That Old Black Magic

Topics: Characteristics of black channel, channel blending, false separations, Selective Color, ink limits, RGB and CMY channels compared

Column first appeared: October 2001, *Electronic Publishing* magazine.

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

Author's comment: This fanciful Halloween-themed column, which casts it spells on black cats with black magic, is one of my favorites. Back then, the Shadow/Highlight command, which helps a lot in pictures of black cats and other objects with important detail in deep shadows, hadn't yet made it into Photoshop. But even today, the value of the black channel for extracting shadow detail remains intact. The advantage of using it often more than compensates for the extra conversion, even if the desired output file is RGB.

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 list.

That Old Black Magic

When the most important things in an picture are black, a bit of witchcraft is in order, because some of the normal rules of image manipulation don't apply. Here's a potion that will make any black cat's hair stand on end.

Those who exert tremendous force against a problem with no discernible result except frustration are said, in English, to be "spinning their wheels." Wheel-spinning is so common in the graphic arts that it deserves a better cliché. My Colombian friends have one. They describe such an exercise in futility as being "like a blind man in a dark room looking for a black cat that isn't there."

In February, an unintentional application of this metaphor provoked a chorus of pitiful mewling from wheelspinners when this column included, so help me, a picture of a black cat that wasn't there.

The image in question was taken in a garden at night with a cheap digital camera. It was almost pure black. I was pointing out the outstanding optics of such cameras, so I hacked a bit and demonstrated that a black cat *was* there and could actually be brought out and printed successfully. The same moves on a similarly dark image scanned from film would have resulted in unholy amounts of noise.

In spite of identifying those moves as a second-rate method of bringing out the cat, it became clear that readers considered it some kind of black art. I was del-

uged with questions as to how it was done.

There are two explanations for this interest. First, these digicams and their novice users are forcing us to start, more frequently than we would like, with just such ridiculously dark images.

More important, black cats are bad luck. They represent an exceedingly troublesome category of images: those where shadow detail is critical, or, to be exact, where the key to success is the color black.

This is particularly so under printing conditions with high dot gains. Newspaper people can testify that reproducing white cats is not a problem. Black cats are another story.

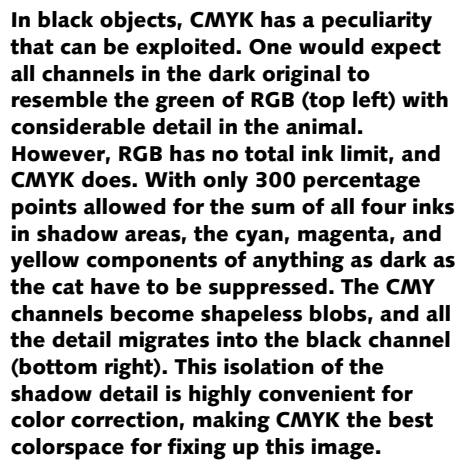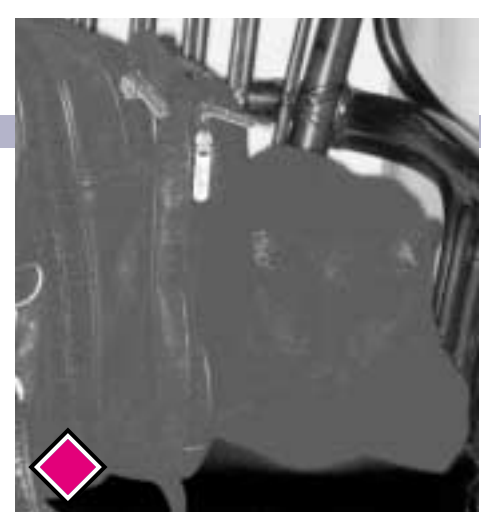To understand how to handle black objects, one has to grasp one of the most perplexing fea-

Plugged, detail-free shadows, like those above, are rarely desirable, but they're especially bad where the most important objects are black. Left, a corrected version.

In black objects, CMYK has a peculiarity that can be exploited. One would expect all channels in the dark original to resemble the green of RGB (top left) with considerable detail in the animal. However, RGB has no total ink limit, and CMYK does. With only 300 percentage points allowed for the sum of all four inks in shadow areas, the cyan, magenta, and yellow components of anything as dark as the cat have to be suppressed. The CMY channels become shapeless blobs, and all the detail migrates into the black channel (bottom right). This isolation of the shadow detail is highly convenient for color correction, making CMYK the best colorspace for fixing up this image.

tures of the CMYK colorspace. This is true even if one is preparing such images for output to some device that requires RGB.

The cat we'll be petting today isn't quite as disastrous as the one in February, but it's plenty dark enough, thank you. Above, have a look at the CMYK anomaly I was referring to.

Not a whisker's worth of detail

In RGB, every channel is much like the green shown above, as far as the black objects go. The red and blue don't look like the green in the seat and arms of the chair, but the cat and bag are very similar.

One would expect the same thing to happen in CMYK, but as you can see, it doesn't. The reason, not particularly obvious, is that there's no ink in RGB, and hence none of the problems of handling on press that are notorious in the nether world. In CMYK, we will be obliged to confine our darkest shadow to a total that the printer will dictate to us. Except in rare cases, it will be between 225 and 340 percentage points when all four channels are added together. This magazine requests 270; like most people with experience in these matters, I tend to give them a bit more. But anything over 300 would run the risk of getting the job rejected.

This peculiarity doesn't affect the chair's seat or arms. Those areas are similar in the green channel and its CMYK cousin, the magenta. But what's up with the poor cat??!!

Assuming for the sake of argument an ink limit of 300 points, this has no bearing on the seat. Its cyan and black are light; to be charitable, let's say 25% coverage of each. If so, even if the dominant inks, magenta and yellow, print solid—

100% each—the maximum total ink will be 250%.

The black areas are a different story. Left to their own devices, each channel might be as high as 85 or 90%. Multiply that by four, and it's way over the limit.

Something has to give. Granted how powerful black ink is, that something is going to have to be the other three.

Sane separation methods. therefore, allow the black to do its own thing, while smashing the CMY into a brick wall once it hits a certain darkness. That's ordinarily something like 80C70M70Y (in RGB, neutral colors have equal values in all channels, but in CMY, more cyan is needed; note how the cyan cat, such as it is, is darker than its MY siblings.)

Wherever that brick wall is located, it will destroy all further detail. That's why, even though these channels are from the appallingly dark image at the top of the opening page, the black channel is so well defined. In the other three, even a blind man could recognize a case of a black cat that isn't there.

With cats, some say, one rule is true

Before groaning at the thought of three channels that, like certain of my relatives, occupy space without serving a useful purpose, consider the good news. Drastic things clearly have to be done to this image. It is extraordinarily convenient to find the target of these changes so wed to a single channel, so divorced from anything else that might prove an obstacle.

Basic principle: to get the detail that's missing in the overall version, we have to extend the range of the dark objects. That is, their heaviest areas must stay dark, but the lighter parts have to get lightened, the more the better.

Consider doing that to the green channel. The seat of the chair is the same darkness as the cat, and the arms are only a bit lighter. So opportunities are limited; any move to the cat is likely to damage the chair severely.

The black channel, on the other hand, has practically nothing in it except the cat and the bag.

Furthermore, although the image itself is full of noise (look at what's happening in the yellow channel) the black isn't especially bad, and even if it were it wouldn't be a tragedy. We can still apply unsharp masking. With the black covered up by so much amorphous cyan, magenta, and yellow, we can afford to have it bloodcurdlingly harsh.

And so, this kind of shadow-critical image is all about the black. Once you appreciate this, some of the secrets of shadow sorcery reveal themselves.

First, even beginners in the field know that the key to color correction is making the highlight as light, and the shadow as dark, as is consistent with holding shape. It would be unthinkable, to such beginners, to intentionally lighten the shadow here or in any other picture.

The stronger the rule, the more surprising the exception. This is it. The cyan, magenta, and yellow are worthless here, thanks to the ink limit. Actually, they're worse than worthless, because they interfere with our appreciation of the real picture, which is found only in the black channel. If we lighten CMY in the black areas this will have the paradoxical effect of increasing contrast as we move *away* from the maximum allowable amount of ink.

Second, suppose that your files aren't going to a magazine, but to the Web, or to a desktop printer that requires incoming files to be RGB. In such a case, you might sometimes convert the RGB files to LAB to take advantage of certain capabilities of that colorspace, but you'd never convert them to CMYK—would you?

Well, not normally. But in this case, the advantage of working the black channel is so decisive that yes, this image should be converted to CMYK for shadow contrast enhancement, and then, if necessary, back to RGB.

Third, if you are an RGB chauvinist who has had bad luck with working with CMYK files, perhaps it's because of a common misconception. Such people hear, correctly, that the CMY inks shouldn't be higher than 70 or 80 in the deepest shadows, and jump to the conclusion that they can't be higher than that anywhere else.

That is, of course, a misread. The CMY inks can't be higher than 70 or 80 if the object

The better image from the bottom of Page ••, with the black plate deleted, shows how little detail the CMY channels contribute in shadow areas. If this were any other type of image, removing the black wouldn't hurt nearly as much as it does here.

is *black.* Furthermore, if the object is black and *important,* the CMY shouldn't even be that high. Any other color, and 100% is just fine. The seat of the chair, for example, has more than 80% coverage in both magenta and yellow.

Finally, someone who grasps that images of black things depend entirely on the black channel has just been liberated. All classes of trickery and arcane ingredients are now fair game to drop into that black cauldron, things one would never dream of employing in any other context.

Landing on one's feet

Just because we know how the story will end doesn't mean we should jump to the last chapter. The fur is going to fly in the black channel, but the image starts out in RGB.

In August's column, I suggested that we could make life easier in this type of image with a false profile—a new definition of RGB, using existing values for primary colors, but a fake number for gamma, or midtone darkness.

The camera that captured this feline takes exposures that normally open up well with either the Apple RGB or ColorMatch RGB definitions, both of which have a gamma of 1.8. This time, however, I used a false profile: Apple RGB with a gamma of 1.4. In my view, that's the best way to lighten the image without blowing out the red seat.

This is another example of how RGB and CMYK, which on the surface are close relatives, have subtle differences. The false-profile approach is theoretically usable in CMYK, but RGB is where it really purrs.

Using Image: Mode>Assign Profile doesn't change the image, merely Photoshop's internal idea of what the image is supposed to look like. In principle, this has no impact outside of Photoshop. However, if the profile is assigned in RGB, and the file goes thereafter to CMYK or LAB, the false profile will be taken into account, and its witchery will be inherited by the new file. There's even, if need be, a way to reconvert the false-profile document into a standard RGB file that incorporates the new appearance.

Furthermore, using a false profile is unlikely to cause a color shift—at least in RGB, where equal amounts of red, green, and blue always make a gray.

There's no such firm neutrality rule in CMYK, and the other advantages aren't there either. CMYK files ordinarily go direct to output. Converting a CMYK file to some other variety of CMYK is a sport for the wealthy and experienced. There may be reasons to use the Assign Profile command in CMYK for monitor preview purposes, but the circumstances are pretty rare.

There is nevertheless a CMYK analog to the RGB false-profile shenanigans of August. It involves not Assign Profile, but Image: Mode>Convert to Profile. Also, whereas the RGB method was to do something sneaky to make the image look better, in CMYK the idea is to do something equally underhanded, and make the image look worse.

The black plate with nine lives

Return for a moment to the channel-by-channel breakdown on page •••. Time for a huddle.

Fixing this mess in RGB is out. One look at the green channel shows that anything positive that can be done with the cat and bag will annihilate the chair.

The black channel doesn't have this problem. The cat and bag are better, and the chair is so light that it won't matter if it gets wiped out altogether when the shadows are opened up.

As good as it may look, it's not even close to being acceptable. Remember, this is the black channel from the demonically dark image at the top right of page ••. We don't need just need a more potent spell than this, we need something huge and hulking, a black that will not just meow, but roar.

A normal separation is not going to work. Instead, we need something made to measure for the shadow-contrast challenge. This calls for a, shall we say, creative use of the Convert to Profile command, shown at upper right.

Unlike its predecessor, Photoshop 5's Profile to Profile command, this one can use (by choosing "Custom CMYK") the familiar separation dialog that has been found in as many different places as there have been versions of Photoshop.

One could also make this custom separation by changing Edit: Color Settings>CMYK>Custom CMYK. The disadvantage of doing so is that the change stays until cancelled. If you forget you've done it, you're asking for a calamity the next time an image shows up that doesn't have critical shadow detail. The Convert to Profile method avoids this booby trap: it applies to the current image only.

Anyhow, the menu lets us specify lots of things, only a few of which are relevant here. Those without massive CMYK experience need only be aware that, unlike RGB, the same colors can often be created in many different ways, by using more black ink and less CMY, or vice versa.

With few exceptions, and this is certainly not one, a relatively light black is best if the final output is a press. That calls for either a separation type of UCR or, as here, GCR with

The above dialog creates a custom separation. By limiting the black channel to a maximum of 60%, it creates a black that seems absurdly light, below.


Light black generation.

The black ink limit in this dialog should almost always be set to 80-90%, both to prevent shadow plugging and to make color correction, if any, easier. But shadowy images like this one are the exception. I've used a maximum of 60% here, which is why the black above is weirdly weak.

The overall image now looks terrible, little better than the blackless wonder at the bottom of page ••. Fortunately, the potion is not yet complete.

Black ink was limited to 60% at the time of separation, yes, but that's history. We can take it to 100% now if we like, and that's just about what the excruciatingly steep curve shown here does. The idea, of course, is that the post-separation black is too light, but it still has plenty of exploitable detail.

A super-steep curve like this brings out contrast in a big way, but is usually impossible because it would massacre anything that started out at 50% or higher. Thanks to the false separation, nothing here answers that description.

Channel: Black

Input:
Output:
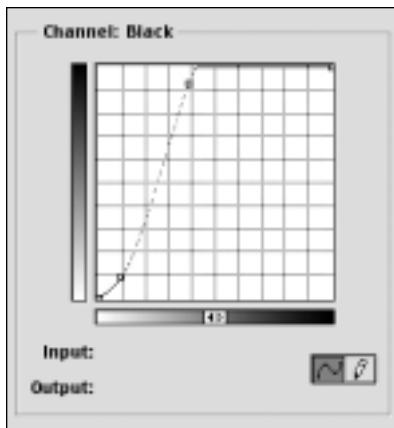
After applying the curve at left and a touch of unsharp masking, the final black, right, seems too harsh. The formless CMY plates, however, soften it. Below, a selective color move reduces the quantity of CMY inks in black areas.

Selective Color

Colors: Blacks

Cyan: -31
Magenta: -22
Yellow: -27
Black: 0

OK
Cancel
Load...
Save...
☑ Preview

Method: ○ Relative ● Absolute

I'd love to show what the image looked like after this curve, but it would fall into the claws and teeth of the preflight department. With the black being jacked up so, the deepest part of the fur reads something like 85C70M80Y90K. *Electronic Publishing's* printer wants a maximum total ink of 270. Twist his tail, and he'd undoubtedly accept 300. A sum of 325 is a cat of a different color.

Lightening the shadow hurts contrast in just about every class of image except this one. Here, though, the dark parts of the CMY channels actually damage the picture, by gumming up the very sharp black.

Fortunately, one can cast a spell that intensifies detail, keep sthe printer happy, and holds the background colors, all with one twitch of the nose. Photoshop's Image: Adjust>Selective Color lets us choose not just any RGBCMY color for adjustment, but black as well. So, as shown above, we remove cyan, magenta, and yellow from black. (I took extra cyan and yellow out because in the original, the numbers for the cat read somewhat green, which is unlikely to be right.) Total ink in the final version, even in the very darkest part of the cat, is only around 250.

For he's a fiend in feline shape

Like cats with a favorite chair, successful retouchers have special tricks they return to time after time. This one—identify important shadow detail, separate with a short black, stretch the devil out of it, and reduce the CMY—happens often enough that it pays to automate. Not the last two steps, mind you: they'd be slightly different with each image.

The funky sep setting, however, is worth saving. So rather than as described previously, I'd recommend doing it—one time only—within Edit: Color Settings>CMYK>Custom CMYK. Having changed the values, choose Save CMYK, and name it "ShortBlack" or whatever. Dump that file into the System Folder>ColorSync Profiles folder, and restore your original CMYK settings.

This avoids always having to go through the process at the top of Page ••. Last time, I advocated much the same thing for
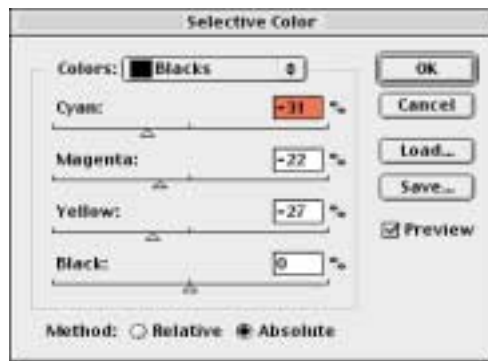
certain RGB settings. How convenient! When an RGB image like this one comes along, I assign the one of several false profiles that pop up automatically (in this case a 1.4 gamma, but I have lots more options) followed by a false-profile separation, using "ShortBlack," which also is a permanent option on my system.

This isn't my only false CMYK profile, either. Can you think of another class of images that requires a drastically different black?

Screen grabs like the ones on these pages are CMYK Photoshop files, just as color photographs are, but they can't be separated in the same way. If they were, their fine gray lines would break into four colors and would look fuzzy, because no type of printing has perfect register.

Instead, the separation needs Maximum GCR—all black, no CMY wherever possible—and that's not all. Where colors appear in screen grabs, they don't have to be particularly accurate. They do have to be bright. So my false profile called "ScreenGrab" has strange ink definitions as well as a nonstandard black generation. The red highlight color on this page therefore isn't particularly close to what it was in the original. So what? As long as it's bright, who cares?

Getting back to the task at hand, there never was a cat of such deceitfulness and suavity. We started with a black cat that wasn't there, and after a couple of color management lies that would horrify the most hardened warlock, he magically reappeared. One is reminded of the most famous cat of all, with a bow to T. S. Eliot.

Macavity's a Mystery Cat: he's called the Hidden Paw—
For he's the master criminal who can defy the law.
He's the bafflement of Scotland Yard, the Flying Squad's despair:
For when they reach the scene of crime—Macavity's not there!

     *   •   •

Ah, but if you know your black magic, he will be.