

Calibration and Profiling for Soft Proofing

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More creative and color-critical decisions are made on an LCD display than on any other device or media. More often than not, this is being accomplished using Adobe Photoshop. One of the most valuable and cost-effective uses of color management is to use it for soft proofing. Yet, most are probably not using color management, Photoshop, and displays in this way to get the best possible color.

What are the advantages of profiling a display? First is for accuracy—to make sure you are seeing the intended color. The whole principle behind profiling is to give you accurate color. Second is for consistency—if a device is consistent and repeatable, then it is predictable. Third is to collaborate—profiling makes sure that everyone involved in the color reproduction process is seeing the same color. And finally for soft proofing—profiling makes the display look like the final output, whether it's a hard proof or a press sheet.

There are different types of soft proofs based on how they are being used. For printers, a soft proof is an accurate representation of what is to be printed on press. The soft proof needs to be as “ugly” as the printed sheet. Printers must be able to hold an actual hard proof or press sheet next to the display and see the “same” color.

On the other hand, for photographers, a soft proof is a digital record of what the camera actually captured. The soft proof being displayed contains a very large color gamut and replaces the traditional color transparency. In this case, photographers are taking full advantage of the display and rendering the color the photographer actually saw. Even with photography, this is important because you again want to have consistency across all devices.

Hardware and Software

The display is the first important consideration when it comes to soft proofing. Liquid crystal displays (LCD) and, more recently, light-emitting diode (LED) displays work very well for soft proofing for a number of reasons. First, they are very bright, and at their brightest

setting they are very close to standard color viewing in a viewing booth. The brightness is also important because it gives you better shadow rendition and detail. Also, LCDs/LEDs don't flicker, which means that they are easier on the eyes when viewing color for long periods of time. LCDs/LEDs also stay calibrated longer—important because consistency is the key to any proofing device. These displays are sharp and, going beyond just color, a sharp display shows more image detail. Finally, for a relatively small investment in a quality display, you have a proofing device that can last for years.

Not all LCD/LED displays are created equal when it comes to color gamut. Displays can either be standard gamut or wide gamut in nature. Standard gamut displays are capable of rendering the sRGB color space—perfectly acceptable for soft proofing for print production. However, as noted above, photographers may want to see a much larger gamut than what we can print. They want to see the colors their camera could actually capture. In this case, a wide gamut display would be required which is capable of rendering the AdobeRGB 1998 color space—much larger than that of sRGB (Figure 1), so it's important to match the hardware to the need.

When it comes to measurement devices for calibrating and profiling a display, the choices come down to either a colorimeter or

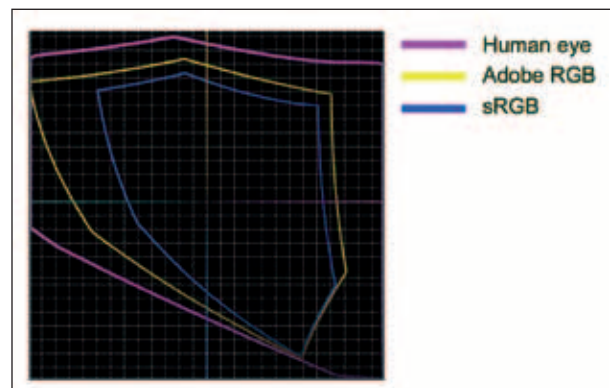


Figure 1. A comparison of color display gamuts.

spectrophotometer. What's the difference? Colorimeters can contain three to seven filters when they "look" at color and do a reasonable job at an affordable price. Spectrophotometers are more expensive but take many more sample measurements across the visible spectrum. The more color samples that are taken, the more accurate the results, and they are often packaged with profiling software applications.

Calibrating and Profiling a Display

The principle behind profiling involves a few sequential steps. First, turn on the display and calibrate it so that is in a repeatable state. Next, place a measurement device on the display and launch the profiling software which shows a series of color patches on the screen that are measured in the LAB color space. Finally, a profile is generated. These five steps are true for profiling any device: qualify, calibrate, characterize, create, and test the profile.

- 1. Qualify the display.** Determines if the device can be calibrated and profiled.
- 2. Calibrate.** If the calibration changes and is unstable, then the profile is worthless.
- 3. Characterize.** Measure the color samples.
- 4. Create and install the profile.** Note: Steps 2, 3, and 4 typically occur together within the profiling software.
- 5. Test.** You must test the profile to see if it's working properly.

Qualifying the display involves making sure the device is even worth profiling, because some devices are not. First, perform a uniformity test. This will show how even (or uneven) the display is across a viewing area. To perform this test, create a 17×11-in. page with a 40% gray tint using InDesign, convert it to a PDF, and open it in full-screen mode in Acrobat. Note any unevenness across the display area (with LCDs, edges or corners are a common place to see visual differences). If there are major differences, don't waste your time trying to profile this display—go and buy a new one.



Figure 2. A representation of a display set at D50 (5000K) and D65 (6500K).

Next, display calibration will set the device to a repeatable, consistent condition. Calibration is more important than profiling. Always calibrate before creating a profile, and if you cannot get the device calibrated to the same (or similar) condition, then profiling is useless. Profiling software will do this as part of the entire profiling process. Note that the calibration method depends on the display type, hardware controls, software, lighting conditions, and the intended use. Main points to consider as part of the calibration process are white point (color temperature), contrast (gamma), and brightness.

White point can be expressed in degrees Kelvin or as one of the standard illuminants or in X-Y coordinates from the CIE Lab chromaticity diagram. In more simple terms, white point is how the color white is produced or defined on a device or media. The industry standard for white point is D50 (5000K), but others also use D65 (6500K) (Figure 2). Either white point setting is fine if there is not an adjacent viewing booth, since the eye will adjust to the white point. However, if you are soft proofing and there is an adjacent viewing booth, then white point will be more important and must be adjusted to D50. It's important to note that a D50 setting on your display may not be *perfectly* accurate, and many viewing booths contain lights that can be adjusted to match the brightness of the display.

Gamma refers to midtone. Many arguments have been made as to whether a setting of 1.8 or 2.2 is correct. The bottom line: gamma is not a factor since 1.8 and 2.2 will look the same (because the profile actually compensates for the gamma) after profiling when using any software application that is ICC-compatible (i.e., InDesign, Photoshop, Illustrator, QuarkXPress, etc.). However, the desktop and non-compatible ICC software (such as Microsoft Office applications) *will* look lighter with a gamma of 1.8 and darker with 2.2.

Brightness and contrast will differ based on the display you are using. With Apple displays, there isn't much to adjust. The backlight should be adjusted to maximum brightness to render the best shadow detail. For brightness and contrast, there is nothing to adjust. Within the profiling software set white point to D50 or leave "native" if no viewing booth is adjacent and set the gamma to 2.2.

With non-Apple displays, you typically have more settings, which is not necessarily a good thing as the controls may work differently based on the manufacturer. The display backlight control works like a dimmer and the brightness control (if available) will adjust the white point brightness. Contrast (if available) controls white to black contrast. LCD contrast control is a little more confusing and may react differently on different LCD displays. With one manufac-

turer it may control how bright whites will be. On another it may control only how black the black will display. There is no common interpretation or control of contrast among manufacturers. If you don't know how the brightness and contrast controls work, open up a grayscale, look at it, and make adjustments to see exactly how your display reacts.

The next step is to use the profiling software to create and install the profile. The steps within this process will vary based on the application used. A workstation has one system profile that is used by all applications. Most profiling software will make the most recent profile that was created the system profile. ICC-compatible software (Adobe CS, QuarkXPress, etc.) automatically recognizes the system profile while non-ICC-compatible software will ignore it.

Finally, the profile must be tested to make sure it is working properly and giving the intended results. First, open a grayscale (you can create one in Photoshop, or you can download one from www.hutchcolor.com). View the grayscale in Photoshop and check for neutrality throughout the grayscale, banding, clipping (loss of detail) in the highlights, or plugging (loss of detail) in the shadows.

Next, test the accuracy of the profile by comparing an image opened in Photoshop with a hard proof or printed sheet. Select an image that is representative of the type of work that you do. An image with fleshtones, neutral grays, and saturated reds, greens, and blues is always a good choice. Follow these steps to display an accurate soft proof in Photoshop (Figure 3):

1. Select View > Proof Setup > Custom.
2. Assign the output profile (this is the device you want to simulate) to image in Photoshop and Simulate Paper Color.
3. Select Simulate Paper Color (In theory, turning on Simulate Paper Color should give you the most accurate soft proof possible and uses the paper color in the profile if it is available. In practice, the most obvious effect of selecting Simulate Paper

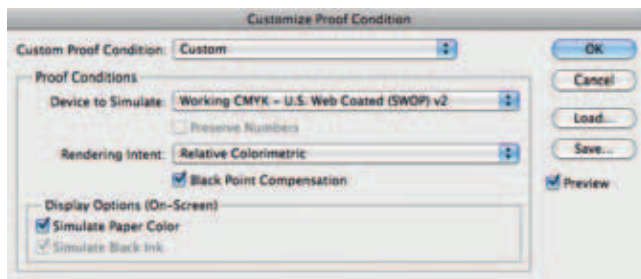


Figure 3. Proof Setup options to simulate an accurate soft proof in Photoshop.

Color isn't that it simulates the color of the paper, but rather that you see the compressed dynamic range of print.)

3. Adjust the dimmer on the viewing booth until the brightness of the substrate in the booth matches the brightness of the "paper" in Photoshop.
4. Evaluate color visually.

Profile Maintenance

One of the most common questions when it comes to color management and soft proofing is, "How often should I re-profile?" The answer: *profile only as often as necessary*. Ideally, only re-profile when one of the following occurs:

- When the display's resolution changes
- Any control is changed (brightness, contrast, etc.)
- When the lighting changes

The key to success is to consistently test for profile accuracy. Perform the tests listed above at the beginning of each shift or when a new profile is created. Only re-profile when you've tested the profile and find there is a color difference or a color problem.

Ideal Viewing Environment

Just as a viewing booth is critical for evaluating hard proofs, the environment in which soft proofs are viewed is also very important. The display should not be in a room where the lighting conditions will change dramatically throughout the day. Overhead (ceiling) lights are satisfactory as long as they are not drastically off-white, but a desk lamp in proximity to the LCD is not. If there are windows in the room, shades should be installed to eliminate sunlight or glare and provide a consistent environment. If possible, the walls should be painted a neutral color to reduce the effects of the surrounding environment. Monitor hoods are also useful in reducing front surface glare caused by overhead and side lighting.

Summary

Soft proofing is a natural benefit of implementing a color-managed workflow and represents a practical way to verify color accuracy in production further upstream. As with any color device, calibration, consistency, and testing are the keys to success. Combining the quality of both LCD and LED displays with the low price point of profiling software and devices, you can't afford not to use soft proofing.

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