

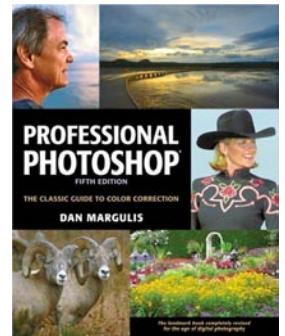
The Fifth Color Follies

Topics: Duotones and other multitone; Limitations of CMYK, the Pantone Matching System; Hexachrome; Spot color channels

Column first appeared: February 1997, *Computer Publishing* magazine.

Source of this file: Chapter 15 of *Professional Photoshop Second Edition* (aka *Professional Photoshop 5*), which is an expanded version of the column, containing a more complete discussion of duotoning.

Author's comment: This chapter's advice came in handy some years later, when the proposed design for the cover of *Professional Photoshop Fifth Edition* (right) contained a large block of pure black. The text explains that this strategy fails in conventional printing, because it transfers too much black ink into the photos. Some readers asserted that the cover's success disproved that. Not so: after the printer convinced the publisher that I was right, they sprung for a fifth color, or rather, a second black. The printing was CMYKK, just as the text recommends.



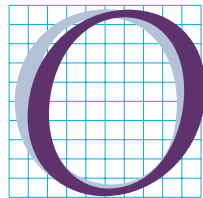
This archive, to be released over several years, collects the columns that Dan Margulis wrote under the *Makeready* title between 1993 and 2006. In some cases the columns appear as written; in others the archive contains revised versions that appeared in later books.

Makeready in principle could cover anything related to graphic arts production, but it is best known for its contributions to Photoshop technique, particularly in the field of color correction. In its final years, the column was appearing in six different magazines worldwide (two in the United States).

Dan Margulis teaches small-group master classes in color correction. Information is available at <http://www.ledet.com/margulis>, which also has a selection of other articles and chapters from Dan's books, and hundreds of edited threads from Dan's Applied Color Theory e-mail list.

Multitones and Extra Plates: The Fifth Color Follies

CMYK is normally enough, but additional inks represent an opportunity—an opportunity either for better color, or big headaches. Here’s how to construct duotones, with extra inks or by simulation, and how to make sure they’ll print properly.



One of the most striking graphic arts advertising campaigns in recent memory likened most scanners to a box containing four crayons. The advertiser’s scanner, meanwhile, was represented as a box filled to overflowing with crayons. Doubtless the success of this campaign demonstrates that we computer artists are children at heart. Give us enough crayons, and we’ll be happy for months.

Children with too many crayons can yield to temptation. It works that way with adults, too, even when there is only one extra crayon to play with rather than a boxful. That is the case we will now explore: the promise and the perils of preparing a job when an extra ink is available on press.

Sometimes this extra ink is a color we pick ourselves. More commonly, it’s one our clients pick for us, because it’s the color of their logo or some such thing. Either way, there’s an extra crayon available, and it can usually be exploited, even if it’s not the particular crayon we would have picked ourselves.

Most of the time, this extra ink is a fifth color; sometimes it is a second color; occasionally a sixth color; on extraordinary occasions, a

seventh or greater. For now, please imagine a hypothetical world in which the extra ink is a *fourth* color.

We are so accustomed to thinking of printing in CMYK that we attribute mystical powers to these inks. And indeed, cyan, magenta, and yellow do have a spark of the divine in them, for they are the direct opponents of the three colors of light upon which all human color perception is based, namely, red, green, and blue. This is a long way of saying that when attempting to print in full color with only three inks, the only rational possibility is with CMY.

As you can see from Figure 15.1, printing with CMY only is highly feasible. It has in fact been done that way in many settings for many years. If you would like to do so, before bringing an RGB or LAB file into CMYK, open CMYK Setup, and choose None under Black Generation.

If we are given an fourth ink to play with we can do better, but there is no particular reason for that extra crayon to be a black one—in fact, black is not the fourth color we'd have in the best of all possible pre-press worlds.

The bride's gown is pretty good in CMY, but the dresses of the women on either side of her exhibit the two major problems that afflict CMY-only printing. First, the darkest areas of the image lack bite. The black dress is brownish. And the lack of a dark ink to use as a backbone causes the whole image to lack snap.

Second, we can't get very good deep blues in CMY. The blue dress here seems pallid in comparison to the red flowers.

A moment's thought about this makes it fairly obvious that the ideal fourth ink would be deep blue, which would solve both

problems at once, unlike black, which handles the first but not the second.

And yet, we all use black. A further moment's thought explains why. We use black because that is what's given to us. Most jobs involve type as well as images, and type ordinarily prints in black, not deep blue. The printer therefore tells us, black is there, take it or leave it.

If there is going to be a *fifth* color, the ideal one is no longer deep blue, because black has fixed up our problem of light reddish shadows. Probably the best choice is some kind of lighter blue or cyan—but beggars can't be choosers.

Printers and Pricing

Getting an additional color to play with can be cheaper than you think. Many printers will negotiate with you. To understand why, let's take a look at their economics.

To even be capable of more than four colors, the printer has to lay out considerable bucks. A press with five printing units doesn't cost 25 percent more than one with only four, but it's pretty close, and four-color conventional presses start at around half a million dollars—and that's for the teeny-weeny ones.

There are philosophical differences in pricing. Some printers want anybody who uses that fifth unit to pay a share of that big capital investment. Others take a more liberal view: they regard the additional units as a promotional expense, a means of differentiating themselves from the competition. They are very happy when we use five colors because they think it makes it less likely we will take our next job to some service bureau or quick printer. So they give us a break. Similarly, many printers buy those extra units because they have particular

large clients who want that capability. If so, the printer may regard any additional five-color printing as so much gravy.

Certain fifth-color expenses will always be around. There definitely needs to be a fifth set of plates, for one thing. But some savings are possible.

The Pantone Matching System that almost all printers use is a recipe method. If we specify PMS 230 or whatever, the printer doesn't just have this on his shelf, nor does he order it specially from Pantone. Instead, he consults his recipe book, which tells him how to whip up this color using some combination of the 14 primary Pantone inks that he does have on his shelf: so much Rhodamine Red, so much White.

Naturally, he has to pay somebody to sit there and do the mixing. He will also have to mix up more ink than will actually be used, and the remainder will be thrown away. Neither of these expenses will be necessary if we specify one of the basic Pantone inks, like Rubine Red, Reflex Blue, or other equally useful ones.

Furthermore, some unfortunate pressman is going to have to wash down the fifth unit, getting rid of the residue of whatever ink was in there last. This is no high-tech operation; he uses a hose. After that, he scrubs down the unit with a towel. When our pressrun is finished, he or some other unfortunate will repeat the washup procedure. All this takes a while, and during this time, the unit cannot be used for anything else, such as printing five-color jobs for other clients.

Reasonably enough, printers expect us to pay for this down time—unless there isn't any. There won't be, if we can piggyback our job on top of another that uses the same fifth color. Opportunities to do that

are more common than you think. There is no law against asking your printer if you can get a price break by sharing a color that somebody else is already paying for.

The Greater Gamut

The argument for using extra inks is that more intense colors are possible than with CMYK only—in most cases.

CMYK, as previously noted, has a problem with blues, due to the decrepitude of cyan ink. Also with greens. Reds and yellows aren't so bad. Fire-engine red can be portrayed in CMYK just about as well as with a custom-mixed red ink.



Figure 15.1 To understand what a fifth color adds, consider what a fourth color adds. Above, a separation optimized for printing with cyan, magenta, and yellow only. When the image is re-separated allowing for the use of black ink, below, the results are better.



If CMYK is so good with red, you might think it would also do well with pink, which is a close relative, a tint of red, if you will. But it does rather poorly. It makes the pink with a dot pattern of magenta and yellow inks. A lot of white paper shows through. To get a truly shocking pink, we are better off mixing up a special ink. The same goes for virtually any other pastel color.

The screen pattern is also a strong argument for a custom ink for type, especially small serified type. Small type that prints, say, 20^M65^C100^Y is going to look very, very fuzzy next to the same type printed in one hit of green ink.

These factors explain why custom inks are so common in consumer packaging work. In commercial printing, using more than six colors is rare. In packaging work, 12- or even 15-color printing isn't unusual.

Fifth colors are often used to solve real-life press problems as well. Or, to be more precise, real-life design problems.

A common design error is to try to have a black, rather than a white, page behind photographs. That is, the design calls for solid black ink (and possibly traces of other inks as well) everywhere that there is no type or picture.

Why is this an error? Because as a practical matter, such a design can't be controlled on press. The designer surely wants the background black to be rich and dark. The black ink pouring rapidly into the background to accomplish this comes out of the same ink unit that has to print the black component of the images. It is simply not possible with present press technology to prevent this black from coming down too heavily, and the pictures will look muddy, as (I assume) happened back in Figure 2.2.

Yet pictures knocking out of a black background can be so striking that you or your clients may not wish to give up on the idea so easily. A partial solution, if you can figure out how to do it, is to create a CMY-only separation like that in Figure 15.1 and add only the merest wisp of black to the shadows. But a much more elegant and effective way involves a fifth color—which, as it happens, is also the fourth color. We will print in CMYKK, with black ink in two units. The second unit will be used for the background only. Not only does this eliminate the problem of contamination of the images, it permits a beautiful, rich black background, because in addition to full coverage from the extra black unit, we can afford to add 30% or 40% more coverage from the first black unit. With two hits of black ink the results can be very dramatic.

The most seductive, tantalizing, and—you guessed it—most difficult use of additional colors is to beef up the quality of standard color separations with them. The concept can be illustrated even in black and white.

You will, I trust, agree that the bottom version of the image in Figure 15.2 is the better of the two—but why?

Assume, please, that this is a two-color job. We have black, of course, and we have purple, because that is our client's corporate logo color. The client has no interest in making the photographs have a purple cast. Does that eliminate the possibility of using purple in the photographs?

Clearly not. It can be used for the highly desirable purpose of adding shadow depth and definition. I've simulated the purple here with process colors, but the way this would be done is as follows:

- Create a blank CMYK file that is exactly the same size as the finished B/W file.
- Copy the B/W file and paste it into the black channel of the CMYK document. Also, paste it into the cyan channel, leaving the magenta and yellow blank.
- Apply the curve shown to the false cyan channel. This wipes out anything in that channel that was going to print at less than a 60% dot. It also exaggerates contrast in everything darker than that.
- Save and output the image. Inform the printer that the plate that comes out labeled “cyan” is actually purple.

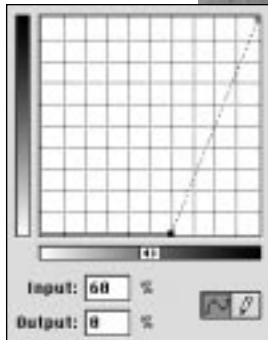
Pretty easy, no? If you are printing in two colors, that's the way you should handle all your B/W images, in my opinion, regardless of what the second color is. Note how similar the effect of added depth is to what happened to the image in Figure 15.1 when we added black.

Practicing Safe Hex

Adding additional inks to a standard separation is an idea whose time has come. Its merits are undeniable, but the tools are primitive, and four big problems are waiting to bite us, namely:

- **Screen angling and frequency.** As we saw in Chapter 14, it's been tough enough for the industry to figure out how

Figure 15.2 When an additional ink is available, images can be subtly improved. Do you agree that the bottom image is superior? It's the doing of a second color, based on the black but with the inset curve applied, restricting the effect of the second ink to deepening the dark areas of the image.



to print with *four* inks without getting an offensive moiré. A fifth color is a further complication.

- **Figuring out how to output the dang thing.** This has gotten a lot better with Photoshop 5, but still, none of the major desktop packages were designed by people who had any clue that foolhardy folk like ourselves would be thinking of making 5/c seps.

- **Proofing limitations.** There isn't any method of making a proof, in most cases. Even if there were, given printers' lack of experience with this, how reliable would it be? What happens on press may come as a surprise—a nice one, we hope.

- **Great expectations.** Adding a fifth ink potentially gives a better-looking product, and sometimes a much better-looking one. If you try to force *potentially* and *sometimes* to become *always*, your fifth color will probably drive you to a fifth of something else, and your printed piece will look worse than if you had forgotten all this lunacy and stuck to CMYK.

The first commercial attempt at such “hi-fi” printing that I know of featured red, green, and blue inks in addition to CMYK. Why the proponents thought seven-color printing had the slightest future in an industry where there are few 7/c presses, I cannot imagine.

Six-color, that's another story. There are plenty of six-color presses around, so a 6/c scheme, of which Pantone's Hexachrome is by far the most prominent example, can be taken seriously.

There's no right answer to what the additional colors should be. If I were designing a 6/c system, I'd add a light blue and a light red to CMYK. That would cure the problem of not just blues but also

pastels: an extra hit of light blue ink would make the dresses of both women on the left in Figure 15.1 more vivid.

Instead, Pantone has added orange and green, and slightly reformulated the CMY inks. They don't do quite as good a job with pastels as my suggested inks do, but they allow really brilliant colors, brighter sometimes than our monitors can display. (To get an idea of Pantone's claims as to how big the Hexachrome gamut is, turn back to Figure 8.2.)

Orange and green have another advantage: they eliminate problem 1, the angling issue, for reasons I will get to shortly. Pantone has rightly attacked problems 2 and 3 head-on. It is vigorously lobbying software vendors to include Hexachrome capabilities, and offers a plug-in for Photoshop that will automatically generate Hex seps from an RGB file.

Similarly, many contract-proof vendors are now able to make Hex proofs. How accurate they will be remains to be seen, but this is a big plus for the process.

Problem 4 for the moment has the upper hand over Pantone and its adherents. Adding orange and green to CMYK does not compare in importance to adding black to CMY. And, as we have seen, that addition of black, while very desirable, will not make us or our clients turn hand-springs with amazement at the magnitude of the improvement.

Nevertheless, here's what a top Pantone official says: “This raises the bar for printers everywhere. The broad applicability of Hexachrome...will create an environment where four-color will always look like a poor relation in contrast. In a side by side comparison, Hexachrome will always look superior.”

Not in a lot of the samples I've seen, it doesn't. In one magazine comparison, Hex looked worse.

That is the fault of the users, not Hex itself. If you start with the assumption that any Hex rendition must look vastly better than CMYK, and attempt to force it to happen, the devil will smile. With a picture of an orange, Hex can leave CMYK looking totally tepid. With a picture of a salad, if you try to flex your Hex, you'll buy yourself the radioactive greenery that has been a common problem in Hex promotional materials.

But, properly handled, it can work. Now. Will it catch on? I doubt it, at least not in a big way. Printers didn't buy those very expensive fifth and sixth units to sit idle in the hope that Hexachrome would one day come along. No, customers were paying good money to put other inks in those units. Not just inks: many jobs are varnished, and varnish uses a unit and counts as an ink. A 6/c press can't run Hex and varnish at the same time. Or even, heaven help us, Hex plus Scratch 'n' Sniff.

There should, in fairness, be less call for custom inks when printing Hex, because

Specifying the Color We Want: The Pantone Matching System

If we are lucky enough to be able to afford printing with additional inks, we need a way to be able to communicate exactly what we want the additional color to be. "Light green with a pinch of an aqua feeling, not too cheesy," may sound precise to you, but to a printer, it's, well, kind of gray.

The standard way of coping with this confusion is the Pantone Matching System, a numbered grouping, with accompanying sample swatches (below right) of around a thousand colors. Several of them might answer the description of our aqua-ish green. All we need do is look at our swatch book, call up the printer, say "PMS 3258" or whatever, and hang up the phone. Although the printer won't have such a weird color on the pressroom shelf, Pantone issues instructions on how to mix it from combinations of 14 primary Pantone inks. It's simple and effective for printer and client.

One common source of misunderstanding arises when one specifies a PMS color and then attempts to emulate it with CMYK inks, rather than having the printer mix a separate ink for use as a fifth printing color. Photoshop, like most other desktop publishing applications, lets us do this. We can select PMS 3258 directly from the color picker. If we place that color anywhere in a CMYK file, Photoshop will insert the values that Pantone says will give the closest match—in this case 60^C34^Y.

The problem arises if you have seen true PMS 3258 somewhere and suppose that 60^C34^Y is exactly the same color. It's not. The real thing is more intense, since it's a solid color, not two screened applications of pale inks on white paper. Because cyan ink is so poor, matching most blue, green, or purple PMS inks with CMYK is impossible. One can get something of the flavor of the color, nothing more. For the closest match, one must also consider dot gain (see page 132).

In the swatch book at right two versions of each color appear side by side. One shows the specially-mixed ink, one the closest CMYK equivalent. Be sure you know which one you're asking for.





Figure 15.3 A common CMYK dilemma: the brilliant blue of the racecar above is a corporate color. If used in advertising, it is likely to be accompanied by type or logos printed in the same color, but with a custom-mixed ink that gives a far more intense blue, so much so that the client may object to the picture printing so tepidly. The solution is to add some of the blue ink into the CMYK image.

the odds are much greater that Hex can match whatever color is wanted. Pantone suggests that we explain this to our clients. Good luck doing that, say I.

Beefing Up the Blue

Let us therefore proceed to the topic of how to improve the CMYK separation if a certain fifth color is available.

For this exercise, assume we are working with the image of a blue racecar shown in

Figure 15.4 Establishing a spot color channel in Photoshop 5. This capability is absent from earlier versions.

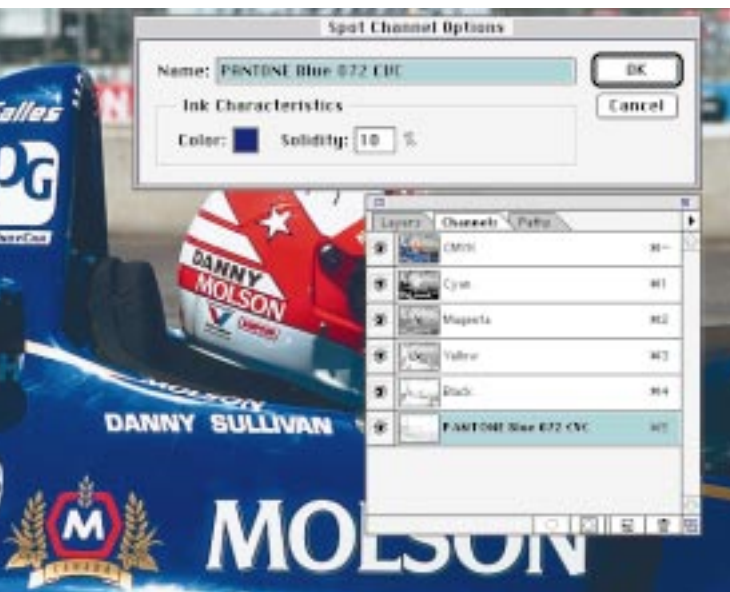


Figure 15.3. Take my word for it, in the original the blue is far more intense than portrayed here, to the annoyance of our client. (It's out of the Hexachrome gamut, too, for that matter.)

Fortunately, blue being the corporate color of this particular client, we have been authorized to use blue ink for various headlines, logos, and whatnot. We will clandestinely borrow some of this blue to help out our image.

This is not for those who spook easily. Anyone who tries this in real life is a desperado. You can stop reading now, if you like. But if you are truly obsessed with getting the best possible color, and are determined to ignore my warning, there is nothing for it but to attack the four major problems, starting with screen angles.

As discussed in Chapter 14, CMYK practitioners have found out the hard way that it pays to have the angles of the screens in cyan, magenta, and black plates offset 30° from one another. Contrary to what you read in many texts, the yellow screen angle doesn't matter: the ink is too weak to cause a moiré.

Blue, however, is a strong ink. There aren't any 30° slots left at which to angle the screen, so our choices are either to take a guess at an angle or let it share one with either magenta or cyan. Don't even think about black or yellow: black will give you the funkier shadow you've ever seen, and yellow is at a moiré-causing angle. (In QuarkXPress, angles are set in the Edit: Edit Color dialog box; in PageMaker, it's done in File: Print>Print Color.)

Hexachrome doesn't have an angling problem because its two additional inks, orange and green, were cleverly chosen. Where there is orange ink it makes no

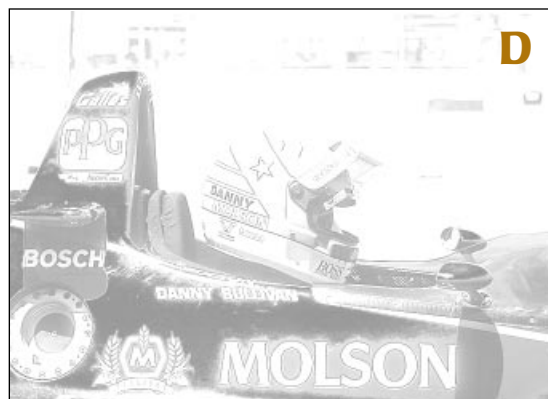
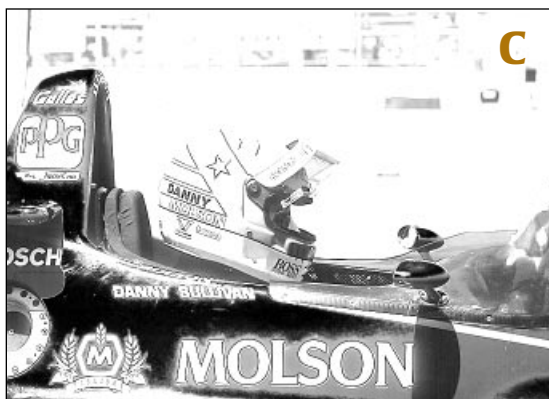
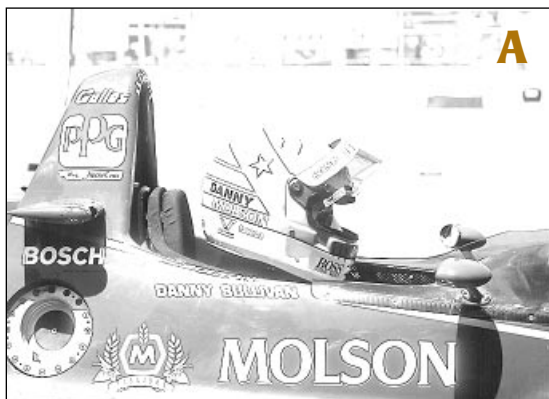
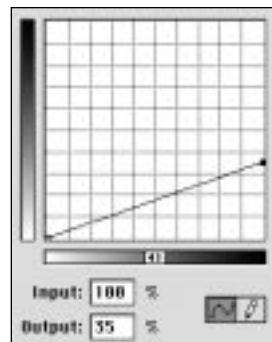
sense to have significant amounts of cyan. Where there is lots of green ink there can't be much magenta. So green is set to the magenta angle and orange to the cyan.

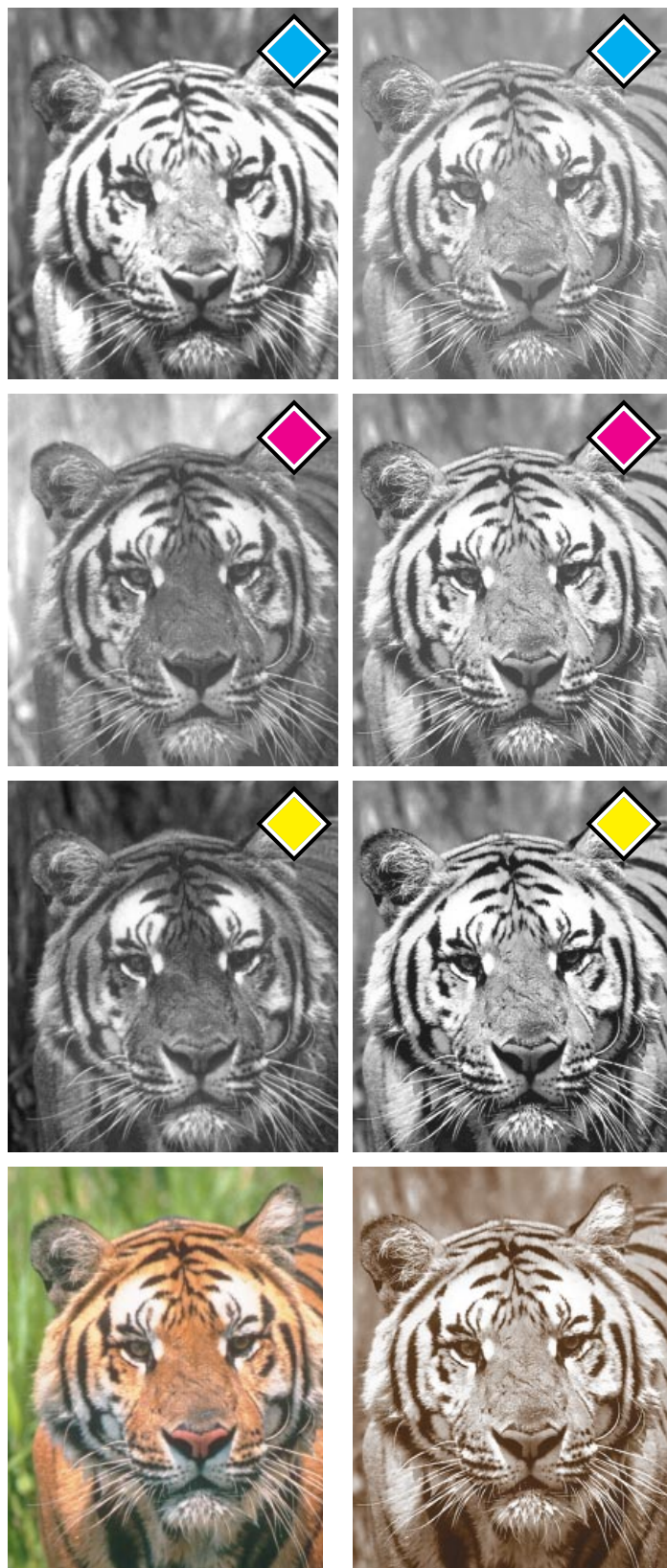
But blue is not so easy. It is an opponent of yellow, not magenta or cyan. So there may be a conflict. There is a somewhat surprising way to avoid it.

When we save an image in EPS format, we can embed a ruling, as shown back in Figure 14.2. Usually, that is a terrible idea. Here, it works. Give the blue plate a 300-line screen, regardless of what screen you plan for the CMYK. Then flip a coin to decide whether to print this extremely fine screen at the magenta or the cyan angle.

It is correct that the printer won't be able to hold those minuscule blue dots on press. What a shame! No dots, no moiré. He also won't be able to hold detail in the blue plate, but that doesn't matter either: there isn't any. We are only using the blue to beef up color.

Figure 15.5 The steps in creating a fifth color plate for Figure 15.3. A: isolating the shadow areas of the image with curves. B: in a second document, using Select: Color Range to isolate the bluest areas. C: Combining A and B into a single channel, with Apply Image (Darker mode). D: C, after the application of the curve at right, which guarantees nothing higher than a 35% dot.





Problem 2, arranging for output, was a major headache until the advent of Photoshop 5, which is the first version to support fifth colors. Previously, we had to have a specialized plug-in if we did not wish to go through a lengthy kludge.

With Photoshop 5, however, we open the Channels palette, choose New Spot Channel, and define the color, as shown in Figure 15.4.

Problem 3, the lack of an adequate proof, is a poser. Some proofing systems allow us to mix up a fifth toner to simulate the ink on press, but this is risky. We may well be the very first people ever to try to make a proof with this particular blue. We won't know whether it accurately reflects how the blue ink interacts with the others.

Accordingly, we have to put our faith in the pressman to decide for us exactly how heavily to run the blue ink. If he decides to make some radical move, it had better not be to reduce the ink flow. That might wash out the blue type that the client is paying the big bucks for. If the pressman wants to step up the blue, on the other hand, it probably won't hurt the type. So we have to be conservative, and create a fifth plate that we suspect is too light.

Constructing the Extra Plate

For all the cautions and ifs and whereases that we have just gone through, making the actual fifth plate is fairly easy.

We could limit ourselves to beefing up the blue car only, but a true swashbuckler,

Figure 15.6 In a conventional four-color image (left column) the individual channels don't have a common ancestor. In a multitone (right column) the channels are slightly different, but all are based on the same original image. This calls for extra care in generating the parent.

realizing that blue is the second darkest of our five inks, will use it to strengthen the shadows as well. One easy way to do this is to make a copy of the CMYK image and convert it to grayscale. Then, apply a curve to it similar to that shown in Figure 15.5, resulting in the image of Figure 15.5A.

Next, we need to put some oomph into the blue areas. This is done with Photoshop's Select: Select Color Range command. With that dialog box open, we click into the area of the car that appears to us to match most closely the color of the blue ink. The Fuzziness setting will vary with the character of the image: here, I used 60.

Once this selection is made, Select: Save Selection, as a new grayscale document (Figure 15.5B).

Step 3 merely combines the two. Image: Apply Image either one on top of the other, using Darker, rather than Normal, mode (Figure 15.5C). Step 4 applies a curve to reduce the maximum dot value to 35%. If this sounds low, it isn't. Before we began, the blue in the car was at around 100^C67^M1^Y. Adding 35 points of blue—a more powerful ink than either magenta or cyan—will have quite an impact.

We also have to be somewhat conservative, because we don't really know how well this blue ink will interact with the others. The CMYK inks are highly transparent, which is very desirable. If we print a magenta dot on top of a cyan one we want to see a combined color, not just magenta.

In defining the screen preview of the fifth color, Photoshop 5 uses the term *solidity*. A good ink would have a solidity of zero; something that wiped out everything underneath it, as many metallic inks do, would have a high solidity. In dealing with an unknown fifth ink, it seems pretty

dangerous to assume that it will be as transparent as it should be. I'd recommend putting in a value of 10% in this field.

Unlike Molson, the publisher of this book doesn't have the budget for five colors, so you'll just have to imagine the effect.

As long as we remember the final problem—that we should not expect monumental improvements—we won't have to imagine the improved quality in our printed images. It'll be there for all to see.

A final warning. This is highly bleeding-edge. Tell a printer that you plan to mix different screen rulings in the same image; that there is no proof; that you aren't too sure exactly what the final result will look like except that it will be better—tell a printer these things, and many a printer will make the sign of the cross and run away in panic.

Then again, some printers will cock their heads, look you carefully up and down, and say, by golly, that sounds like it has potential. Let's give it a try!

And that, why, that could be the start of a beautiful relationship.

How Strong a Duotone Effect?

The "duotone look" has become one of the most popular and powerful tools in creating effective advertising—and no wonder. Consider the advantages:

- A multitone combines the greater tonal range of a color picture with the drama of black and white.
- The choice of base hue for a multitone is able to set the mood for an overall design in a more powerful way than a full-color picture can.
- Multitones tend to look earthy, not brilliant. They are an excellent foil for full-color images: running color side-by-side

with multicolors will make the color images seem more vibrant.

- If a fifth ink happens to be available on press, the presence of a duotone using it will play off dramatically against any four-color images.
- Decidedly listless color originals can be made into very pleasing multicolors.

Historically, multicolors have been difficult and expensive—more expensive even than process color. Now, they are within everyone's reach.

What Is a Multicolor?

The technical definition of a multicolor is: any image where every color channel is based on the same (monochrome) information. The information can be lightened, darkened or otherwise modified in each channel, but it must derive from the same original. This can be seen in the right row of Figure 15.6. Although the cyan plate is lighter than the yellow, they are clearly related. In the full-color image at left, the cyan and yellow are different images.

Figure 15.7 Three styles of duotoning. Left, the old-fashioned way of a flat tint of color on top of a black base. Center, a default conversion to black and white and a default duotone curve applied to a color original. Right, a B/W conversion done using the methods of Chapter 13, followed by custom duotone curves.



A *true duotone* consists of two inks only. Although Photoshop permits construction of duotones using any two colors, in practice one of the colors is almost always black. The other color can be black as well. Black–black duotones, also known as *double-dot printing*, increase the dynamic range and detail in a black and white image. This method is popular in Europe, especially in art books.

In true duotones, the second ink is usually not cyan, magenta, or yellow, but a custom color that is selected specially or happens to be available on press because of the nature of the job, as in the hypothetical example of the purple logo.

To reiterate a point made earlier about fifth-color plates: if you are creating a true duotone, you have to keep the lessons of Chapter 14 in mind and step in to avoid moiré. By default in both QuarkXPress and PageMaker, an additional color is set at the black screen angle. Leave that alone, and your duotone will have both plates at the same angle and you will curse the day you ever had the idea of experimenting with fifth colors. Instead, set the fifth color either to the magenta or cyan angle, creating the 30° difference that kills moirés.

Far more common nowadays, however, is the *process duotone*—the use of CMYK inks to produce the look and feel of a true duotone, without the attendant angling and proofing problems. All of the examples in this chapter, naturally, are process duotones, since I don't have a fifth ink available. Some purists would say these are technically not duotones because they use more than two inks. When trying to simulate a green duotone, for example, we have to create what some would insist on calling a *tritone*, because it will use (at

least) cyan, yellow, and black. A sepia, or coffee-colored, look requires a *quadtone*.

Technically incorrect or not, for the sake of sanity I will henceforth refer to as a *duotone* any image that uses multiple plates but is based on a single ancestor.

Almost everyone uses one species of process duotone—the four-color black and white. Black-and-white images look richer and deeper when cyan, magenta and yellow are added in more or less equal quantities to the black, and this is standard professional practice when printing black and white and color pictures on the same form.

Where B/W and 4/c images are in close proximity, there is really no argument for doing things any other way. News-magazines, for example, have to use monochrome historical photographs right next to normal color images. If printed in black ink only, they would look not only colorless but lifeless. The color images would have richer blacks (since 80° 70° 70° 0° is darker

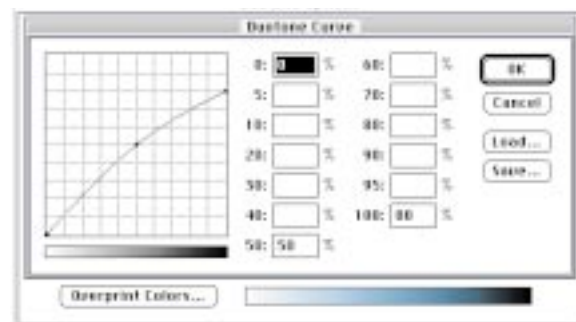


Figure 15.8 Photoshop's multitoning dialog boxes. Once the base colors are chosen (right) preset curves can be loaded. Both the colors and the curves can be edited freely.



than 90^K), and the screening pattern in the B/W would be more noticeable. An unwary reader might conclude from these factors that the magazine's production staff was incompetent, but a better adjective would be thoughtless.

Creating a four-color B/W image is as easy as changing from Mode: Grayscale to Mode: CMYK, but there is one small catch. Before doing it, we should go to Edit: Preferences > CMYK Setup and change the setting to Heavy GCR. The reasons for doing so are amplified in Chapter 7. Any time an image is predominantly composed of neutral grays (and this one will be *entirely* so composed) we are in danger of being torpedoed by careless presswork. The more black there is in our CMYK version, the less likely that an ink imbalance on press will cause a disastrous color cast.

In real life, of course, we do not apologize for or try to hide the use of duotones. In their classic form, we use the second ink

not only for a deeper shadow, but for a better highlight as well. Purple is a dark ink, but it is lighter than black. A highlight of 0^K2^P is better than one of 2^K0^P. More range equals more contrast.

This method will, unlike my first example, give the image an overall purplish cast. We would have a purple picture with black used for depth only, more or less the same way it is in full color, not just a black and white with reinforced shadows. Clearly, one could split the difference between the two extremes in several ways. The decision would depend on how much of a purple feel we wanted.

Some writers, scientists, and other benighted individuals have actually suggested that the way to achieve the purple look is to plaster a flat tint of purple over a B/W picture. That obsolete approach dates from the days when decent duotones were difficult. Adding a tint of a second color gives the image a certain flavor, all right, but in the nostrils of the professional it also gives it a certain smell. Figure 15.7 shows the difference between such an effect and a properly constructed duotone.

As with any duotone, we are applying different curves in each channel to the same original monochrome image. Naturally, we continue to follow the rule that the steeper the curve, the more the contrast. As you might expect, the magenta and yellow use the same curve. The cyan curve has to be somewhat different, since neutral colors require more cyan than magenta and yellow. And the black curve is a law unto itself.

It is also perfectly workable to copy the original black and white into two or more plates of a blank CMYK file and then apply curves in the normal way. This is how I made the crude duotone of Figure 15.2.

Specifying a Duotone: The Five Questions

1. What will the second color be?
2. Have you taken into account that the multitone will seem darker than a sample swatch of your second color?
3. Will this be a true duotone, with an additional spot color, or will it be simulated using CMYK inks?
4. Roughly how strong should the tinted effect be? In the four examples in Figure 15.9, we'd term the strength strong, moderate, light, slight.
5. Are you looking for a standard, high-contrast, reproduction, or does the design call for a softer, less-focused look?

Photoshop's Mode: Duotone controls are, however, one of the strongest points of the program, and the remainder of the examples in this chapter will use this method of applying curves.

Curves, Preset and Otherwise

Figure 15.8 shows Photoshop's duotone dialog box, which is accessed by changing Mode: Grayscale to Mode: Duotone. In Photoshop, one cannot convert a CMYK or RGB image directly into duotone; it must go to grayscale first. The basic two colors can be changed freely by clicking on the existing ones. They can be defined either as

percentages of values from any colorspace or by their Pantone identification number.

Once we click OK, the monitor will show us what looks like a duotone. One would expect the new Photoshop document to have two channels, just as an RGB file has three channels and a CMYK file four. Frustratingly, it does not, which causes some handling problems.

Certain of these, such as producing a hybrid image duotoned in only a certain area, can only be resolved by converting the duotone file into CMYK. But if the duotone will eventually print in CMYK, we should convert the file as well, even though

Figure 15.9 Photoshop's preset duotone curves come in four levels of strength. The first always favors the colored ink more than the black; the second through fourth gradually reverse this. Below, the four default cyan duotone curves applied to the same B/W original.



page-layout programs can separate a Photoshop duotone file. Process duotones should be separated using Heavy GCR, and it won't happen unless we do it ourselves.

Each half of a Photoshop duotone is the original black and white image, modified by a curve. The curve is clearly necessary in at least the black plate, since if a significant amount of a second color were added to an unaltered black, the image would become too dark. If you have become proficient with curves, you will be able to come up with adequate duotone curves, although Photoshop's built-in ones are quite nice. What the second color is (assuming black is the first) makes a big difference. It also depends on what kind of look you are trying to achieve with the duotone, for there are many possibilities.

Assuming we are doing a duotone with black plus color X, it's a safe bet that we want the highlight to be 0^K2^X and the shadow to be 90^K90^X. Thereafter, complications set in. If X is something heavy like a purple or brown, its curve will probably have to dip in the middle. If X is light, like cyan or yellow, the curve may actually have to bulge to make the X plate heavier than the original B/W was. And if X falls somewhere in between, like red or blue, we may not need a curve at all.

If you'd like to use Adobe's preset curves and have installed Photoshop normally, they will be located in a subfolder called Goodies>Duotone Curves and can be loaded directly from the dialog box shown in Figure 15.8. In each of the colors that are included (and there are around 20), there are four variations. The first is the one that most emphasizes the second color. The fourth is mostly black with the second color added for depth in the shadows only, like

the duotone of Figure 15.2. The other two come down in the middle.

Figure 15.9 shows one image as treated by each of the four preset curves for a black-cyan duotone. Which look is best? It is purely an artistic call. One may be right for a certain project and not for another.

Aesthetically, though, there is no doubt that certain colors work better in duotones than others. Those who are successful in designing with duotones almost invariably stick with darker, subtler colors in combination with black.

As you can see, the duotones produced by Adobe's default curves are of quite respectable quality. And there is enough of a selection to let us find a curve for just about any of the infinite number of duotone colors we might be motivated to use. For example, in Figure 15.7 I used a CMYK simulation of PMS 485 as a second color because it happens to be included in the defaults. But the specific colors and curves are easily edited. The default red curve should not be used to define a cyan duotone, but it will work for just about any red. So, if we decide that the existing red is too bright and we want a dirtier-looking second color, we simply open the default duotone curve, click on the color box that specifies PMS 485, and change the value to 20^C80^M80^Y or whatever. Since the alteration takes seconds, we can try one color after another until we get the desired effect. Photoshop 5 introduces a big advance here: in previous versions, one couldn't preview the effect of the alteration without actually applying and cancelling the curves.

Excellent as these are, however, they are only defaults. Pictures with special characteristics need special handling. Normal rules of curvewriting have not been

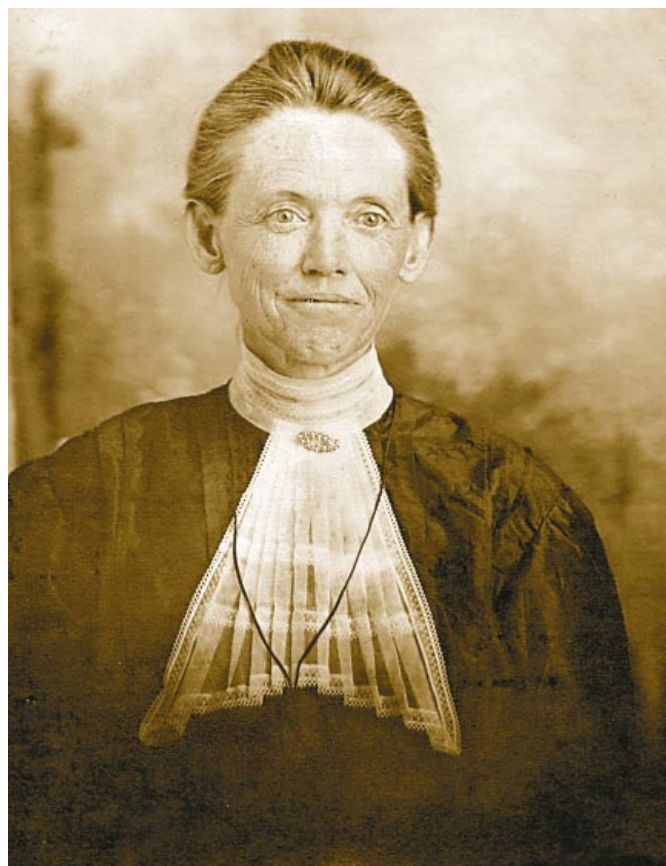


Figure 15.10 Hundred-year old originals present a restoration challenge both in detail and color. To get back to the sepia look of the version at right, one has to use Photoshop's multitoning capabilities.

repealed just because we have entered a new colorspace. Whether the image is color, grayscale, or multitone, we build contrast in the same way. We find the values in the area we want to accentuate, and then arrange for the curves to be steeper there.

A Study in Sepia

The antique effect of a coffee-colored duotone is highly useful in a rapidly growing field of computer artistry: the restoration of old images.

The original of Figure 15.10 is more than a hundred years old. It's badly faded, and has damaged areas near the bottom.

Although this is a monochrome image, it pays to treat it as being in color, so that the tricks discussed in Chapter 13 can be brought to bear.

When a color image requires this much work, we ordinarily think of LAB. That makes no sense here, however. The L channel is nothing more than a grayscale rendition of the document; if we wanted that, we shouldn't have bothered to scan in color in the first place.

Instead, we should use RGB.

The normal reason CMYK is preferred over RGB, as fleshed out in Chapter 9, is that the channels are more subtle, easier to

control. RGB would be better for really poor color originals, but one rarely so uses it, since LAB is better still.

In the current competition, however, LAB is disqualified. Given the two remaining choices, RGB is better. And since we aren't worried about color, we should, as a first step, set highlight and shadow in each channel just as though each were its own grayscale image.

Looking at the results in Figure 15.11, it's pretty clear why we scanned in color. Each channel now has different strengths and weaknesses. The green is the best overall. The blue has the best face of the three but the worst dress. The red has the best dress but the worst face.

The two intolerable things are the damage at the bottom of the blue channel and the featureless face of the red. I chose to take care of both of these by creating a separate blending channel, based on the green. But in this channel, instead of having a normal highlight to shadow range, I set the endpoints to be 0 and 100. I then blended 50% of this into the blue channel, killing the damage.

Next, I applied a curve to the blending channel, dropping the midpoint. This intensified detail in the dress at the expense of the face. In spite of this, the face was still better than in the red channel, so I blended 50% into the red. And having done so, I applied unsharp masking to the red and green channels, omitting the noisier blue.

As part of the sharpening process, I also trotted out the sharpening tool, running it across the eyes, the folds of the kerchief, the wrinkles in the face, and the brooch. And, because it is very easy to make a rough selection of the background, I did so, and ran the Dust & Scratches filter, to eliminate some of the more obvious noise.

The revised blending channel is shown in Figure 15.12, along with the document at this point. This burgundy dress looks strange, but who cares? It's about to go into grayscale, so the fact that the color was wrong will remain our secret.

So, Mode: Grayscale, followed by Mode: Duotone. For a default setting, I chose, under Pantone Duotones in the Photoshop Goodies folder, the first brown duotone.

Figure 15.11 The red, green, and blue channels of the original of Figure 15.10, after setting a proper range in each, as though each were a grayscale image.





DUOTONE AND OTHER EXTRA-INK PROBLEMS

- ✓ One needs to be conservative in adding fifth colors to CMYK files, because there are usually not good methods of proofing, printers have little experience doing this, and the extra ink may not be as transparent as we are accustomed to.
- ✓ Before using a fifth color in a halftone image, the screen angling issue must be addressed. By default, fifth colors use the black angle, which is usually wrong.
- ✓ Even if there is only one other color available, and even if you do not want anyone to know you are making a duotone, you can use the second color to deepen shadows undetectably, making for a superior B/W.
- ✓ True duotones use only two inks, one of which is almost always black and the other usually a special color. This look can be duplicated, however, by breaking the color components into CMYK.
- ✓ The key to getting a good duotone is a good, high-contrast B/W image. If you are planning to make a *color* picture into a duotone, be sure you grasp the concepts of color-to-B/W conversion explored in Chapter 13.
- ✓ Photoshop provides an excellent array of editable preset duotone curves. There are four curves for each color, each of which emphasizes black more than the last. The colors can be changed easily, and so can the curves.
- ✓ True duotones using a nonprocess color are easily manufactured in Photoshop, but a lot can go wrong afterwards. There is no good way to proof them, for example. Also, screen angling problems are common.
- ✓ As a general rule, brilliant colors are not good choices for duotone work. They can never print at their full intensity, since the darker they get, the more black appears. Earthtones and other subdued colors work better.
- ✓ In Photoshop, a duotone is a single channel, which is not what one would expect. Certain manipulations, such as a retouch of one duotone plate but not the other, can only take place if the duotone is brought into CMYK.
- ✓ In a process duotone or 4-color B/W image, press problems will be minimized by running a heavier black than normal. Before separating into CMYK, therefore, change Photoshop's CMYK Setup to Heavy GCR.



Figure 15.12 Left, a special channel used for blending into the red and blue channels. Right, the document just before conversion into grayscale.

This creates a second color channel based on PMS 478, or, to use its CMYK equivalent, $69^C87^M100^Y$. To me, this brown was too deep, so I changed the color definition to PMS 130, $0^C27^M100^Y$. And because I felt the image needed slightly more weight, I changed the curve for this color from one with a slight midtone dip to a straight line at a 45° angle.

This done, I changed CMYK Setup to Heavy GCR, and converted the duotone to CMYK, to get the final product on the right side of Figure 15.10.

As this image suggests, fashions change. So do possibilities: this kind of work was

inconceivably difficult before the age of electronic imaging, but there is demand for it. So, in the last chapter of this book, we'll do a few more of these oldies.

Before entering that final round, a reminder: once again, the techniques we used are all closely related. Assuming a color original, you cannot produce a decent duotone without knowing how to get the most out of a black and white conversion. You can't do *that* without a good grasp of standard professional color correction. And you can't do professional-level correction without curves, blending, and sharpening—which will never go out of style.