

Monochrome and duotone printing

In order to successfully print black and white images you will need to go through several preliminary steps to calibrate your system. The steps are:

1. Determine the extreme values your printer can reproduce.

The two critical points are, a. Maximum shadow detail density (the darkest point at which you can begin to discern detail from total black) b. Minimum highlight detail density (the lightest point at which you can hold highlight detail -- this is NOT the value you would use for specular highlights)

2. Determine the color tweaks you will need to make to produce neutral grays throughout the tonal range. The only additional equipment (optional but highly recommended!) is an 18% gray card. As Bruce Clifton pointed out, you are profiling the profile! Here are the steps in detail: For step 1 you will need to create a step wedge. Here's how I do it:

Set the foreground color to 0,0,0 and the background color to 255,255,255. Create a new document of 2580 pixels wide and 100 pixels high. Use a screen resolution of 150 ppi and 8 bit resolution. Now create a gradient from foreground to background, making sure that dither is unchecked. Next go to Image>Adjustments>Posterize. Choose 129 steps and click OK. Now cut the left-most portion of the step wedge (with values ranging from 0,0,0 to around 30,30,30) and paste it near the top of a new document with dimensions 1200 x 800 pixels. Using the color sampler, determine the density of each band and create a text level to label the bands in the wedge. Flatten the image. Now cut the rightmost portion of the original stepwedge including values from about 235 to 255 and paste it on the bottom of the same file containing the left part of the stepwedge. Again, determine the densities of the bands, label and flatten the entire image. Save this image! Print this file for each different paper and rendering intent. As a guide, I find that with Epson Premium Lustre the Maximum Shadow Detail point is around 20,20,20. I find that I can discern 254,254,254 from 255,255,255 but to get decent highlight detail I need to set the Minimum Highlight Detail Density point about 5 units lower -- 249, 249, 249 works for me. For some odd reason Photoshop does not allow you to create a posterized gradient with sufficient steps when the foreground is 000 and the background is a dark gray (say 50, 50, 50). That's why I used the odd-looking approach outlined above. I'll discuss how to actually use these points later on.

For step 2 Create another stepwedge from 0,0,0 to 255, 255, 255. This time divide it into 21 segments. Save the file and print it using the appropriate profile and both relative colorimetric and perceptual intents. Next, determine whether you have a color cast. Here's where I find the 18% gray card useful because it gives me an unbiased reference point and corrects for visual accommodation. Determine the density where the color cast is greatest (generally in the midtones). Now open the stepwedge in Photoshop and create a curves adjustment layer. For this

example let's assume that you have a magenta cast that appears to be greatest in the band 127,127,127. Open the green channel curve ctrl-click on the 127 wedge. A point should now appear in the middle of the curve and the box below should read input 127 output 127. To eliminate the magenta cast we could add green or we could subtract both red and blue. Start by adding 4 units of green so that the input reads 127 and the output reads 131. Note that as you add color (green in this case) you are increasing the luminosity of your image, so you will need to decrease the luminosity by an appropriate amount. To do this switch to the RGB channel curve and ctrl-click on the maximum color cast band previously identified. Now adjust that value back to 127 Save the curve.

Print the wedge and again compare it to the gray card. You may need to repeat this sequence of steps several times before you get it right, and you will need to repeat this with every paper and rendering intent that you use.

Now, whenever you print a black and white image (in RGB mode) load the appropriate saved adjustment curve. It helps to give curves descriptive names like atk1440premlustpercept. Finally, note that pigment inks exhibit metamerism -- perceived colors shift depending on the light. Therefore, it is best to evaluate your wedges in the same light you will view your images.

1. Open your color image and resize it for final output.
2. Crop the image and repair defects (dust, unwanted elements, etc.) but do not adjust contrast or colors.
3. Create a channel mixer adjustment layer, and, with the monochrome box checked, adjust the color channel sliders to create a pleasing B&W image. The values of the various sliders should add to around 100%, and you may use negative values. If possible, keep the blue slider as close to 0% as possible because the blue channel contains most of the digital noise.
4. If certain colors in the image are rendered poorly in gray scale they may be remedied by using one of the color selection tools, creating a hue/saturation adjustment layer, and altering the color characteristics of the selected color. Make sure that the channel mixer adjustment layer is visible while you do this.
5. Save the image with all layers so that you can go back and correct your work if necessary.
6. If you are planning to print black and white continue on with the following. If you plan to do duotones I'll talk about how I do them in the next e-mail using the saved image from step 5.

Black and White Only

7. Create a curves or levels adjustment layer and adjust the contrast to suit your taste. Save the image, flatten and sharpen. You must have a flattened, sharpened image for the next step to succeed.
8. Open a levels adjustment dialog and double click on the black eyedropper and enter the maximum shadow density (on my printer it's 20,20,20), the minimum highlight density (249,249 249 on my printer). Save these values as default. Now, from the levels dialog screen press the alt key while sliding the left input slider to the right. Note the number appearing below the slider when you first want to see shadow detail. This point should not be confused with the point where you first see deep shadow that will be rendered black. Next, find the brightest highlight value that you wish to hold detail. Now, using the black eyedropper set the shadow detail point by clicking on the appropriate pixel. Repeat this procedure using the rightmost input slider and setting the highlight point with the white eyedropper. It is often difficult to find the exact shadow pixel, especially if you have a slight case of the shakes!, so here's a nice trick: create a new image and fill it with a gradient from 0,0,0 to 255,255,255. Now, with your original image selected and the black eyedropper selected move the cursor to the gradient, depress the left mouse button and with the button depressed move the mouse over the gradient. When the info palette shows the proper value, release the mouse button and the proper pixels will be set on your B&W image.
9. Now create a curves adjustment layer and load the previously saved printer adjustment curve.
10. Print using the appropriate intent and printer profile

Notes:

1. Using the eyedroppers is not the same as using curves. The eyedropper produces a linear data transformation, and is useful for very small, very accurate shifts in tonal range. Shifts are based on the ratio of target value to source value in the case of the white eyedropper, and $(255 - \text{target})$ to $(255 - \text{source})$ in the case of the black eyedropper. The curves and layers adjustments are non-linear and do not produce equivalent results.
2. You cannot use the eyedropper and curves at the same time, because the two interact in complicated (and for me) unexpected ways. Therefore, use the eyedropper on a flattened image that has already had its contrast adjusted.
3. Use the eyedropper after sharpening, because sharpening will alter the tonal value of some pixels.

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