Digital Black and White

Black and white was what first got me "seriously" into photography. While I never attained real mastery in black and white printing, I have spent a long time in various darkrooms. I still enjoy the aesthetic of black and white a great deal, and of course have tried to get the "look" I like in digital as well. Thanks to a lot of experimentation, some reading up, and tips from people who are a lot better at it than I am, I'm finally starting to see the kinds of results I wanted. In particular, thanks to Jim Fuglestad, aka Shutter at DPREview, who thought up the "dodge and soft light" technique described in this essay.

The craft of traditional black-and-white photography consists of three stages: **exposure**, **development**, and **printing**. Each has its niceties and techniques with which specific "looks" or other effects can be created. With digital black and white, the latter two phases, "developing the negative" and "printing" happen in post-processing. However, there is a digital analogy to this three-step process. Here’s the short version:

1. **Expose for the highlights.** In-camera, do everything you can to get strong highlight detail -- underexpose, bracket, shoot RAW; whatever you can and whatever it takes.

2. **Develop a "B/W negative."** Convert your color original to black and white with your favorite method -- "canned" film actions, channel mixing, Russell Brown's "filter and film" technique, [http://www.russellbrown.com/tips/photoshop.html](http://www.russellbrown.com/tips/photoshop.html) the "layered channels" technique I describe below, or any of a number of others. Your objective should be to retrieve as much tonal detail as possible from the color original.

3. **"Print" the B/W negative with tone control layers.** Duplicate the "neg" twice, set blend mode to Color Dodge on the first one, and Soft Light on the second one. Add a Curves layer to control contrast, and a Hue-Lightness-Saturation layer with Colorize to correct the "cold" look. Then play with the opacities of the layers to control the look of the "print."

4. **Finish.** Dodge and burn locally, add the final touches to the tonality with Levels or Curves layers until satisfied.

Straightforward enough? Maybe, but it might be some of the steps need a bit of elaboration, so here's the long version.

**Exposure**

The objective of correct exposure in film black and white photography is to capture as much of the dynamic range of the scene as possible, with as much contrast in the critical midtones as feasible. The same applies for digital, only the rules are reversed.

The big difference between digital and "silver" black and white is in dynamic range. Black and white film has so much latitude that it's not much of an exaggeration to say that no matter how you expose it, you'll get a usable picture. Moreover, black-and-white particularly likes overexposure: in fact, it's common practice to shoot B/W film at one stop below its rated sensitivity -- ISO400 film at ISO200, and so on. With digital, it's the other way around: to get a good picture, you need to be pretty careful with the exposure, especially at higher sensitivities, and especially careful not to overexpose -- otherwise you'll lose the highlights.

Digital cameras are designed to mimic color slide in their response. In fact, blown highlights are less distracting in color photography, since the color adds another dimension to the picture: the blown-out bits aren't necessarily the ones that stick out. Black and white lives and dies on tonality, and blown-out bits are much nastier... unless you work them into the look of the picture, that is. Moreover, "digital highlights" even below the blow-out point are often flattish, lacking in tonal detail.

There is another important difference about black and white and color: grain or noise. Noise generally looks pretty bad in color photography, while in black and white it can actually add interest to it -- so much that at times it might even be advisable to add noise to the final product.

Be as it may, while with digital color photography blown highlights are an issue to be managed, with black and white, they must be fought. In fact, the main issue while behind the camera becomes to make the most of the dynamic range there is. There are a number of approaches to this.

**When in doubt, underexpose.** Digital cameras actually gain in capture fidelity the closer they are to
blowing out. However, they tend to be economical of their highlight detail in their default conversions, in
order to keep noise down: rich highlight detail has to be pulled from the midtones, which have to be in
turn pulled from the shadows, which boosts noise. With black and white, richer highlights are more
important than low noise. Therefore, it pays to underexpose and pull up the tonal detail into the highlights
instead of increasing sensor sensitivity -- you'll buy richer highlight tonality with increased shadow noise.
Of course, this only makes any sense if there's any detail in there to work with -- underexposing so much
that the histogram "flattens" completely isn't a good idea. On a DSLR, a stop under won't mean a thing at
ISO400, and has minimal impact even at ISO800. By putting the exposure well under, you'll avoid
clipping highlights -- an annoyance for color, it can seriously lessen the impact of a black-and-white print.
This is especially true if you're shooting JPEG rather than RAW: the richer tonal detail nearer the
midtones will end up looking a lot better in the final print.


This picture would be a good deal more effective had I underexposed a stop and retained the detail in
those waves.

Consider shooting RAW. If you shoot in RAW, you can convert with several settings, to pull out the
detail that's just below the blow-out point. Since black and white is all about tonality, RAW can actually
help a good deal. Another advantage of RAW is that the deeper images are less prone to posterization --
something that can happen easily for example if you manipulate curves or levels in flat areas like the sky:
you can convert to a close approximation of the tonality you want directly from RAW, and avoid this
issue.

Development

In digital development, the objective is to extract as much of the captured tonal range as possible, and
produce a roughly balanced version of the final image. Simulated filter effects (GND, yellow, amber, or
red filter) should be applied in digital development. The objective is not (yet) to produce the best-looking
final image, but rather, an 8-bit black and white image that contains as much tonal information as
possible. There are several tricks that can be used to further this objective.

RAW conversion

Use low-contrast RAW conversion settings to retain as much of the tonal range as possible. However,
with high-contrast images, it may make sense to produce several versions at higher contrast settings;
when combined in various ways, this allows for more latitude in manipulating the tones. For example, you
might want to convert three images at the High contrast setting at different degrees of digital exposure
compensation (say, -1, 0, +1) for combination in post-processing. In an ideal situation, you will have no
blown-out highlights and rich tones near what will be the highlight end of your print; never mind if the image looks flat and gray. Of course, bracketing in-camera works marvelously for extending the camera's dynamic range, and is especially suited for black-and-white.

Creating the digital B/W negative

Once you have your RGB image, preferably somewhat underexposed (either digitally or actually), it's time to create your digital B/W negative from it.

This shot was underexposed about a half-stop, and converted at the Low contrast setting. Looks drab and has bad color balance, too... but rather nice tones.

The key to this is mixing the red, green, and blue color channels in nice proportions. The "standard" way of doing this is by using the channel mixer, although there are others -- there's a nice summary of them at Russell Brown's website [http://www.russellbrown.com/tips/photoshop.html]. However, I prefer another method: extracting the channels into layers: simply copy the contents of each channel into a layer. This has a number of advantages over the quick-and-dirty channel mixing: for one thing, you can visually control the contribution of each channel to the final image simply by adjusting the opacity of the channels, and by using layer masks, you can select different mixes for different parts of the image. For a picture like this, with faces the main interest, I'd tend to emphasize the red channel, add a dollop of green, and finish with just a touch of blue. (Incidentally, this approximates the effect of using an amber filter on black and white film.)
However, by switching the channels on and off, I noticed that the green channel has the richest tonality for the girl's shirt, so I decided to create a layer mask for the red channel, and airbrush in a mask on the shirt: this gets the green channel to dominate in that area.

[Image]

There, all done: we have our digital B/W negative. It contains as much tonal detail as I could easily extract from the color original. However, as expected, it looks pretty flat. It's time to "print" it. Let's merge the layers so we have one B/W image, and have at it.

"Printing"

The objective of the printing phase is to use the tone detail present in the "digital negative," and produce a pleasing final image out of it. There is no 1-2-3 technique for this: it's eye-work and in any case depends a great deal on personal preference. What's needed from technique is a way to control the tonality of the "print" as precisely and as easily as possible. We will use Jim's technique to achieve this -- a "digital darkroom" where tone can be controlled simply by adjusting the opacity slider of image and adjustment layers.

We will set up our virtual darkroom by adding three control layers and a tone correction layer: the dodge layer, the soft light layer, the curves adjustment layer, and the tint layer.

Setting up

1. Duplicate the bottom layer twice, naming the first copy Dodge and the second copy Soft.
2. Set blend mode to (Color) Dodge on Dodge, and opacity to 4%.
3. Set blend mode Soft Light on the second one, and opacity to 25%
4. Add a Curves adjustment layer on top of the whole stack, using an over-aggressive S curve, pulled up a bit towards the highlights if your "negative" is slightly under.
5. Turn down opacity on the curves layer until the effect looks about OK.
6. Add a Hue, Saturation, Lightness adjustment layer, and name it Tint. Check the Colorize box, set Saturation to 50%, and pick an orange hue.
7. Set Opacity to 4% on Tint.

Fantastic, we're all set up to get the tonal control over the print that we deserve.
This is what the "neg" looks like after simply applying the above steps mechanically. Not bad, but it'll get even better.

Controlling overall tonality

The nice thing about this setup is that you can get a tremendous amount of control over the overall tonality of the image -- simply by playing around with the opacity sliders of the layers! I could try to explain exactly what each of the layers does, but that would take longer and be less informative than this: just try it. Set the sliders to various opacity settings, click the layers on and off to see what each of them does, and use your eye; that's what it's for. Try balancing the effect of the Soft Light layer against the effect of the Curves layer -- they do a bit of the same thing, only differently. Oh, and why not try Hard Light instead of Soft Light, or some of the other blend modes too?

On this image, by the way, I noticed that the Dodge level tends to flatten out the tonality in the girl's shirt, so again I used a layer mask to mask it out from that area. Here's what I got after a bit of playing around:

The picture is starting to look pretty good to my eye already: just the finishing touches to go. I wanted to bring out the girl's eyes a bit -- as Shutter suggested, 'Eyes make a photo for me' -- so I added a Levels adjustment layer where I shifted the gamma to brighten up the picture, masked everything out except the eyes (i.e. filled the layer mask with black, then used the eraser in airbrush mode to get in the eyes), and turned down opacity until it looked nice. Then I added a Levels adjustment layer, clipping the histogram a bit from the right and turned up the gamma a tad to get the overall tonality to click into place, and finally, I cropped out the blurry bit (part of my mother-in-law, actually) at lower right. Here's the result:
The nice thing about this layered “soft light and dodge” technique is that it allows very dramatic changes to the tonal range while minimizing degradation of the image data. The operations shift tones around, but the translucency ensures that they tend to fall between each other: after all this manipulation, including that pretty severe levels clip at the end, my histogram looked very neat -- barely toothcombed at all. More importantly, there's no shadow posterization that I can see either.

**Grain**

I like grain, especially black and white film grain. I'm not too particular about the brand, T-Max looks just about as good to me as Tri-X or one of the Ilfords. But I like it to be there; it gives a sense of structure and texture to the image that's quite pleasing. I don't like grain in color images at all as much, though, and the grain in color neg isn't nice at all. Therefore, even though I like to think of digital B/W as a whole new medium and feel quite strongly that trying to imitate B/W film is usually not the best way to go about it, it's not very surprising that I've tried any number of techniques of simulating grain on clean digital captures. I've tried a variety of noise-adding and Photoshop grain filter techniques, until I finally decided to try the obvious: get off my lazy ass, scan in a frame of B/W neg with some boring flat sky, and try to incorporate that into digital B/W images.

Guess what? It worked. Miles better than anything else I've tried. I guess the folks at Grain Surgery were right all along, but I'll be damned if I'm going to pay for software that just adds and removes grain.

The tricky part was preparing the field of grain. After that's done, it's so simple it's hardly even worth calling a technique:
An actual-pixels crop of one of the B/W pictures I processed for this article. No grain, and just a touch soft, too.

1. Take your prepared grain field. Copy and paste it into a new layer on top of the image you want to grainify.

2. Set mode to Overlay.

3. Pick up jaw from floor.

4. To control the look of the grain, adjust opacity, apply Gaussian blur, or scale the grain field up or down.
The same image after adding grain. Is it real, or is it Photoshop? -- Actually, this is rather more grain than I would want for the picture; for the one I eventually ended up with I downsampled the grain to about 75% and turned down the opacity too, for a subtler effect. I decided to show this version anyway, since it illustrates the effect better.

To get my even field of grain, here's what I did:

1. Scanned in a frame of B/W neg at 16-bit gray (since I would be doing violent things to it in post-processing). I picked one I took in Budapest, that consisted mostly of boring, uniform, flat gray sky. One specially shot for the occasion would've saved a bit of work later, of course.

2. Since I wanted a big chunk of grain, I copy-pasted the scan four times flipping each copy so that there wouldn't be abrupt lightness changes, and cloned out the seams. Because of vignetting, my cheap-o scanner, and the fact that it was, after all, cloudy sky, my grain field was rather variable in lightness.

3. Did stuff to it to get rid of lightness variations. I don't recall exactly what I did, but in essence I duplicated the background layer, added Gaussian blur to get rid of the grain in the top layer, inverted it, and jiggled with the blend modes and opacity until the grainless negative canceled out the lightness variations in the grainy positive.

4. Adjust Levels so that the histogram ends up neatly in the middle. Makes a nice Gaussian bell curve
too.

5. Convert to 8-bit, since the violent parts are now over.

6. Apply the Dust and Scratches filter to get rid of, well, dust and scratches (but leave the grain structure alone). Then clone out the rest of the bigger boogers.

7. Apply Unsharp Mask pretty aggressively, to sharpen and accentuate the grain. Voilà, I had a moby frame of grain -- uniform, very nearly 50% gray, and structured.

8. Save as PNG -- grain doesn't compress well at all, so JPEG is a no-no. Lossless compression is the way to go.

Now I can just open up my saved grain field, slap it on the picture, set it to Overlay, and I'm done. Faster than waiting for the Film Grain filter to calculate its stuff, and the result is miles better. If I want finer grain, I just scale down the grain field (it's big enough for that!), if I want more accentuated grain, I increase its contrast, if I want subtler grain, I turn down the opacity or apply some Gaussian blur to it. Easy!

A small sample of the grain field I prepared. You can download the full-sized PNG from David Gandy's website [http://byscuits.com/grain-tm400.png] -- thanks for the bandwidth, Dave.
By the way, Russell Brown has a QuickTime tutorial on adding film grain that uses a pretty elaborate mask-and-screen technique. The advantage is that the scanned grain field doesn't need to be a uniform gray. The disadvantage is that it doesn't work -- not with Photoshop CS anyway. He says so himself on the site. I get a feeling that it actually exploits a bug in older versions of PS to work. To my mind, screening an image through the grain and the negative image of the grain should cancel out the grain, and in fact this is exactly what happened when I tried it -- perhaps older versions of Photoshop had a rounding error somewhere that kept the grain in. In any case, it's a lot more complicated than my technique, once you've prepared your even grain field, that is.

**Tips and techniques**

**Bracket the exposure, if needed.** Bracketing works especially well for black and white. I merged two exposures for this picture -- although one of them only contributed the wall around the streetlight, which was blown out in the main picture.

![Villagescape. Saignon, France, 2003. EOS-1D with Tokina 17/3.5.](image)

In the developing phase, concentrate on extracting tonal detail. Layer and mask the channels especially for the extremes -- shadows and highlights. By looking at each channel individually, you'll find that there's a surprising amount of detail in nearly blown-out or blocked areas. Use layer masks to make the most of them. For example, I shot this picture in direct sunlight, yet it turned out that no area was completely blocked or blown out: by weighting the red channel for the sky and rock and the green channel for the shaded foliage, I could get tonal detail everywhere. In the "printing phase," I masked the dodge and soft light layers to get the look I wanted.
Apply simulated filter effects in the developing phase. If you want a red, yellow, or amber filter effect, weight the red and green channels against the blue ones. If you want a graduated neutral density one, add a graduated layer mask. You can easily do graduated tinted filter effects this way, too. For example, here I simulated a graduated red filter: the sky is mostly the red channel, while the bottom (foreground) is mostly an even mixture of blue and green.
Senate Square, Helsinki, 2003. Provia 100F with Tokina 17/3.5. Yep, shot on film -- but digital B/W works just as well on color slide as on digitally originated pictures.

Use levels and curves adjustment layers with masks to bring out detail in the extremes. For this picture, I treated the background and the subject separately, to bring out the detail in the chainmail and shields behind him, while getting enough contrast on the gentleman’s face.
Canned actions

As a special reward for anyone who made it this far... here's a selection of canned actions for working in black and white. They automate many of the steps described in this article. Download [bw-actions.atn] and enjoy!

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