The Science of the Skosh

Topics: Limitations of commercial printing, relations with the printer, some advice on teamwork.

Column first appeared: January 2006, *Electronic Publishing* magazine.

Source of this file: The author's draft as submitted to the magazine.

Author's comment: Readers and I both consider this late effort a favorite. It came at a time when it was fashionable to bash the efforts and intelligence of commercial printers. The provocation for the column, however, was the suspension of a highly-paid football player for repeated public insults directed at his teammates. He became the pivotal character of the column, as I suggested that a bad teammate is still a teammate and that insulting him is not likely to get him to play better. The printer and client are on the same team; they both win or they both lose. If the printer isn't particularly skilled, precautions can be taken to make it less likely that he'll harm the team.

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 more than a hundred edited threads from Dan's Applied Color Theory e-mail list.

The Science of the Skosh

Preparing files for commercial printing requires techniques very different from those of the image manipulation that photographers are used to. The printer may not always be the best teammate, but he's a teammate nevertheless.

My greatest strength" Terrell Owens remarked in a written apology in November, "can also be my greatest weakness. I'm a fighter—I've always been and I'll always be. I fight for what I think is right."

Mr. Owens, in addition to being a color scientist, is a football player of considerable skill. It appears, however, that he will spend most of the season as the most well-paid spectator in the history of sport, in consequence of some impolitic remarks about the abilities and personal qualities of other members of his team.

It must be granted that Mr. Owens did not choose his teammates. In that regard, he is like most of us in the graphic arts. His melancholy experience may help guide us in dealing with our own.

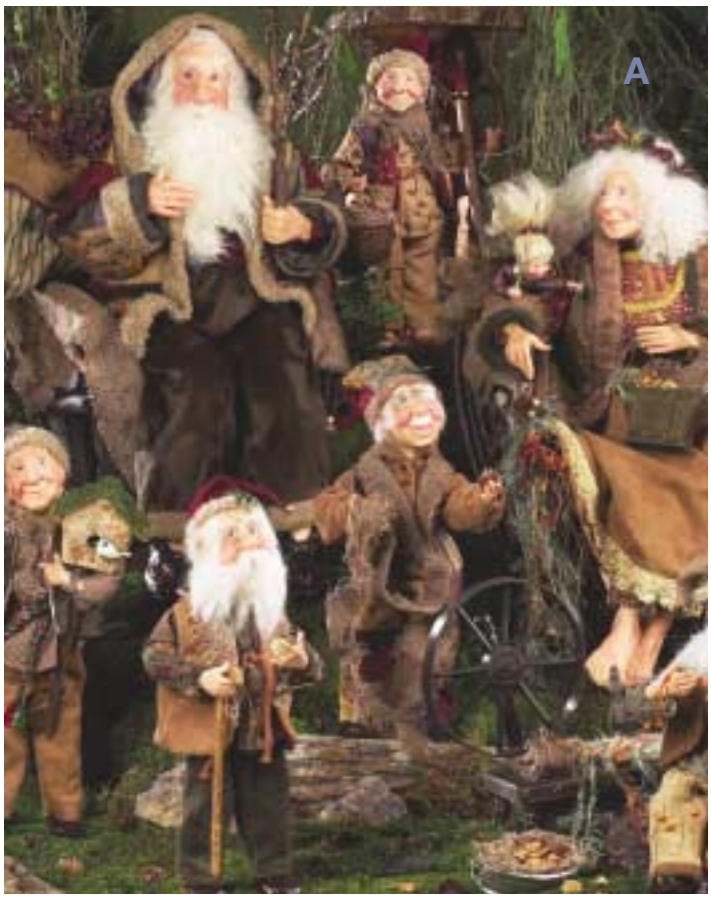
In fairness, Mr. Owens has found fault with every other team he has played for, but this is again like us. More specifically, it's like the ever-tense relationship between commercial printers and RGB-oriented clients, particularly professional photographers.

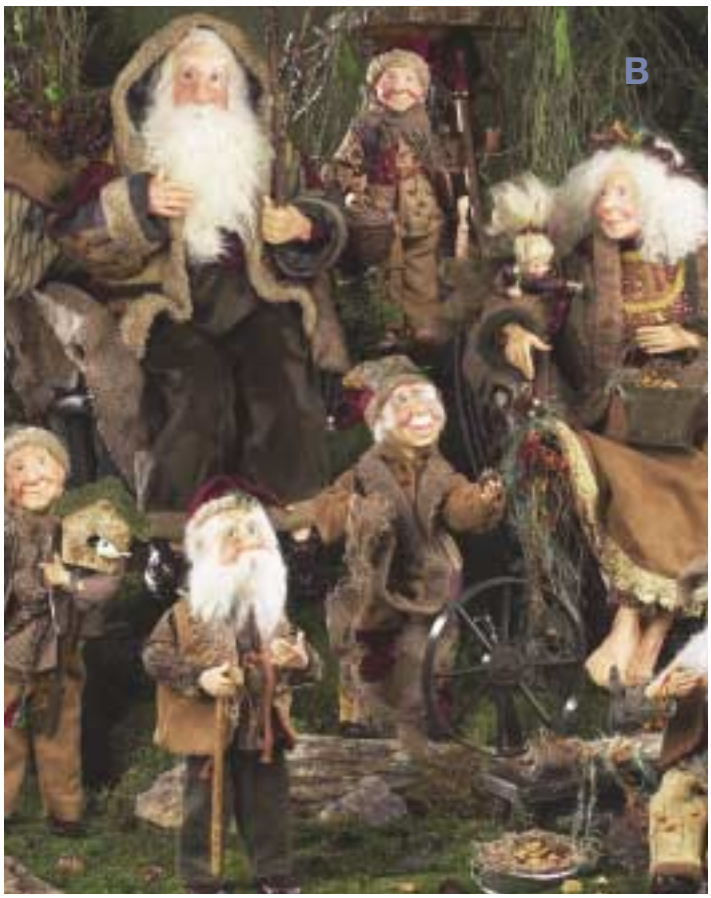
The subtle, rich reds of Image A are what the photographer intended to get. The washed-out B is what he got in print. Unfortunately, this was a rather important picture in a rather important setting for a rather important client. And the blame game began.

When a receiver drops the ball, it is certainly an individual failure, but the team pays the price. Whether the printer and photographer liked it or not, they were on the same team, and the team failed. The result was bad for both. Dissatisfied clients can be expensive luxuries, especially when they have to listen to the photographer and the printer jawing about why their teammate is to blame for the job getting messed up.

How this particular image got hosed is less important than the principle, but as a formality, the photographer provided an RGB file with an embedded tag

The photographer intended the look of image A, but the printer did not honor the embedded profile that identified the file as being Adobe RGB. The result was the muddy-looking B.





The brilliant pinks of the original RGB file are out of gamut in CMYK. Download the file to see the difference.

identifying it as Adobe RGB. The printer ignored it, treating the file as though it was in sRGB, producing the muddy mess for which each thought his teammate was at fault.

Actually, three parties share the blame. Adobe is partially responsible, for not providing an interface that would alert the printer to the presence of an embedded RGB profile while allowing CMYK profiles to be ignored altogether; the lack of this feature is a strong inducement to printers to ignore *all* profiles. The printer is partially responsible because, even if he doesn't look at embedded profiles, he should have known that his client was a professional photographer, and that professional photographers generally loathe and despise sRGB.

Being proficient at the blame game myself, I assign principal blame to the photographer, first for not appreciating that many printers don't know how to convert from RGB to CMYK properly, second for not being aware that printers commonly ignore embedded profiles, third for not finding out whether his teammate was on the same page, and finally because he had a lot more to lose from a badly printed job than his teammate did. Many similar land mines are buried, waiting for photographers to step on them, which is why we need to provide a roadmap—including a guide on when to use that vital tool to insure print quality—the skosh.

The lesser of the evils

Photographers, like Terrell Owens, sometimes have a legitimate case that their teammate isn't giving his all, or isn't good enough to be playing professionally in the first place. Even Mr. Owens, however, would not criticize a defensive tackle for being slower than he is, or not being able to catch a ball as well. Without a good knowledge of football, however, one might not realize why it is natural that defensive tackles don't have these skills. Without a good knowledge of commercial printing, a photographer can fall into the same trap. To see how, let's try some questions involving hypothetical pictures that you have to imagine are yours.

- Your picture is one of a fashion model. Would you prefer her face to be too beet-red, or too pale? (Note: if you want to know why it just can't be printed correctly, shut up and answer the question.)
- In a picture taken in the open spaces of a national park, would you prefer the sky to be too cool (cyan) or too purple?
- A landscape shot features lots of greenery. Would you prefer it too light and clean, or too dark and muddy?
- A shot of a cityscape at night shows the dark edges of the skyscrapers barely outlined against the sky, although the lights and stars are clearly visible. Is it better that this image print too dark, or too green?
- Substitute a shot of silver jewelry. Should this one be too dark, or too green?

Photographers who think of printing presses as being slightly larger versions of their desktop printer or of a photo lab can have a difficult time grasping the significance of these questions even as they admit the obvious answers. To that, there are two responses.

First, if you don't like your desktop printer, trash it and buy a new one. If you don't like your photo lab, find one that you do. But if you don't like the printer who your client has chosen to print your job, there's not a lot to do except welcome him to the team.

Second, wide receivers are built for speed. Defensive tackles are built to be difficult to displace. We don't see 300-pound wide receivers, defensive tackles who are Olympic-class sprinters, or presses that print thousands of time faster than desktop printers yet can maintain the same consistent colors throughout the pressrun.

A press, although it weighs several tons, spits out paper so rapidly that it perceptibly bounces during the run. It mixes ink, which may be old and which lives in a trough whose cleanliness is open to question, with water and slathers the mess over a sheet of aluminum whose performance varies with age, which sheet hits an aged piece of rubber whose ability to accept the mixture depends on the skill of the pressman who wrapped it around a cylinder whose own performance is rather dubious. This kludged system deposits ink onto paper that is giving off lint as it runs through the press and whose receptivity to ink is affected by temperature, humidity, the speed of the press, and the mood of the pressman.

A skosh of prevention

Printed results are therefore going to be erratic. The only question is, *how* erratic? It won't be as bad as the difference between images A and B—color intensity can't vary as much as that. But it can be pretty bad with respect to darkness. To get a rough idea of the magnitude of the problem, find yourself a typical RGB image that looks good on your screen. Go Edit: Convert to Profile>Apple RGB. After clicking OK, duplicate the image. To the copy, Edit: Assign Profile>sRGB. (Note: these two commands are found under Edit: only in

Photoshop CS2. In previous versions, choose Image: Mode.)

Compare the two versions. It you were expecting the original, and got the second in print, you'd be entitled to be upset—but variation that big happens all the time in the print world. It shouldn't, but it does.

Now, imagine a lesser variation—one that's halfway between the two. Now, you don't have a leg to stand on. It may not be acceptable to you, but it's roughly acceptable to SWOP, the standards-setting organization. Such variation is approximately within specified tolerances.

The philosopher Epictetus said, "Do not ask for things to be as you wish; wish for them to be as they are." A stoic hands the printer the file as he hopes it will be printed, and has to pretend afterwards that he likes whatever the result is. A sensible person tells Epictetus to take a hike, and follows a philosophy of trying to prevent what is not wanted.

The *skosh* is a crucial unit of measurement for anyone serious about their prepress. It is somewhat less than a tad but considerably more than a weenzie. It is the experienced person's insurance policy against an undesired result.

Did you vote against purple skies and beet-red fleshtones? If you think that the alternative is more palatable, the solution is obvious: a skosh less magenta than you would send to an output device you were more confident of.

If you'd rather have colors that are too clean than too muddy, take insurance by making the file a skosh lighter than you think it will print. And, if you'd rather chance a file being too dark than too colorful, you use another trick that confounds the photographer.

In RGB, there's only one way to define colors. In CMYK, everything except brilliant colors can be constructed in many different ways, by adjusting the amount of black up and the CMY down, or vice versa. If the subject is something gray, like a drop shadow, give your teammate more black ink, which can't print as any color but gray, instead of inks that impart an ugly cast with ease, if he isn't giving his all to process control.

That opens up the can of separation worms, the difficult RGB to CMYK conversion. Unfortunately, getting the team to use the same playbook becomes problematic, because the coaching staff has failed to show up.

A pound of RGB-Centricity

When it became possible to do serious professional work in Photoshop in the early 1990, the huge majority of jobs both started and ended in CMYK, as digital photography did not yet exist, drum scanning was the rule, and the only output device that wanted RGB files was a film recorder.

Since then, almost all input and quite a bit of output has shifted to RGB, but there is still a massive population of users, possibly the majority of professionals, to whom CMYK output is critical. Mastering the sciences of the skosh, separation settings, and suchlike is essential to their getting good results. But who will teach it to them? And where did their teachers' experience come from?

To say that Photoshop authors and instructors tend to be RGB-centric is an understatement. The best example is the educationnal staff of the Photoshop World show, a group that I am proud to be a member of. It is the greatest assemblage of Photoshop talent ever put together. Just about all of the most prestigious experts are found there.

According to the web site promoting the next show, this current staff comprises 33 people. Seven are unknown to me. Of the 26 I know, 24 are/were professional photographers or come from another almost exclusively RGB background. One of the others has significant CMYK experience, but only one actually has a strong CMYK production background, and that one is getting old and long-winded.

This incredible imbalance is by no means limited to Photoshop World; it's worse elsewhere. If you buy any book on Photoshop, the chances of the author knowing anything about the realities of commercial printing are not good.

There are a whole lot of reasons that the most well-known experts are not representative of Photoshop users at large, but they aren't particularly germane to this column. The consequence, however, is. When discussing how to prepare files for print, the advice of most Photoshop books is the blood-curdlingly perilous one of asking the printer.

Asking the printer is on the whole somewhat more worse than asking the plumber or the electrician. On the one hand, it is slightly more likely that the printer will know something more about Photoshop than the plumber or electrician would. On the other, the plumber and electrician will at least shrug their shoulders confess that they have no idea what you're talking about, whereas many printers are so embarrassed about their lack of knowledge that they will feel compelled to lie.

Then again, why *should* the printer know? On our team, he is a specialist, and when forced to play out of position, he's as likely to be effective as Terrell Owens would be playing linebacker. The printer's job is get us to approve a proof, and then run the press to produce something we consider acceptably close to it. It is very much in his interest to be able to

CMYK has no difficulty matching relatively dark, pure colors, like the square at top left. But as the gradient gets lighter, the colors get grayer. Compare this printed version to the downloadable RGB file.

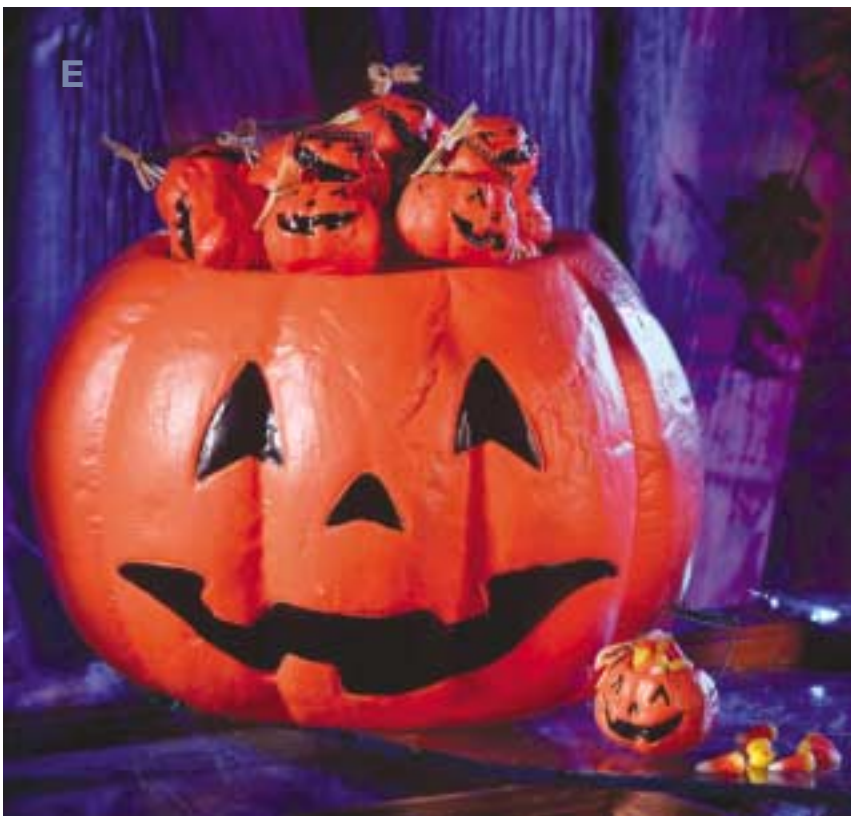
match that proof, because if he doesn't, not only does he have an unhappy client, but he gets to eat the cost of the job.

Helping the client make the file that would produce an acceptable proof is another story. The printer's biggest clients already know how to create a good CMYK file. As for the smaller, less experienced ones (read: professional photographers) there's not much incentive for the printer to get involved. Even in the unlikely event that he knows what to do in Photoshop, he doesn't get paid for technical support; he can't teach the photographer all the ins and outs of CMYK file prep in 15 minutes even more than the photographer could teach him everything there is to know about photography in the same time span; and if he does get involved and the job is unsatisfactory, his participation may get him involved in playing the blame game later.

Therefore, although some commercial printers are actually capable of giving helpful information if you find the right person to speak to, you certainly can't count on printers to do much more than match their own proofs, which brings up the question, why can't they match *yours?*

Too good to be true

Today's desktop inkjet printers are often so good that a commercial printer would have as little chance of keeping up with their quality as he would of beating Terrell Owens in a footrace. They often use more than four inks, permitting some vivid colors, particularly blues, that a press has no hope of matching. Also, many photographers proof their own work on paper that costs nearly a dollar a sheet—around ten times as much as the paper it will eventually be printed on. At first glance, it seems to be only a skosh whiter, but it has a profound effect on reproduction.



In Adobe RGB, many of this file's colors were too vivid to be reproduced in print. These oranges lose detail during conversion to CMYK.

Nobody can make a white whiter than the paper being printed on, and whiter whites equal more contrast just as the blacker blacks that such papers support do. Printing on paper like that of this magazine is destined to look flat by comparison. But the real difference is in pastel colors, which are impossible to show under the printing conditions of this magazine. You'll have to fetch the original RGB images of C and D from http://XXXXXXXXX.yyyyyyy Open them, go Image: Mode>CMYK and watch them go gray.

Magenta ink is quite potent. A swatch of solid magenta on this page is a color too intense for a monitor to display. Then again, that color never occurs in nature. There are lots of magenta flowers, but they're light magenta, like in image C. Or, at least, they *were* magenta, when they were in RGB. Now, they're quite gray, and any photographer who had told a client that CMYK prints nice magentas would have a lot of explaining (and blaming of teammates) to do at this point.

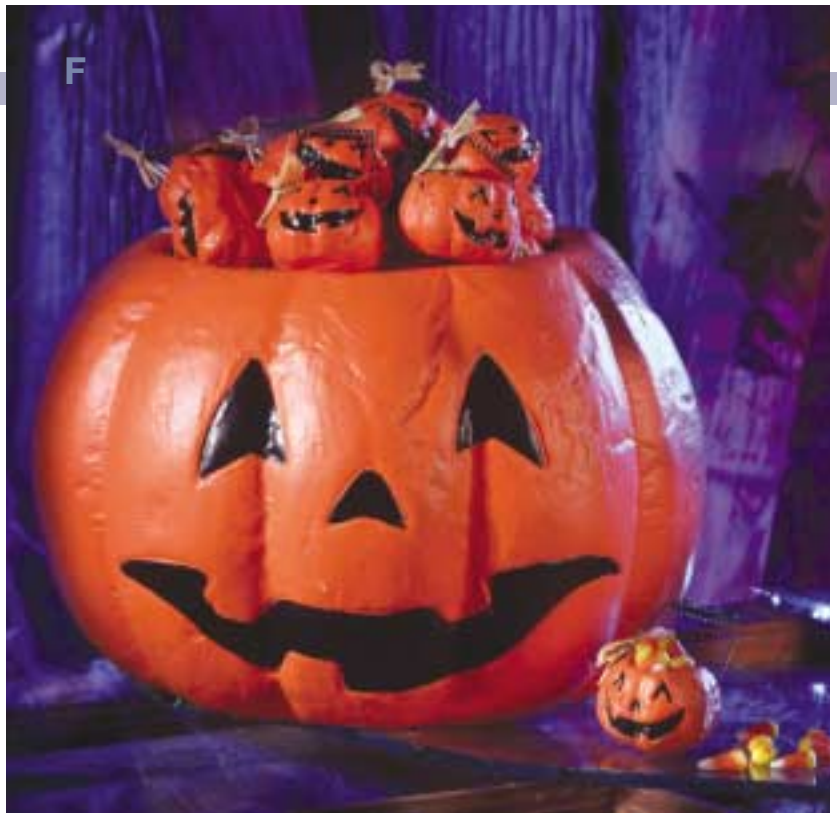
A viewer perceives magenta when her eyes are flooded with red and blue light. The most intense magenta would be as much red and blue light, and as little green, as possible. On an RGB monitor, this is accomplished by firing the red and blue guns at full intensity and turning green off altogether. In CMYK, laying down a solid coating of magenta ink blocks reflection of green light while permitting red and blue.

In RGB, a lighter magenta is made by adding green light, since red and blue are already maxed out. Therefore, the act of lightening the RGB file makes the color less pure.

In CMYK, the lightening is achieved by reducing ink coverage and exposing more paper. That only works as well as the RGB method when the paper is absolutely, totally, blindingly white. Anything less achieves its non-whiteness by blocking reflection of not just green light, but some of the critical red and blue as well. The darker the paper, the more pitiful the light magenta. The dollar-a-sheet stuff is quite white. Paper that costs a tenth as much absorbs ten times as much of the red and blue.

Consequently, if you convert the RGB gradient of image D, which is based on pure CMYK magenta, to CMYK, the dark square doesn't appear to change on your screen. In fact, it doesn't even convert to 0C100M0Y, which is out of the RGB gamut. But note that the lighter areas of the gradient distinctly seem grayer after the conversion. That effect is what's eviscerating the flowers of C, which are a brilliant pink in RGB.

What's a poor photographer to do? There are several possibilities, but all involve understanding why CMYK is incapable of doing what is wanted. To get a purer-looking color, we need to leave less paper exposed. That means we have to use more ink. We can



A false profile of sRGB was assigned to this image, causing Photoshop to believe that it had duller colors. Upon conversion to CMYK, it retained detail better than the image on the facing page does.

add magenta to make the flower darker, or yellow to make it redder, or cyan to make it bluer, or some combination. It depends on what lie we wish to tell. But any of these three lies, in my view, would be better than leaving image C the way it is.

Turnabout is fair play

Lies, skoshing, and brigandry are reasonable responses to the unjust world of commercial printing. We've just seen a mild version of what happens when we attempt to print unprintable colors. Usually, the color in question is somewhat darker than the pinks of C and D—and what happens to them is even more brutal.

All recipes for taking an RGB file into CMYK offer slightly different solutions to the problem of how to accommodate out-of-gamut colors. Mapping them to the closest matchable color sounds right but often doesn't work. It could cause an extremely bright object to come into CMYK without any detail at all. It would be possible for every part of the object to become the same color even though in RGB there used to be many subtle differences.

Some algorithms try to compensate by toning down all other colors in the image, deliberately failing to match matchable colors in the interest of leaving more room to depict colors that can't be matched. However, even the most aggressive such algorithm wouldn't dare tone down the other colors as much as would be needed to accommodate all variation in the out-of-gamut ones.

Some loss of detail in such colors is therefore inevitable; the only question is how much. Possibly we may not care. Many brilliant objects don't have much detail anyway. But if we do care, the obvious solution is to make the colors a skosh less brilliant while they're still in RGB. A less obvious, but perhaps more effective one, is to pay back the system by turning one of its abuses against itself.

The same photographer who was victimized by a profile mixup on the first page of this column provides the image of E and F. Presumably we agree that F is better; it's certainly shapelier. But it wasn't always that way.

Adobe RGB, the choice of most photographers, has its uses. Meshing well with CMYK isn't one of them. The oranges aren't dark enough for CMYK to have a chance of matching any part of this pumpkin.

Solving this problem involves doing on purpose what the printer did by mistake with image B. We force a "misinterpretation." We don't do this with the Convert to Profile command, asking Photoshop to change the values so that the new sRGB file has the same appearance as the old Adobe RGB one. Instead, we lie and tell Photoshop that it already *is* an sRGB file, with Assign Profile>sRGB. And then, we convert the file to CMYK before giving it to the printer, to make sure he doesn't foul that part up.

Assigning the false profile makes the RGB image look mangy, but one of the happy peculiarities of CMYK is that nobody remembers or cares what the RGB file used to look like. The brightest area, to the left of the nose, measures the same in both CMYK versions. But E, the Adobe RGB version, stays too bright too long, because so many of the out of gamut colors were mapped to the same CMYK values. In F, more of the pumpkin was already in the CMYK gamut before the conversion, so the shape is better defined.

Finally, why do we convert to CMYK, rather than allow the printer, who may know his own conditions better? That's like asking Terrell Owens why he wants passes thrown to him. Whoever is best at this business should be carrying the ball. In the year 2006, the photographer is probably better at image manipulation than the printer is.

If you know that the printer is competent, by all means let him carry the ball. If it's an unknown printer, and you suspect that he might be better at image preparation than you are, you should ask yourself whether you like that situation and what you are prepared to do about it. And if you could carry the ball yourself but insist on forcing the printer to do it because you think he's unprofessional if he can't, do what Terrell Owens should have done before opening his mouth. Take a look at a mirror, and ask yourself whether you are fighting for what you think is right or casting blame for your own deficiencies, and—whatever your answer is—whether doing so is really in the best interests of the team.

Contributing editor **Dan Margulis** *(DMargulis@aol.com) is author of Photoshop LAB Color. For information on his color-correction tutorials in Atlanta, Chicago, and San Diego, call Sterling Ledet & Associates at 877-819-2665. To join Dan's on-line color discussion group, www.ledet.com/margulis.*