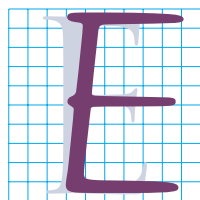


12

Making Things Look Alike

Everyone needs to calibrate, everyone needs to manage color. Getting the great results that elude those who use calibration as a substitute for thinking depends on understanding that there are few absolutes, and that the question of how humans actually see color is, shall we say, diabolically difficult.



Examples like Figure 12.1 are popular in all kinds of color discussions. This particular variant appears in a textbook coauthored by a color scientist, who had the temerity to write, “To most people the green segments at the top appear to be darker than the ones at the bottom, but both are the same.”

Whaddaya, blind? Give us a break. *Anybody* can see that they’re different. Saying that they’re the same is the sort of bogus trickery that’s given color science and color management such a bad name.

We all know where the scientist is coming from. He thinks that if he wheels out a colorimeter, a spectrophotometer, or similar product, he will be able to convince us.

Despair thy charm! say I. There is an inherent defect in all artificial color-measurement devices that causes them, in situations like this, to imagine that the two greens are the same.

How tiresome language can be! If locked in a room for a long enough time, the two of us would probably agree on the following phrase: *the two greens don’t look alike*.

The scientist is therefore correct, in a manner of speaking. If we were to modify the second part of his statement to read, “the two greens are



Figure 12.1 Are the two rows of green patches the same color? How would you prove that your answer is correct?

the same, in the unanimous judgment of artificial color measurement devices,” we’d have to call that accurate.

The scientist’s initial statement contained a most unscientific error. He said, “To most people the green segments at the top appear to be darker...” and, of course, this is not so. They appear darker to me, to you, and to everyone else, including even my color-blind friends. It’s the superior simultaneous-contrast technology of the human visual system that causes us to see colors in context,

just as the faulty technology of the artificial instruments causes them to have the illusion that the greens are the same.

So, are they the same, or not? The answer seems to me to depend on who our audience is. If it consists of spectrophotometers, densitometers, and colorimeters, then the greens are the same. If the audience consists of human beings, they’re different.

The topic of this chapter and, peripherally, the next two, is, how do we know

whether our images will look like we want them to when they go into print or otherwise take their final form?

This question is both relevant and irrelevant to what we’ve been discussing so far. Irrelevant, in that every correction recommended here has universal application. That is, if we send the digital file for a random original and corrected version to a newspaper, a flexo press, and a color copier, and also convert the file into a random flavor of RGB and post it on the Web, the corrected version will look better everywhere.

Relevant, in that we can plainly do better if we know a even a little bit about the output conditions. If these corrections go to a newspaper, they will still look better, but will be too dark. If we had known ahead of time, we could have compensated for it.

In addition to wanting to know about the final conditions, we usually want to have some kind of proof, or preview, to predict what the final job is going to look like. Whether this proof is a monitor or some type of hard copy, there’s nothing as depressing as discovering that the color stinks after the press has run.

The Devil and Daniel Margulis

Before reading the next three chapters, which deal with the subject historically known as *calibration* but nowadays often called *color management*, a short apology, and a lengthy warning. There are now so many possible calibration situations, and so many ways of dealing with them, that this section has to be long on concept and short on specifics. If you understand the topic, you can take many different approaches. So, if you are looking for advice as to how to make your particular model of desktop printer match what’s shown on your make

of monitor, I regret that you will have to extrapolate.

Now, the warning. As you have probably gathered, I have many faults. Lack of self-esteem isn't one. I do not generally require flattery. One of the quotes on the back cover of this book, however, would both flatter and flabbergast anyone with any sense of aesthetics whose name was invoked in the same breath with that of Leonardo da Vinci.

Da Vinci is the pivotal figure in the development of modern artistic forms, not just in painting, but in music, architecture, and literature as well. At a time when other artists became slaves to complexity, he made it art's servant. Without da Vinci, the High Renaissance might never have occurred; his style defined Western art for 500 years.

I've been compared to some extraordinarily talented people in my time, but this is way over the top, unless I am being compared to da Vinci the writer, the exponent of artistic theories.

Let me admit to having read everything he ever wrote, which is less of a pleasure than one might think. While there is amazing insight, not to mention findings that are still not appreciated a half-millennium later, on the whole, with the possible exception of John Grisham, the very last writer in the history of the world to whom I would care to be likened is Leonardo da Vinci.

An 1830s scholar, who made quite a living by stealing da Vinci manuscripts, had this to say about the *Notebooks*: "There is everything here: physics, mathematics, astronomy, history, philosophy, short stories, mechanics. It is a marvel, but it is written in such a devilish manner that once I spent a whole morning in comprehending and copying two or three small pages."

Hopefully, you will not accuse me of *that*.

Being somewhat caustic about many nominal authorities, I am occasionally called an anti-intellectual. Not so—anti-academic is a better description. Nowadays most scholars, and not just in color science, are so absorbed in their own narrow field that they can't see the saturation for the chroma. You want an anti-intellectual, there's none more bigoted than Leonardo, who refused on principle to read anything anyone else wrote. Me, I'm the guy that says that any professor who studies Tolstoy and not Tchaikovsky, or Frank Lloyd Wright and not Velásquez, is never going to get it.

For all these seemingly insurmountable differences, there is in the entire history of the graphic arts one distinction that I share only with da Vinci, and in the Western arts of the last 500 years only with the playwright Shaw and the musicians Paganini and Liszt. The previous quotation might give a clue.

Each of us has motivated the assertion, repeated with some regularity by different parties, that we are (or perhaps only one of us is), in fact, the devil.

Farewell, Happy Fields

That da Vinci might actually be the Anti-christ occurred to several contemporaries and at least one twentieth-century novelist. The title of another contemporary novel, *The Bonfire of the Vanities*, refers to a historical event in which several da Vinci works were among the objects of art gleefully burned.

Some would like to do the same today. Shortly after the publication of *Professional Photoshop 6*, a user commented on-line that my views on a certain subject were non-standard, but seemed to make a lot of sense. My would-be Savonarola replied:

“That’s the danger of Dan’s work, it sounds so logical, and even seductive. If one should ban books for the sake of the damage they can do to vulnerable minds then burning Dan’s works would be a good start. He’s brilliant and talented, and if only he would make peace with the present situation and use his miraculous powers for the forces of good...(the rasping breathing behind the black mask continues)”

Though the above has me as Darth Vader rather than Lucifer, you get the idea. Oddly, the accusation has nothing to do with anything you’ve read so far, or, for that matter, anything found from Chapter 15 on. Quite the contrary: those who advocate exorcism of parts of my teaching freely admit that my correction techniques are, shall we say, diabolically effective.

No, it’s about the topic of the next three chapters. This is the area in which I am alleged to be the evil one, ordinarily, as here, by someone who sells a product intimately connected to it.

The reason for this lengthy opening is to stress that if you do not care to risk eternal damnation, it is quite okay to skip these three chapters. All of the color-correction stuff is in the other 15. If you don’t understand how Edit: Color Settings works, you’ll need to review parts of Chapter 13, or some of Chapters 16–18 won’t make sense. Otherwise, if you’re only interested in technique, you can safely skip ahead. What you will miss if you do is as follows:

- Because so many people get fouled up by basic concepts, this chapter talks about what we are trying to achieve and what the obstacles are, avoiding the specifics of Photoshop wherever possible.
- Chapter 13 discusses the aforementioned Edit: Color Settings.

- Chapter 14 deals with the sad realities of offset printing, and how to adjust Photoshop’s dot gain setting to compensate.

Correct arguments do have a tendency to be seductive. It’s unlikely that they would have been demonized had time not shown that they had a lot of merit. For that matter, when ideas win out in the marketplace, it’s more likely to be because they’re good ideas than because of intervention from devils, however silver-tongued.

The Worship of Certainty

As with the discussion of any controversy, it’s best to agree upon the desired goals first. A heavenly state would be the following:

- We would have some automated method, starting with one master file, of ensuring that an image would look the same, whether it was in film, on a monitor, a wide-format inkjet, a newspaper, a magazine, or some form of fine printing.
- We could trust our monitors completely to tell us what the final color would look like, whatever the final output was.
- All of our proofs, cheap or expensive, digital or analog, should also accurately predict the final output.

* * *

None of these three goals is completely attainable. We can approach, but never achieve, what we’re after. Those believing otherwise, worshipping the use of measurements, and attributing unholiness to those who oppose them, are the descendants of a group known as *calibrationists*.

This has been a bad decade for calibrationism. One after another of its cherished tenets has vanished, as the Church Militant of the sanctity of specific images and the Church Triumphant of the omnipotence of human perception have gained sway.

As a result, although relics persist, true calibrationists are now as rare as copies of Photoshop 2, which was the program of choice in their heyday. The folks with densitometers in their briefcases today are close to falling into sacrilege.

Much of the debate over the years stems from the incestuous relationship between the related subjects of color management and color correction.

At first glance, one might think that the two could be easily distinguished. If the original photograph looks flat and washed-out on the screen and it also appears flat and washed-out in print, this is certainly a failure of color correction, but it's a success for color management. If we hit an image with curves that make it look much better on our monitor, but in print it appears darker and muddier, this may be a successful color correction, but our color management leaves a lot to be desired.

Early calibrationism took the view that color management could replace color correction. Living in a time when print was king and when most images headed there were shot by professionals, it assumed that the objective of the entire process was to make as close to a literal match to the original film as possible.

In those happy days, originals as poor as some of the ones seen in this book were rare enough that the calibrationists could reasonably ignore them. Still, the concept failed, for two eminently predictable reasons. The first was theoretical. The calibrationists assumed that all colorspace conversions, particularly the RGB>CMYK one, could be made perfect. They can't.

The second was a misunderstanding of the real world. Some photographers talk up the idea of making the print version

"match the art," but in reality neither they nor anybody else wants to do it. The idea, as everyone now understands, is to make the image look *better* than the original if possible, or in any event as good as it can look given the constraints of the final output conditions.

We're able to smile today at how quaint early calibrationism was, in much the same way we smile at the early Puritans, who, among other things, hunted witches and all other forms of diabolical threats.

There are no Puritans today, any more than there are pure calibrationists. However, descendants of both groups still adhere to some of their less agreeable principles, to the detriment of society at large.

Today's color Puritans in fact show some religious features: missionary zeal, a somewhat lengthy list of sins and proscribed behaviors, unnecessary deference to icons such as histograms, and an inclination to blame the devil when society doesn't develop in the desired manner.

The problem with faith-based systems is that they require things to hang one's faith on. The extreme assuredness of the color scientist in Figure 12.1 is a perfect example. If one accepts as a religious postulate that the two greens are in fact the same, a lot of logical conclusions follow. Once skepticism sets in, once we open the possibility that they may not be the same even though a machine considers them so, the carpet can be pulled out from under the whole house of cards.

Here We May Reign Secure

The children of calibrationism, unlike their ancestors, agree that color correction is often necessary. Calibration is about predictability; if the original file is poor, all

that proper color management will accomplish is ensure that it remains predictably poor throughout the rest of the process.

Similarly, no matter how expert one is in color correction, one also has to acknowledge the need for calibration. Nobody wants unnecessary variation between outputs. Nobody wants inaccurate proofs.

So, color management and color correction are compatible, not competitive—or at least it seems they aren't. But don't found a religion on it, because it isn't quite as clear-cut as you might think.

To see why, let's return to the topic of Chapter 10, which is one of the most troublesome color management issues of all: RGB to grayscale.

It may seem crazy to think of black and white as being color, but it's no more so than supposing that the two greens of Figure 12.1 are the same. All the features of a color-management showdown are in place. The two spaces don't match up. One can say that color is missing in black and white, or be the devil's advocate and say that an RGB file is excessively colorful. One algorithm is needed to convert between the two. And the idea is to create a figurative match, as obviously a literal match is impossible.

So, what's the best way to convert into grayscale? Without knowing more about the individual picture, my answer would be to use the formula Photoshop does, three parts red, six parts green, one part blue.

Now suppose that some other joker comes along and says that instead of 3-6-1, a better formula would be 4-5-1. In support of this proposition, he supplies two conversions of the parrot of Figure 8.3, and, sure enough, his way is better—more accurate. A third person shows up claiming that 3-3-4 is best of all, backing up her position with

the Canadian flag of Figure 10.7. And an old-time scanner operator, showing us the woman of Figure 10.12, advocates 0-10-0.

How would you resolve this issue? Use a tristimulus tricorder? Consult a priest?

The only logical test would be to get 100 or so typical images together, convert each of them all three ways, and get a jury to decide in each of the 100 cases which of the three was the most accurate. I have never tried this, but imagine that 3-3-4 and 0-10-0 would be the clear losers and that 3-6-1 would probably win.

It would, however, depend on the images. If they are supplied by a portrait photographer, 0-10-0 might be in first place.

One thing's for sure: the winner wouldn't even come close to a clean sweep. If one method was judged superior in 70 of the 100 images, that would be a stunning upset.

Photoshop and the Deep Blue Sea

Having verified (if we indeed have) that 3-6-1 is the correct formula, the next question should be, who gives a damn? Probably not you, if you've spent the money for this book. You're unlikely to be converting lots of B/Ws without preliminary work on the color file.

You'll be blending channels first. But in that case, how often will you literally be using the 3-6-1 formula? Once in a lifetime? 3-6-1 is irrelevant, no more than a convenience, a known result when you execute Image: Mode>Grayscale. If the formula were something else (provided we knew what it was), the impact on workflow would be exactly and precisely zero.

Black and white has no color and is therefore a lot more absolute than CMYK, which merely has no blue. But the same considerations apply.

The mystical power of color has bewitched far more than a group of vendors. As we will see, a striking number of strikingly intelligent people who aren't color professionals have nevertheless been motivated to write about it in depth. Although the phenomenon has existed for at least the last half-millennium, we'll start with one of our contemporaries whose excellent novels have been overshadowed on the best-seller lists by two sets of essays that he produced out of the blue, as it were, on color. Here's how Alexander Theroux describes the subject of Figure 12.2.

"The deep blue of Oregon's enchanting Crater Lake, the deepest lake in North America, almost intolerable in its beauty, can swamp with emotion the flickering power of analysis. The lake is 1,932 feet at its greatest depth. Fed only by snow and rain—and drained by sun and wind alone—the lake suffers no silt from running water, the sunlight striking it reflecting the blue rays, while the rays of the other colors are absorbed, all serving to make it the bluest blue lake in the world."

In short, this is one of the bluest objects on the whole planet, and Figure 12.2 bears the same relation to it that a square-dance fiddler does to Paganini.

Wail and gnash your teeth all you like, o photographer, but the CMYK reality is a harsh one. The RGB file will be reasonable, because RGB produces nice blues. In CMYK, we need a solution. Da Vinci would know what it was, and so will you if you look back at Figure 12.1.

An artificial instrument will find Figure 12.3's lake no purer than Figure 12.2's. Fortunately, we need not worry about its defective color perception. As you can plainly see, the water is more blue, for the

same reason that the stripes on the bottom of Figure 12.1 are more green.

I've asked a number of people to decide which version is the more accurate rendition of the RGB image found on this book's CD. The verdict was as unanimous as it is obvious. Fortunately, the question was not which version had the most accurate background hills.

To make a human being see something as being more colorful, add colors that flatter it; subtract those that compete with it. To make Figure 12.3, I set up a duplicate layer on Figure 12.2 and raised the quarter-tone of the yellow curve, flooding the image with yellow everywhere except in the lake, which had no yellow in the first place. I also added magenta to the highlight, forcing the sky to be more purple, pushing it away from the more cyan lake.

This hurt the critical magenta channel, as the curve was flatter in areas darker than a highlight. Therefore, I changed layering mode to Color, which is an LAB-like command that uses the contrast of the bottom layer and the color of the top.

Different Context, Different Color

The first impression of our next case is that it's the same problem. Or, it would be the first impression if one were to open the RGB file, in which the woman's sweater is an electric blue that Figure 12.4 matches up with about as well as a child playing Chopsticks matches up to Liszt.

Let's assume that the sweater is a critical element. If so, the indicated solution is something like Figure 12.5 and the way to go about it is by working in LAB and using the curve shown, or something quite similar, on the B channel.

While this is basically the same idea as

the Crater Lake maneuver, the result is quite different. There, things that were approximately gray became more yellow. Things that were slightly blue became more neutral. And, once again, almost anybody seeing the original RGB image would conclude that Figure 12.5 is the more accurate way of reproducing it.

In real life, though, the chair isn't gray—it's a subdued blue, just as Figure 12.4 shows. But if you begin to believe that converting such blues to gray is generally the right way to go, I will bring out the Crater Lake image again, in which such a move would have been disastrous. And, as easily as one can cite Scripture for one's purpose, I can produce several images in which the

correct rendition of this color is as a darker and stronger blue.

We saw the same effect in the first B/W conversions of Chapter 10. A bright red is a light color in a picture of a parrot, but the same red is a dark color in a Canadian flag. Perhaps they are the same color in the view of a trispectricorder. But if you believe that, you worship a false God. Your clients will be pleased to inform you that the measurements are wrong.

The calibrationist faith depends on moral certainties, which have just been busted. There is no perfect way of solving the conversion problem. No matter how good your method, I can produce a file that breaks it. No matter how preposterous a

Figure 12.2 *The inability of CMYK to produce a vivid blue confronts one of the bluest objects in the world, Crater Lake. The blue at bottom contains no contaminating yellow or black, so this is as blue as it can get.*



method I propose to compete with yours, I can find images that favor it.

You may respond, sure, but if we try it on a large number of randomly chosen images, the superior method will win far more often than the ridiculous one.

But the rock you stand on will again prove to be quicksand. I will say, who chooses these random images? Because it may be that one method of calibration suits one user and not another.

Figure 8.16, an underwater shot so overwhelmingly blue that its red channel was basically nonexistent, is one of the images I'd hold in reserve, waiting for one of the faithful to declare that the perfect calibration method has been found. To portray

it accurately, a massive amount of color real estate must be reserved for things that are brilliant blue. Other colors have to be suppressed. Such a treatment would be very bad for more typical images.

Granted that our calibration methods need to fail in certain cases, it makes sense for this to be one of them, because you and I seldom work on such monstrosities. But what of the underwater photographer? He gets that type of image 50 times a day.

Once more, the sense of certainty takes it on the chin. Not only is there no perfect method of conversion, there isn't even a *best* one. The calibration that would be appropriate for you and me would be very wrong for this underwater photographer.

Figure 12.3 *Introducing yellow into the background can persuade the viewer that the lake is bluer, in much the same way that the background of Figure 12.1 alters our perception of green.*



If Not Victory, Is Yet Revenge

Trying to make two versions match up with one another automatically can work, especially if the outputs being compared have similar characteristics, like a digital proofer and an analog film proof. It can work if one condition totally encompasses the other, as some inkjet printers fully encompass the CMYK of a web press. It can also work if you cripple one or both of the outputs: if you resolve never to have bright blues in your RGB files or bright yellows in your CMYKs, and that your printed products should be overly soft, you should be able to

convert automatically between them all day long.

But in the more common case, where we have two dissimilar conditions and want optimal results in both, there's no way to avoid human intervention at least some of the time. To expect one master file to magically metamorphose into versions suitable for both a newspaper and an annual report, let alone for a newspaper and the Web or for a magazine and a film recorder, is ridiculous. The sharpening issue alone would torpedo the idea, even if the insurmountable color issues didn't exist.

Relying totally on the conversion produces at best an equality of mediocrity. The color may be reasonable; it may even be pretty good. And there are plenty of people for whom that will be satisfactory.

Many more, however, want the best quality attainable. And they include most of the leadership users—those who are not professional pundits, but who influence others by their knowledge and techniques.

Admittedly, I have beaten this horse to death for the last several pages, all to prove what virtually everybody now knows, that total reliance on conversion methods doesn't work and will never be accepted.

It may therefore come as a shock to learn that less than ten years ago, the nearly unanimous view of prognosticators was that it *would* be. Every magazine, every trade show, every vendor believed that CMYK was going to go away. All color correction would migrate into RGB. Files would never exist in CMYK at all. They would be converted into CMYK on the fly by a RIP.



Figure 12.4 In the original photograph, the woman's sweater is an electric blue, clearly impossible to reproduce on the printed page.

To the stupefaction of all, the market moved briskly in the opposite direction. Considerably more people work in CMYK today than when the repurposing delusion was all the rage.

While as far as I know I was the only one to predict the failure of the concept, I was simultaneously, along with a very few others, saying that digital proofs were an adequate substitute for Matchprints, and that the future of photography was the digital camera. So, the successful prediction couldn't be explained away as a lucky guess by a curmudgeonly conservative. And nobody was ready to admit that the entire world could have been wrong about the real need for the RGB-only workflow.

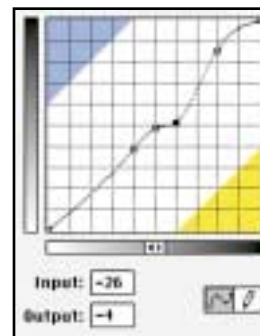
Only some black art could have been involved, some supernatural power of persuasion that seduced the market, much to the detriment of users and, especially, of those who wanted to sell them color management products! Sense the frustration here, from the same guy who wanted to burn my books: "Dan has done more, singlehandedly, to impede the movement to an ICC based RGB workflow than anyone else in the world. It seems a shame that his brilliance, skill and humor should be wasted on such a negative campaign."

I therefore became not merely a devil but a CMYK devil. Early on, that phrase meant only that I did not believe that CMYK was going away. Over the years, this somehow got transmogrified into a CMYK-only devil, which is odd inasmuch as my writings are by far the most colorspace-agnostic ones on the market.

But, as with a later controversy concerning the color architecture of Photoshop 5, which I correctly said would never fly and which was, (after some gloriously vicious

commentary from Adobe and its sycophants directed at me), duly withdrawn in Photoshop 6, it's all just common sense—almost like correcting by the numbers.

Figure 12.5 To make the sweater seem more vivid, the background chair has to be made more gray. The eccentric curve to the B channel of LAB, right, is the logical way to increase color variation between the two objects.



It was clear ten years ago that the future was going to hold many more output possibilities. Therefore, the idea of having one master file that could be repurposed for all seemed appealing and was assumed to be inevitable.

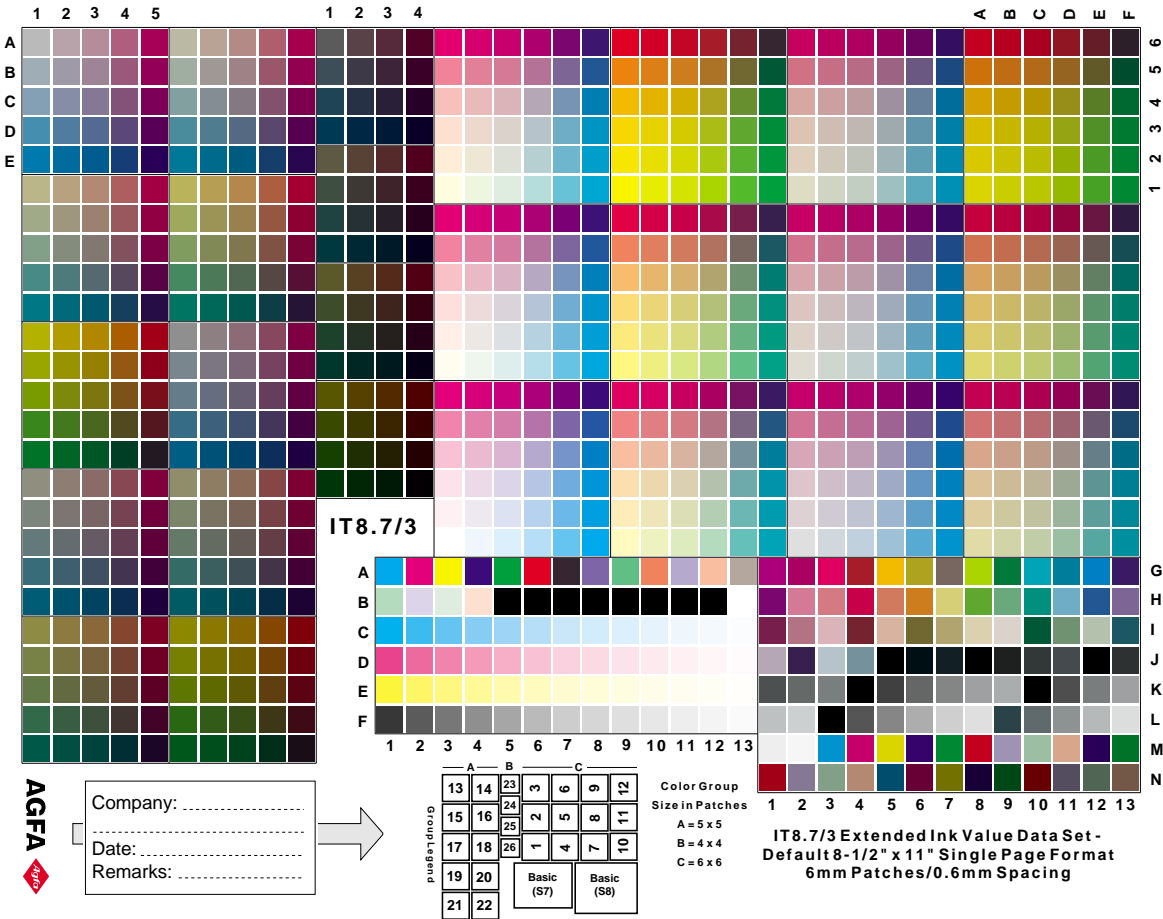
The market, however, did not and does not agree. The lower end doesn't care about quality; the top end will do an individual version for each output; and in any event, it's likely that one version may be so much more important than any of the others that it will get all the attention and the others will be generated from that one.

So, the real market for an RGB-only

workflow was and is those who have several output destinations of approximately equal importance, and who are willing to spend time and money to get better, but not great, results. Such people certainly exist, but not in anything like the hoped-for numbers. Time has demonstrated that there aren't enough of them to carry the day.

If you want top quality, customize. As for the choice of colorspace to do it in, take a tip from an expert in the field, Marlowe's Mephistophilis: "Hell hath no limits, nor is circumscribed/In one self place; for where we are is hell,/And where hell is, there must we ever be."

Figure 12.6 A typical group of swatches used to create profiles with the aid of artificial measurements.



To Reign Is Worth Ambition

Whether attempting to make a monitor match a print, a black and white match color film, or a desktop proofer match a large-format printer, basing calibration decisions on a single picture is bad. One needs to put together a suite of typical images and accept that some of them will always turn out better than others.

In evaluating how close you've come, keep in mind the point of the exercise and concentrate on the problems rather than the images that are close but not quite there. It doesn't matter whether the proof matches the final output. What matters is whether, given unlimited time and money, we would do the job over again in view of the variation. If not, the proof was good enough.

Accept that some matches will always be better than others, and it follows that the blind-faith approach exemplified in Figure 12.6 is a poor one. Too many people produce one of these sets of swatches, measure them with a lumihumitron, and use the result to generate a profile, thus guaranteeing that if a client ever calls on them to generate swatches, they will be in good shape.

The proper reproduction of swatches is very low on the list of priorities of the practical person. Why, then, given that we can't do well on certain classes of image, would we want to be sure that this is one of the kind we do handle well?

A good general-purpose profile will *not* do well with something like Figure 12.6. Some of the darker reds would turn out too neutral, some of the lighter pinks too light, some of the lighter greens too cyan.

A machine-generated profile would do better, because machines don't understand context. There are, for example, swatches of $10^C 20^M 40^Y$ and $40^C 0^M 100^Y$ in this grid.

A machine will unfailingly measure these as being too dark and too yellow, which is just fine if we are in the business of reproducing swatches. In the context of the swatch, the machine is right. In the context of a flesh-tone or natural greenery, the machine is wrong, just as it is wrong when it says that the bottom green of Figure 12.1 is the same as the top.

The question, then, is whether we make more money reproducing fleshtones and natural greenery than swatches. If we do, and we wish to portray them more accurately, the colors may measure what they do in the swatch, but they aren't the same.

Note that it won't do for the measurements to quibble about the word *accurate*. We know who the King of Lawyers is. Any reasonable definition will leave the decision to human eyes, which will invariably decide that fleshtones and greenery prepared in this fashion are not just better, but more faithful, to the original scene.

Consider, also, the three images we've just dealt with: Crater Lake, the woman with the blue sweater, and the underwater scene. Note what it took to bring them into a state of accuracy: an obscure blending mode in one case, a difficult LAB curve in the second, a series of complicated blends in the third. Most people don't have these skills. If you would like your images to be their best, you have little choice but to develop them.

But if you develop them, then it won't much matter how good your separation algorithm is, as long as it gets you close. You'll correct afterward one way or another. This is why the overwhelming majority of skilled people still use Photoshop's built-in method, which is hard to configure and of suspect quality generally but at least

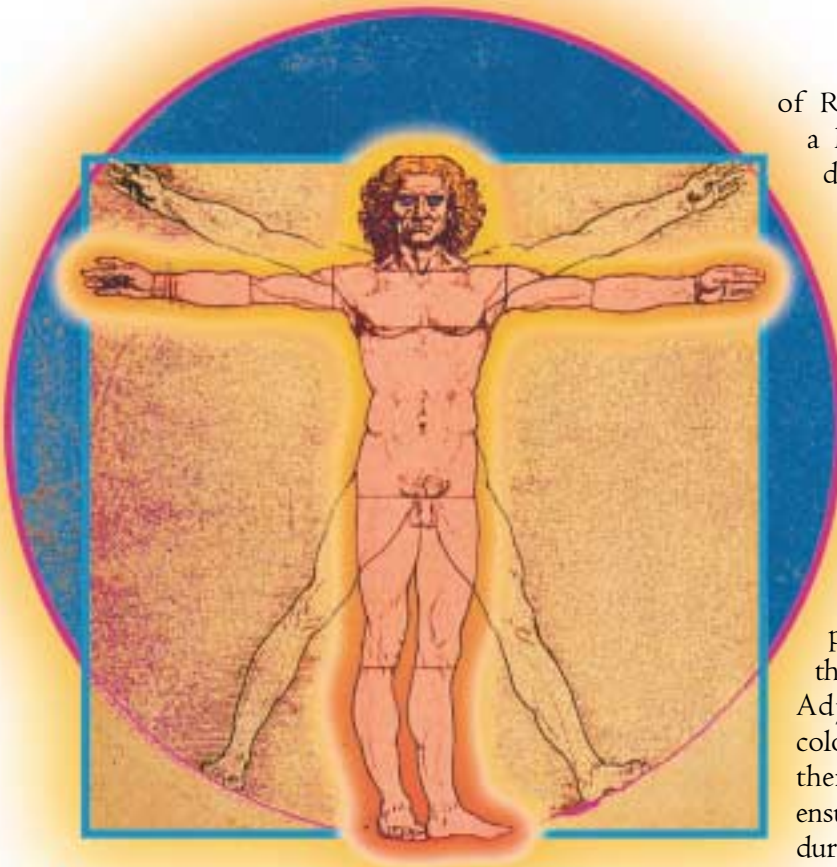


Figure 12.7 Leonardo da Vinci has inspired generations of artists, but also generations of color scientists.

allows us to change black generation easily, in preference to paying consultants to make CMYK profiles that might well be more accurate for typical images but that can't be edited within Photoshop.

Similarly, if you have these skills, you have enormous latitude in deciding what method of calibration to adopt. Suppose, for example, that we return to the issue of making what we see on our monitor resemble output from our desktop printer. Whether we're working in CMYK or RGB, for present purposes, makes no difference. It could be accomplished in several ways:

- By manipulating the monitor settings until the monitor matched the print.
- By changing the Photoshop definition

of RGB or CMYK, to get a lighter or darker screen display without actually changing any numbers.

- By tweaking the printer's internal settings to alter its output characteristics.
- By using a pair of ICC profiles to alter the file on the fly when it prints.
- By creating curves that when applied to the file make the monitor display look like the print and then loading the curves as an Adjustment Layer during color correction, discarding them before printing, thus ensuring an accurate display during correction.
- By doing the opposite: writing curves that would transform the printer output

into what appears on screen and then creating a Photoshop Action that would apply those curves to the finished files before sending them on to the printer.

Some of these solutions are more politically correct than others. However, they all work. Some work better under certain circumstances. The last two, for example, are rather cumbersome if one expects to make a lot of use of the printer as time goes on. If one is on-site and is using a certain printer only that day and never again, they become a lot more attractive.

Could you calibrate a new output device, or at least come close, with all of the above methods? In principle, you should be able to, because they're all basically curving

exercises. If you can't, it will be hard for you to decide which one is best.

Worse, desktop printers and monitors are disposable items these days. It won't be long before you have to buy a new one. When you do, you may discover that the way you've been using to calibrate doesn't work on that particular equipment, and you'll have to improvise.

Lasciate ogni speranza, voi ch'entrate

"That which is beautiful," remarked the guy whose work is the basis of Figure 12.7, "isn't necessarily good. I refer to those artists who are so in love with the beauty of colors that, regretfully, they saddle their paintings with very weak, almost imperceptible shadows. . . . In this error they are like those who speak well but whose words don't make any sense."

Now, that's the case for by-the-numbers color correction in a nutshell. Leonardo was also the first to point that shadows are nonintuitively neutral, which is why we balance the dark point even when it falls in the middle of a forest or other definitely colored area.

The debate over the value of measurement v. human perception is hardly recent. Isaac Newton's *Opticks*, the most influential text in the history of color, was first published in 1704. Very, very few human beings deserve mention alongside da Vinci. Newton is unquestionably one who does.

That got him no respect from another who incontestably is in the same category, Johann Wolfgang von Goethe. Not to put too fine a point on it, he thought that Newton was a calibrationist. And he was so incensed that, in spite of a lack of scientific background, he wrote a countertext about color, glorifying perceptualism.

Goethe was a lot better at poetry than color theory. He later used that skill to skewer Newton as follows:

Whaddaya know! A learned man.

If you can't touch it, it's a million miles away.

If you don't get it, it must be nonsense;

If you can't figure it out, it's false for sure.

* * *

Goethe put those words into the mouth of friend Mephistopheles, lampooning an academic in *Faust*.

This namedropping is to remind you that you have become involved in a topic that has fascinated humanity's finest minds for centuries. We've learned a lot in that time but there is a lot we still don't get. Beware the simple solution; beware those who make a religion out of their beliefs, and especially, if somebody tells you he's got the ultimate color management solution, ram a keyboard down his throat.

Speaking of a devilish misuse of religion, the cover of the *New Yorker* magazine of September 24, 2001, was a scintillatingly, seductively, sublimely simple work that would have done da Vinci proud. Except for the magazine's title and the date, it was entirely black, or at least it seemed that way until held at an angle. One could then see that while the overall cover was indeed solid black ink, additional CMY overprinted it, creating the shapes of the obliterated twin towers of the World Trade Center.

The audacious graphic depended on the human sense of simultaneous contrast. A camera taking a picture of the cover, a scanner trying to record it, would perceive little more than darkness.

If we had to reproduce that cover here, the only way to truly get the effect would be the same way the artist did: a flat 100% black plate with additional inks in the

towers. No rational method of color management would produce that automatically.

Excluding that remote possibility, any attempt to duplicate something so subtle here would have to involve a rather drastic lightening of the background. Much of the contrast that viewers saw in the original cover was the different texture where additional ink appeared, and not so much added darkness. A scanner wouldn't pick that up. Possibly one could see the towers in an RGB file displayed at high magnification on screen, but in the lower-contrast world of CMYK, there'd be nothing but black.

While this once-in-a-lifetime image certainly shows that in some cases normal methods will produce an inaccurate separation, the more spectacular examples are actually everyday images.

Back in the first chapter, there was a deeply instructive summary of how people felt about three versions of an image, the pig of Figure 1.2. The vote was split between a high-contrast version that was somewhat orange and a softer rendition that was more accurate for color.

The scientists who have really made a difference in the field are those who, like da Vinci, had an astute appreciation of aesthetics on many levels. And because their knowledge was so interdisciplinary, they were able to point out things that specialized artists couldn't see. The school of painting known as French impressionism would never even have existed without the work of M. E. Chevreul, who was a chemist by trade but wrote the definitive work on simultaneous contrast in 1834.

That more people went for the bite would not have surprised Ogden Rood, a 19th-century American physics professor and Renaissance man. Rood said, in one of

the deepest observations ever recorded about color:

We forgive, then, a partial denial of the truths of colour more easily than those of light and shade, which probably is a result of the nature of the optical education of the race. For the human race, thus far, light and shade has been the all-important element in the recognition of external objects; colour has played only a subordinate part, and has been rather a source of pleasure than of positive utility.

* * *

When the comparison was between the orange pig and a third version, correct for color but slightly less detailed than the one preferred by some, several hundred persons unanimously preferred the snappy one.

Suppose that we accept that the middle version, the one with good color but slightly less contrast, is what's desired. Which of the other two is the closest match to it—the snappy version with poor color, or the flatter one where the color is the same?

Inkjets, Monitors, and the Eye

We pay lip service to the idea of good contrast, good color. The fact is, however, the worse the output conditions, the more we have to favor detail, even when color suffers. If we want quality reproduction in a newspaper, we have to be ready to play fast and loose with the color, far more so than if the final output is something forgiving like a high-quality inkjet printer.

As to whether the first or third pig is a closer match to the second, I haven't done a survey. My guess is that most but not all humans would vote for the extra snap, and that most machines would state that in their colorimetric opinion the flatter version is closer.

If we were to reprint those three files on newsprint, however, the results would be very different. I'm confident that nearly all humans would now vote for the snappy version not just as the best of the three, but as the closest match to the middle.

Almost everyone understands that newspaper printing is difficult and is prepared to cut its practitioners a break. Large blown-out areas, a mortal sin in commercial printing, are acceptable in newspaper work, as a desperate attempt to gain contrast. And not even the most ignorant art director would expect newspaper reproduction to equal commercial quality, let alone match the colors found in the original capture.

Yet nobody says that newspaper color should be abolished. It's a shame that such realism often doesn't translate to other areas of calibration. We can scream, shout, and curse all we like, but we can't make hardware perform feats it's incapable of.

It's amazing how many refuse to accept that in images like the Crater Lake of Figure 12.2, the blue we want is not the blue we're going to get. No mixture of CMY inks can produce that color. So, we work around it with various tricks.

And, if we own an inkjet proofer, most of which can make brighter blues, we decide whether the idea is to make a beautiful print or to predict what is going to happen on press. In one case, we'll print those vivid blues in all their glory. In the other, we have to take some action to tone them down.

For that matter, we have to accept that desktop proofing has its limitations. These devices can be programmed to match color very nicely, provided you know your curves. However, the results are always somewhat softer than in print.

This shortcoming limits the number

of images on which we can reliably use digital proofs to perhaps 99 percent. If you absolutely need to evaluate sharpening, or whether the image will moiré on press, or even whether it's overly grainy, lighten your wallet by ordering up film and an analog proof, such as a Matchprint.

But if some prepress zealot tries to get you to buy into the nonsense that only an analog proof is a valid predictor of what will happen on press, remember: there are *always* exceptions. As generations of designers have discovered the hard way, surround an image with a large solid area, or even put it in the vicinity of one, and it will be contaminated by that solid—on press, that is. On the analog proof, there is no clue that a disaster is waiting to happen.

One of the most cherished tenets of early calibrationism was that hard proofs and by-the-numbers color would fall by the wayside as it became possible to rely totally on monitor appearance.

While a calibrated monitor is much to be recommended, relying on it *totally*, without reference to any numbers, doesn't work, because of the human visual system's inconvenient insistence on recalibrating itself to whatever light source may be hitting it. We react to brilliant highlights by desensitizing ourselves to them, allowing us to overlook objectionable detail. And the more we look at an image with a cast, thanks to the human phenomenon of chromatic adaptation, the more the cast vanishes.

Furthermore, judging delicate contrast issues accurately on screen is possible, but, in my view, extremely difficult. Especially in midtone areas, our eyes see more snap in the monitor than in any kind of print. I am relatively experienced at this, and still I have reshuffled pages in this book because

I had to pull an image that showed enough improvement on screen to warrant commentary on how to do it, but looked just about the same as the original file did on the contract proof.

Similarly, recall the oversharpened face of Figure 4.5. I'm not aware of such an intentionally oversharpened image appearing in any other publication. It's not because other authors haven't tried to do it. Instead, they trust their screens, not realizing how incredibly forgiving of such artifacts the print process is, and the image they identify as being oversharpened looks pretty good.

A well-maintained screen can be accurate for relations between colors and, especially, to give a sense of overall darkness. By all means, calibrate it—just don't rely on it for highlights, shadows, or neutral colors. That is why we have an Info palette.

Or think back to the yellow pepper of Figure 9.6. Some years ago, I had to do an unscheduled and unwelcome emergency retouch when a contract proof revealed a large blemish that was practically invisible on my well-calibrated monitor. CMYK output generally doesn't have as wide a gamut as a monitor does, but yellow is an exception. The brilliant yellows of the proof showed variation that the monitor simply couldn't display. There is no calibration solution, except knowing that brilliant yellows pose these problems.

Let Us Now Praise Precision

That we do not live in a perfect world should not excuse us from trying to make it better. Presses are notoriously skittish beasts, but still many of those who own them try very hard to make them as consistent as possible. Our role is to understand that while precision is desirable, there are

different levels. A photo lab should be able to get a near-perfect match between the film it processes today and tomorrow. And Photoshop *is* perfect, in the sense that if we do the same work on the same file tomorrow, if we haven't screwed up our settings, the result should be exactly and precisely the same as if we did it today.

There are similar levels in other conversions. The idea of a perfect separation method, as we've seen, is ridiculous. Even if one existed, it wouldn't be enormously useful, since correction is inevitable afterwards.

The idea of setting up a monitor calibration that will exactly match some print condition is also unattainable, but less silly. We have to accept that there are going to be exceptions here and there, such as an inability to evaluate neutrals or portray bright yellows, but on the whole the thing can and should be done.

And the idea of converting an LAB file into RGB accurately is crazy, because much of LAB is out of the RGB, let alone the CMYK, gamut. But the goal of converting an RGB file to LAB and back again is theoretically achievable. Not only that, it's eminently desirable, since it allows us to go back and forth between the two to take advantage of the strengths of either.

An infinite amount of energy can be thrown into this color management stuff. As none of us have infinite time, we have to become selective, and to do that adequately, we need to become realists. Calibration is a noble goal. Some of it is worth the effort. Some of it is not.

The successful color manager, therefore, must be practical above all, which implies not just doing things in one of the many right ways but avoiding practices that are obviously wrong.

For example, computer marketing types set up their products to have interesting, colorful backgrounds in the desktop area of the screen. Failing to change this to a simple gray completely invalidates any monitor calibration one may try later. Think simultaneous contrast. If the background is blue, all images will seem too yellow on screen; your unconscious compensation for this during correction will result in printed images that are too cool.

There's also the matter of discipline. Color management isn't a file-and-forget thing. Monitors change day by day. Output devices aren't quite that fickle, but they also move over time. One has to check, and keep checking, and then check some more. And, because successful color managers are practical above all, in this effort one can (and, in the case of larger operations at least, *should*) enlist the aid of those machines that I've been railing against for so long.

Look for the Pattern

You shouldn't eschew artificial devices just because they make inadequate profiles, any more than you should assume a poor golfer can't correct color. We all have our skills. Machines are very bad at telling whether images look alike, but they are rather good at telling whether a certain color is the same color that it was yesterday. In fact, they are better at this determination than we are.

Accordingly, once we are happy with our calibration, these devices are extraordinarily useful in making sure we stay that way. They're terrible at determining what the right measurements are but great at verifying that once the right ones are known, they don't change from day to day.

Similarly, although machine-generated

profiles are generally going to be inadequate for the needs of color professionals, they are considerably better than nothing for persons of limited color experience. Some printers now come with automated routines whereby they print their own swatches, scan them, and try to calibrate themselves.

Also, the price of third-party packages that generate a profile from measurements continues to plummet. A measuring device is still needed, but one can put together a package now for less than \$1,000.

But the basic argument for using one of these devices has to be that a machine can analyze the characteristics of images better than you can. For typical users, that may be true. It's hard for most people to tell whether images are consistently too green or whether they aren't magenta enough.

That sort of decision requires experienced eyes, and also some discretion. The big trap that not just calibrationists but some logical people fall into is assuming that all unsatisfactory matches are the result of poor calibration techniques.

Maybe they are—but there are often other explanations. For calibration to be at fault, there has to be some kind of pattern. It may be gross, as in almost all images are too green, or something very subtle.

Either way, there's a simple test. Ask yourself, is there a pattern? And if so, would you be able to correct for it in Photoshop?

Suppose, for example, that you are trying to make your monitor agree with the results you're getting back from a certain print shop. If that is not currently happening, it's probably a bad Custom CMYK setting on your part, but it could be a lot of other things—it doesn't really matter.

It also doesn't matter whether you think the printed product looks good or bad.

The question is, can you call up the file and apply some kind of curves or whatnot to make it look on screen the way it looks in print, or at least to be a closer match? If you can't, it's probably not a calibration issue, but one of capabilities. If you can, then the question is whether that same series of commands would also make most other images match the print more closely.

If it wouldn't, the issue is probably one of process control. If half of the images show up too light and the other half too dark, and half of them are too colorful and the other half too gray, you can try to calibrate until hell freezes over and only succeed in making matters worse.

But if you've gotten this far in the book, you should be able to detect whether there's a pattern; you should be able to calibrate your monitor with any one of several options; and, assuming that your final output is CMYK, you should be able to generate a plausible Custom CMYK for every printer you deal with, especially after you read the next two chapters. And that Custom CMYK is an ICC profile, which can be exchanged with other applications or reused in a variety of ways.

Remember: without a pattern, there's no point in doing anything. If somebody shows you a single image and says that you're calibrated, you're not. That goes double if the image is a set of color stepwedges.

The Superior Measuring Device

Our perception of color has proven too complicated to be reduced to rules understandable even by humanity's best minds—let alone a machine. We've already shown several examples of *simultaneous contrast*—the idea that the background affects the foreground colors. *Chromatic adaptation*

explains why we can't trust what we see on screen for neutrality without the aid of the Info palette. And we haven't even considered the Stevens Effect, the Hunt Effect, the Bezold-Brücke hue shift, the Helson-Judd Effect, the Abney Effect, and, lest we forget, the Helmholtz-Kohlrausch Effect.

If somebody asks you what all these effects mean, give the same answer that I would. They mean that machines don't see things the way we do.

Bluntly, we are comparing two technologies. The cheaper one—the artificial color-measurement device—offers repeatability from day to day, but little more. The expensive alternative—your eyes—is vastly more sophisticated, works under a far broader range of conditions, has a longer Mean Time Between Failures, detects more minute differences, evaluates colors in context, and is in every other way a superior instrument.

Calibration is the art—and to a much lesser extent, the science—of making images look alike. The idea that something other than the human eye can make this determination is highly dubious. Use the eye, not the machine, and your profiles will be not just cheaper and faster to produce, but *better*.

Some scientists argue for artificiality, but the scientists with artistic sensibility, including yet another one of the elect who can stand comparison with da Vinci, have long known better. Charles Darwin voted for anticalibrationism as follows.

It is scarcely possible to avoid comparing the eye to a telescope. We know that this instrument has been perfected by the long-continued efforts of the highest human intellects; and we naturally infer that the eye has been formed by a somewhat analogous

process. But may not this inference be presumptuous? Have we any right to assume that the Creator works by intellectual powers like those of man? If we must compare the eye to an optical instrument, we ought in imagination to take a thick layer of transparent tissue, with a nerve sensitive to light beneath, and then suppose every part of this layer to be continually changing slowly in density so as to separate into layers of different densities and thickness, placed at different distances from each other, and with the surfaces of each layer slowly changing in form. Further we must suppose that there is a power always intently watching each slight accidental alteration in the transparent layers; and carefully selecting each alteration which, under varied circumstances, may in any way, or in any degree, tend to produce a distincter image. We must suppose each new state of the instrument to be multiplied by the million; and each to be preserved till a better be produced, and then the old ones to be destroyed. In living bodies, variation will cause the slight alterations, generation will multiply them almost infinitely, and natural selection will pick out with unerring skill each improvement. Let this process go on for millions on millions of years; and during each year on millions of individuals of many kinds; and may we not believe that a living optical instrument might thus be formed as superior to one of glass, as the works of the Creator are to those of man?

* * *

Protected, perhaps, by his inspired words, Darwin has never been alleged to be the devil. Often, however, he is called the devil's servant, even as the entire world has come to accept that his theory of natural selection was and is substantially correct.

Understanding evolution is much like understanding color. We know Darwin was on the right track, but he demonstrated that we are still in the dark ages. Every year we learn more about his field and refine his teachings, just as we now understand where Newton, Chevreul, Goethe, and even da Vinci fell short in their appreciation of how color works.

With due respect to our incomparable optical system, the most impressive attribute of our species is our ability to sift through concepts, reject some, accept others. Darwin forced us to confront that, to think about where we came from. But to do so, we have to make our life far more uncomfortable by giving up certain things that we used to accept on blind faith.

It is indeed heartrending to abandon the beautiful, seductive, yet ultimately unsatisfying words of the Book of Genesis, just as it is to accept that two greens that measure the same are, in fact, different colors.

The Mind Is Its Own Place

"I tell you, wretch," says an old woman in Shaw's *Man and Superman*, "I know I am not in Hell."

Don Juan asks how she knows.

THE OLD WOMAN. Because I feel no pain.

DON JUAN. Oh, then there is no mistake: you are intentionally damned.

THE OLD WOMAN. Why do you say that?

DON JUAN. Because Hell, Señora, is a place for the wicked. The wicked are quite comfortable in it: it was made for them. You tell me you feel no pain. I conclude you are one of those for whom Hell exists.

* * *

As the years go by, workflows change, often for the better. In the days of drum scanning, very skilled operators did what we do today in Photoshop with curves. They merely applied the curves during the scan.

Requiring the scanner operator to exercise such fine judgment implies that many scans will be unacceptable. If the operator tries too hard for that perfect 5^C2^M2^Y highlight, sometimes he'll miss; the Info palette will show a bagel in each CMY ink, and then the job will have to be rescanned.

At the time, calibrationists came up with the notion that the scanner should be dumbed down, that every original should be scanned in exactly the same way, the better to match the art. Typically, this ignored the real world. Recommending a workflow that requires more color correction was not particularly intelligent in a time when one could apply a curve in Photoshop and step out for a beer while the Macintosh did its thing.

It makes a lot more sense today, when images are recalculated almost instantaneously. Personally, I still use the scanner, where possible, to make gross color moves where obvious, to avoid having to write drastic curves later. But trying to nail the highlight perfectly and risk having to rescan, which made sense ten years ago, no longer does.

This is one of many ways in which our life has been made easier over the years. Some of these advances have involved color management. For example, when we save our Custom CMYK setup, not just Photoshop can use it, but Corel's Photo-Paint and almost any other modern graphic application. This compatibility is the fruit of an industry agreement on a standard for interchangeability of color profiles. For those

who need to manage color, this eliminates needing to learn 20 proprietary systems, which, I'm here to tell you, is no fun.

There is, however, a dark side.

Traditional methods become traditional by proving their merit. One should change them when better methods present themselves. If one changes them solely for the sake of change, it may make matters worse.

Standardizing on ICC profiles is a step forward. The assumption that more than a small minority would use them correctly has proven to be a bigger step backward. The number of files that have been wrecked by someone misapplying color management have more than wiped out the gains. Passing an RGB file to a stranger, something that was simple five years ago, is now dangerous. Even something as basic as opening a group of files for inspection and closing them unchanged has become a major operation in Photoshop 7.

With the ICC format, we theoretically can make better profiles—but Photoshop doesn't give us the means to edit those created by third parties, which makes life tougher than it need be. And if we make them the recommended way, with a machine, not only do we generally get a lousy profile, but it takes longer than doing it the old-fashioned way.

Even those who sell machine-made profiles admit that they "tune" them by eyeball, often several times, before giving them to clients. This brings up the question of why bother to do the initial measurements at all, but rather just load some assumed settings, and "tune" those, as I do.

Whether profiles are better the eyeball way or the machine-measurement way is largely irrelevant. If you want to be successful, you have to learn the eyeball method.

Quick & Dirty

MAKING THINGS LOOK ALIKE

- ✓ While calibration, or color management, is a contentious subject, there's no question about the goal: make the monitor match the proof; make the proof match the output; make the output match the output on a different device.
- ✓ Many different ways usually exist to manage color within a given workflow. One can make adjustments to the hardware; apply Photoshop curves; use ICC profiles; or employ some combination. Pay more attention to what works than what's politically correct.
- ✓ The Working Spaces under Edit: Color Settings house the RGB and CMYK *profiles*, which can be Photoshop's defaults, ones supplied by a third party, or ones you build yourself within Photoshop. All profiles generated in Photoshop comply with ICC specifications and can often be used in other applications.
- ✓ No matter how excellent the color management, there will always be exceptional images that defeat it. Don't go overboard in trying to match individual images. Only make changes when you have detected a clear pattern, as when all images are too green in the shadows.
- ✓ Striving for perfection in color matches is generally pointless. If the match is close enough that you would not redo the job given unlimited time and money, that's perfection enough.
- ✓ The most important factor in calibration is luminosity, or relative darkness. If this is correct, it will far outweigh minor variations in color.
- ✓ The human visual system has its own powerful system of color management. A color changes appearance if there is a change in neighboring colors. This ability to see colors in context is not shared by artificial devices. Humans are, consequently, much better than machines at deciding whether two images look alike.
- ✓ Human vision is self-calibrating in that it neutralizes any color imbalance in the ambient lighting. Unfortunately, this neutralization effect also occurs when staring at a monitor. Some color casts that would be obvious in print can't be detected on the screen—or at least, people can't detect them.
- ✓ If you are panicked by color management, relax. The subject has confounded some of humanity's greatest minds. Many expert opinions have been proven wrong in the past. If you understand the basic principles, you'll get by.

In calibrationist heaven, all owners of print shops and the like furnish us with their own custom-made profiles, which we use with great confidence.

Back on this planet, print shops give us deedly-bop, or occasionally a canned profile of highly dubious quality. To that, some suggest asking them very politely to run color swatches for us on the press and paper that will be used for the live job. In the real world, suggesting this is a good way to find oneself face down in an empty 55-gallon drum of isopropyl alcohol.

A lot of the time, if not most of the time, you'll be calibrating to new printing conditions using the by-guess-and-by-gosh method. That is, you get no swatches, no profile, what you get is a bunch of images that look too green and too dark, so you tweak a few settings and hope they work better on the next job.

You therefore will learn to calibrate by eye, or you'll never be able to adjust to certain print realities, and you'll never be able to persuade your print vendor that your proofs are reliable enough.

Beyond that, if you wish to calibrate by machine, go ahead; like almost all other color management methods, they're compatible with the general approach of this book. But even if you refuse to rely on what your eyes tell you, rely on your common sense, a commodity that is often lost in these arguments.

If Our Substance Be Indeed Divine

As I hope this chapter has indicated, I *do* believe fairly strongly in calibration. But I do not make a religion of it; I insist that science and mathematics be my servants and not my master; when I see an image

that looks lousy I say so even if a machine says it looks good. And so, I am not a calibrationist, but I am a color manager.

If someone offers you what seems like a plausible scientific argument, like, say, offering to trot out an artificial instrument to measure whether the two greens of Figure 11.1 are the same, think it over before buying into it. If you allow yourself to be buffaloed by technology into believing things that your own eyes and intelligence can tell you are false—well, then, beware. Tomorrow's calibrationist could be *you*.

With an apology for sticking what amounts to a chapter on philosophy in the middle of a book on practical color correction, I leave you with a thought from a raffish, buccaneering literary character who would doubtless have made an excellent retoucher and color manager. He rejoiced in the name of Sporting Life, and offered the following wisdom:

Dey tells all you chillun
De debble's a villun
But it ain't necessarily so...
Oh, I takes dat gospel
Whenever it's pos'ble
But wid a grain of salt.

* * *

That grain of salt is more properly called the spark of divinity.

Many of the problems besetting the entire industry, let alone individual users, over the last decade came about because people went looking for certainty where there wasn't any, and for scapegoats and devils when the concepts were proven wrong.

You can do better. To start on the path to righteousness, stand up straight, take a deep breath, and let the world hear it: those two greens are different colors.