100F and you calibrated your scanner on that, the scanner will be calibrated for Provia 100F. If you apply a Provia 100F profile a second time, as a film profile, the color will go nuts again. You only need to calibrate for specific films if you're using different ones -- and, IMO, if your original target was more or less neutral, like Provia, other transparencies will look more or less like they should. So, either use the profile you created as your scanner profile or your film profile, but not both.

Incidentally, you'll save yourself a lot of grief if you decide which two or three color films you're going to use, and learn what it takes to get good color out of them.

"Most of my pictures print out fine, but I've got a couple that look like they've got carrot juice (or some other vegetable juice) poured all over them, especially one of a nice sandstone structure at dusk."

First thing: check your monitor profile. Miscalibrations are most apparent in the extremes. It might look fine on your screen, but that don't mean it ain't totally wrong.

However, it can still happen even if everything is profiled just peachily. This means that the colorspace conversion between your image's colorspace and the printer's colorspace has gone wrong. Colorspace conversions are rarely neat one-to-one affairs; instead, the color values can get shunted around a good deal. That's why there are different "intents" for colorspace conversions. Most of the time "Perceptual" is the one to use -- but, being a best guess, sometimes it guesses wrong, especially if the picture has a uniform, subtle color to it; reds, yellows, and oranges are particularly sensitive. If printing from a colorspace-aware application, try setting some other intent -- Relative Colorimetric or Absolute Colorimetric just might save the day. The second thing to try is converting your image to a narrower gamut: for example, from Adobe RGB to sRGB, and then printing from that.



I went nuts trying to print this image: whatever I did, it wanted to come out orange. It turned out to be a combination of two problems: recalibrating my monitor and using Absolute Colorimetric got the result I had in mind.

If all else fails, you can muck around with the transfer curve, or the image itself. Whatever you do, don't mess with your printer profile if it works well almost all the time -- if you fix it for these few pictures, chances are that you'll break it for everything else.

"I'm using CaptureOne DSLR, and the preview doesn't match the developed images, or the JPEG's I extracted from my RAW files."

Any chance that if you click on the Soft Proofing button, your pictures and thumbnails will turn into a mixture of hot pink, cyan, and orange? Just curious. Anyway, this happened to me, and the culprit was my monitor profile -- C1 didn't like it. I profiled my monitor as described above, [#profiling] and the problem went away. Note that you will have to click the Soft Proofing button to see what the output will look like -- un-click it, and you'll see... something else. There's a reason C1 starts up with soft proofing on, and the reason is that it should stay that way, unless you have a good reason to do otherwise.

"My pictures always look too dark or too light or the wrong color on-screen, but they print fine."

Check that you're using the factory profile for your monitor (see the second-to-last item in the profiling guide [#profiling]). If you are, profile your monitor as described in the guide.