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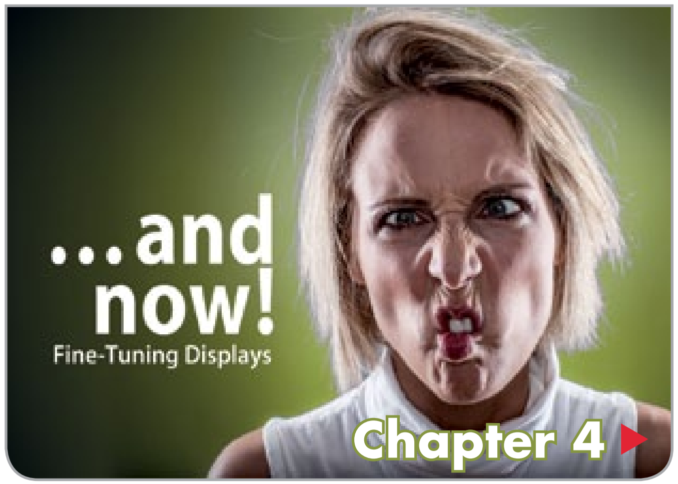
YOURWORLD

Spyder eBook

All about Your Color Management



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Spyder eBook

All About Color Management

Datacolor
C. David Tobie – Global Product Technology Manager

Chapter 1: aha Understanding Digital Color


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Understand digital color
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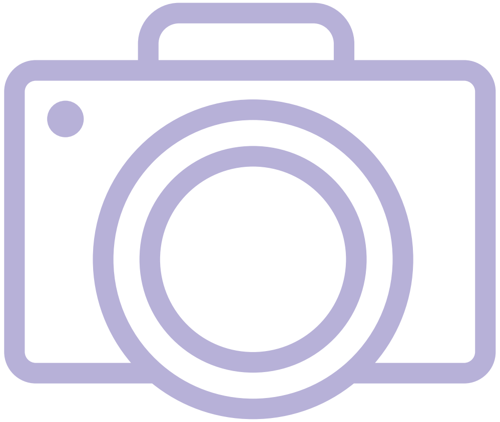
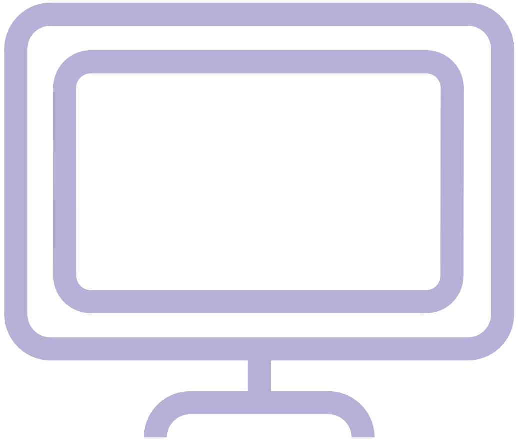
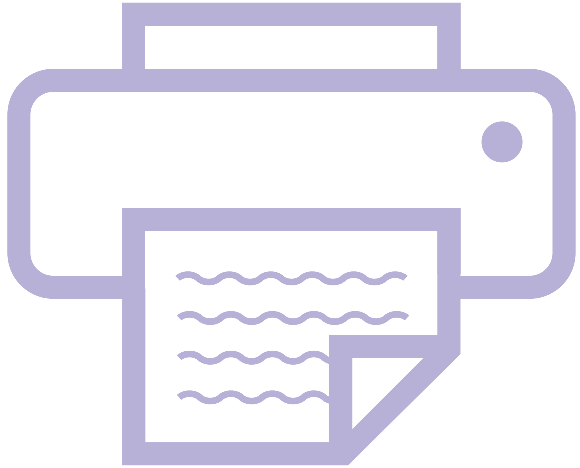

Preface

High quality digital photography with RAW files is no longer a complex science, but can now be quite easy to achieve: A photo is reviewed on the camera's LCD screen and downloaded to a computer for editing. There you can adjust, retouch, and print. Even for the non-technical person these processes work well today, after a short and painless learning curve.

But the professional photographer was not always responsible for color management. Previously they shot a photo, had the film developed, and received chromes or proof prints from the lab. If the colors were not accurate, no one blamed the photographer. But if color accuracy was required it could only be achieved using specialty labs at premium prices.

Working in the current digital "darkroom" on your desktop has many advantages. But the photographer or designer is now responsible for the technical problems that can occur between capture and print, and the final image color.

Colors do not automatically show on the computer monitor exactly as they are defined in the image file. Technically, this is not surprising: working with three different devices that do not share a common denominator is bound to cause problems. The camera chip captures an image using an RGB color model. "RGB" stands for red, green, blue, and refers to an additive color space, similar to the red, green, blue color cone system in the human eye.

After copying the images to the computer, we see the pictures on a monitor, using the RGB colors the camera produced. Already we are dealing with two devices that have different color capabilities, and which define color differently. If the image is then sent to a printer, the printer driver converts the data again; moving us from the colors of the light the camera saw, to inks - using anywhere from 4 to 12 ink colors.

Anyone who has ever tried using an artist's paint kit to mix an exact color, has a rough idea of how difficult it is to reproduce colors as seen by the eye, using dyes or pigments. Many amateurs can live with the color differences of an uncalibrated system. But serious photographers and professionals cannot.

The goal of this series is to teach you what you need to know to control your digital color.

Color Measurement Hardware

Color management without additional color measurement hardware is possible – but the results it provides are not all that accurate. To use color management, but then not get well managed color seems contradictory. But color management in everyday practice requires accurate display of images on the monitor, and matching images from the printer, and the process to reach this result requires more than software-only solutions provide.

Anyone who has shot with digital or film cameras has seen that these devices interpret color differently than the human eye, depending on the nature of the film or digital system, and the optics used. Compact digital cameras often provide strong bluish colors, poor quality lenses produce color-casts and vignetting, and each film emulsion responds to light in a different way. Given these variables, using color creatively, not precisely, is the easiest solution.

We can have more control with a digital image displayed on a monitor. But here we also see effects of the device on color, the brightness of the display, its color gamut, how it interprets highlights and shadow detail. When it comes to the printing of images on paper, we see further device effects from the printer, paper, and inks. One needs not to have studied physics in order to be able to understand that this all leads to color and density errors.

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The time spent on reading color charts to create printer profiles decreases, reading the entire line in on pass. The issue is precise color definitions for special papers.

In short: We move beyond the physical world of color and rely on multiple digital devices that interpret colors differently. If you look at the this color clutter armed only with your eye, attempting to create corrections for each of these devices is beyond human capabilities. Some people stop being aware of these variations, because their eye adapts to the differences, and they mentally compensate. Those that are color sensitive despair, because on the one hand, they are expected to adjust color with primitive controls and coarse units, and on the other hand must depend on the agility of their eyes. Unfortunately the eye quickly adjusts to color casts, as can be seen by changing display profiles; what looks wrong at first, soon becomes typical.

Regardless of whether the colors are right or wrong, our brains adjust to color cast within minutes - similar to the way we can adapt very quickly to the lightness or darkness of an environment. It is actually possible for a photo lab professional - especially when working with a black and white photographer – to adjust the screen successfully to match the densities of prints.

But even for the black and white photographer, the money invested in trial-and-error sample prints would be better invested in a good monitor calibration tool. This would then assure a universal correction, not a device-specific match to one printer. Such one-on-one matching of a screen to a printer fails when a different display must be used, or a different printer is required, say for a larger print.

The wiser choice is to invest in hardware to make these measurements and adjustments for you. This brings accuracy and objectivity to the process for a few hundred dollars. Basically, you need two different devices: one for emitted colors on the monitor and one for the reflective colors in prints. Measurement capabilities and prices are now quite reasonable, and different options are available for more advanced users and special needs.

There are differences in printer profiling processes. Manufacturers target different groups: Some specialize in the higher priced specialty segment serving prepress (CMYK offset printing) and others in more affordable tools designed for amateur photographers, which are today in the language as a marketer "Prosumers".

Datacolor products target the mid-priced segment that we are addressing here, focusing primarily on advanced and professional photographers as well as fine art printmakers. However, Datacolor products also address videography and other related uses.

What exactly do ICC profiles do?

"An ICC profile is used to describe the characteristics of a device recording and display of color, to compensate for errors in color reproduction." This catchy definition by Andreas Kunert (from: Color Management in Digital Photography, Bonn, 2004) illustrates the principle of ICC-based color workflows: to assure accurate reproduction of all devices; camera, scanner, monitor, and printer, have a description of their color at the central collection point, the color management system (CMS) of the computer's operating system. There, the variations are checked and balanced. Ideally, this results a uniformity of color reproduction in all devices, providing reliable results.

Unfortunately, it is not enough simply to profile each device once to use it afterwards in any situation. Monitors change over time. Here repeated calibration is necessary for the color temperature to remain constant and the color channels to remain balanced. Inkjet printers are relatively constant over time, but vary depending on the paper and the ink used. Laser printers, on the other hand, vary with temperature and humidity, requiring seasonal reprofiling. Digital cameras need to be corrected for white balance and color calibration for different lighting situations and workflows.

Framework

Before you deal with color profiles in detail, you should keep this in mind: Working with profiles does not necessarily improve the visual elements, but does improve the technical elements of an image. A photo may look "pretty" without color management, but it may at the same time be less accurate. Accuracy and consistency first, can allow attractiveness to be produced later, without compromising color management.

The difference between these two color profiles is obvious to the untrained eye.

Anyone who has worked with slide film knows the difference between daylight and artificial light film. The two types reproduce the color of a subject in different ways, so the colors in mismatched lighting conditions, with such film, are wrong. This is necessary because, unlike the adjustable human eye, film does not change in response to various intensities and colors of light. With digital photography, the situation is a bit more complicated; the sensors are so sensitive, and so literal, that adjustments for each lighting situation are required. In contrast to the eye, the sensor sees a huge difference between a scene lit with a cold light, a warm incandescent bulb, or a fluorescent light. To adjust to any light condition, digital cameras meter the exposure before a white balance. They measure the luminance, then adjust the "Kelvin" scale color temperature.

Anyone who has worked with RAW files is familiar with these settings. In actual use, further complicating factors may occur. This results in a mix of automatic camera settings, and manual settings carefully selected by the photographer.

Unfortunately this could mean that photographers shooting in Jpeg format would need different profiles or camera corrections for every light condition. This is solved when shooting in RAW mode by the flexibility to adjust these settings in post-production.

ICC Background

The acronym "ICC" refers to the International Color Consortium, an organization composed of representatives from hardware and software manufacturers. The starting point of the consortium was an invitation to the community - Forschungsgesellschaft Druck eV (Fogra) in 1992, with the goal of defining the future of color communication in open computer systems. It selected methods from color management solutions already in existence. What was new in this field was the use of "open standards". Previously scanners, computers, monitors, printers from different manufacturers were not color coordinated. Before current prepress systems, at the beginning of the digital age in the '80s, all systems were closed and proprietary, so that their components all had to come from a single manufacturer.

These systems were not only expensive but also very inflexible. Sometimes they did not even offer and form of data-communication to the outside. The first ICC standard was published in 1993. It provided a description of the color rendering behavior of each component in a device-independent specification language.

Today, the ICC standard currently stands at version 4.3. There is more information about the ICC and its standards on the Internet at **www.color.org.**

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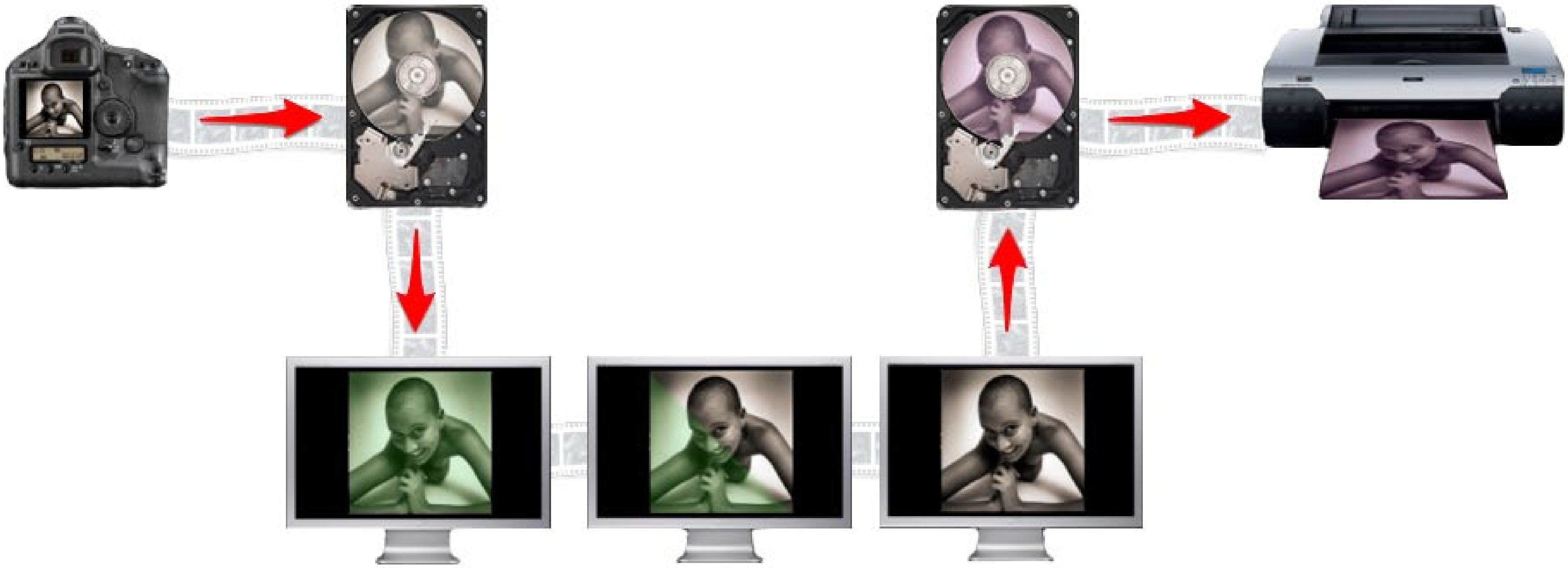
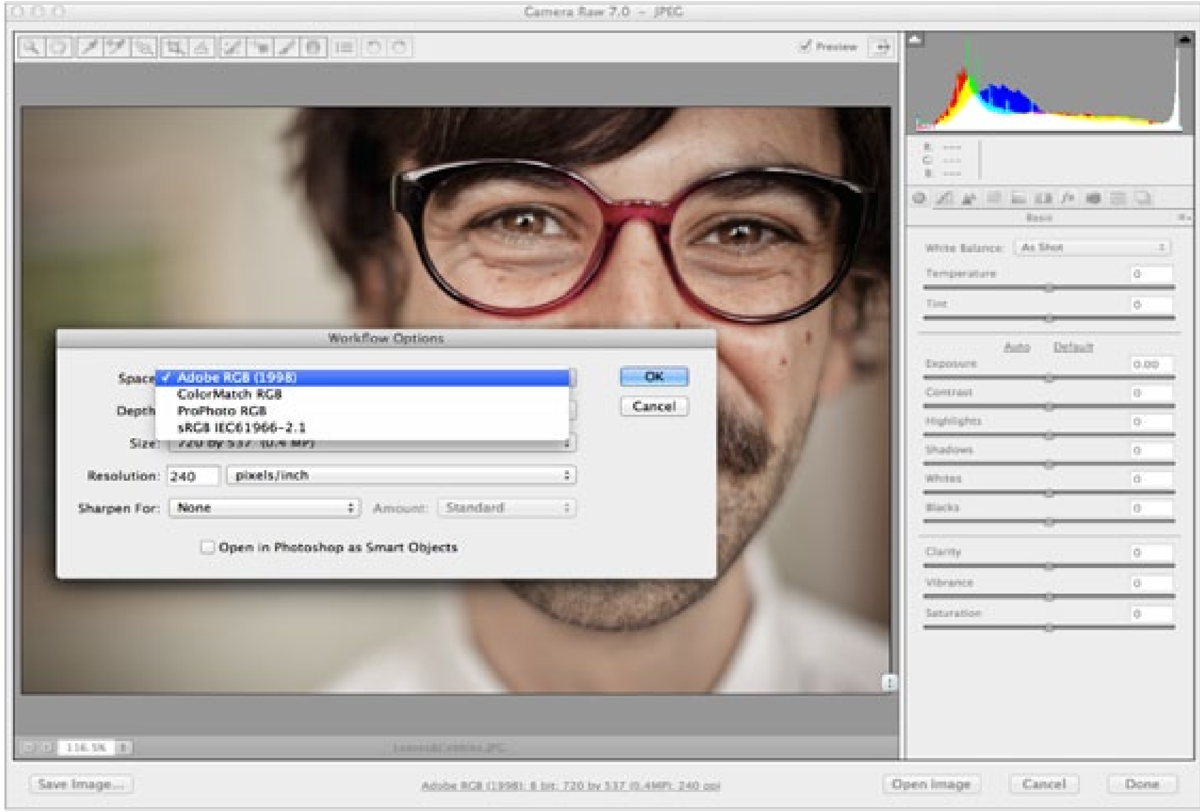


ICC in Practice

Even someone who has looked closely at the world of digital color does not necessarily know which profile is most appropriate for a particular purpose. The problem begins with the fact that some people have been setting their monitor profile as their RGB working space in Photoshop, and then wondering why this did not solve their color management problems; in fact it makes them worse.

1. Color Models

Basically, you should learn, before beginning to use ICC profiles, three areas of color management. First, you need to determine which RGB color space you should be using when working with images. Cameras and monitors work on the RGB model in which the spectrum of colors are created from red, green and blue using the additive color model, where maximum red, green, and blue creates white (every white pixel on your monitor is created of red, green and blue sub-pixels in this manner). The images are then printed to paper, where the situation is not so easily defined. In offset printing the subtractive CMYK color model is used, with the color spectrum composed of four basic colors (cyan, magenta and yellow primaries, with black added for cost savings and deeper blacks). In the photo lab, photosensitive paper is exposed using the additive color model, adding red, green and blue like a monitor. Inkjet printers, however, are more complex. While they are based on the subtractive (CMYK) color model, the process is not standardized. Inkjet printers may use four, six, eight, even up to twelve ink colors, with no standard set. This means that image data can not be prepared in the actual colorspace of the printer, but uses the RGB color model instead. Since this book's main audience is photographers, we will not cover offset printing workflows, and focus only on an RGB photo workflow.



If photos are taken in RAW Mode, it does not matter which color profile you set in the camera. The application of this profile only occurs when rendering out of the RAW converter

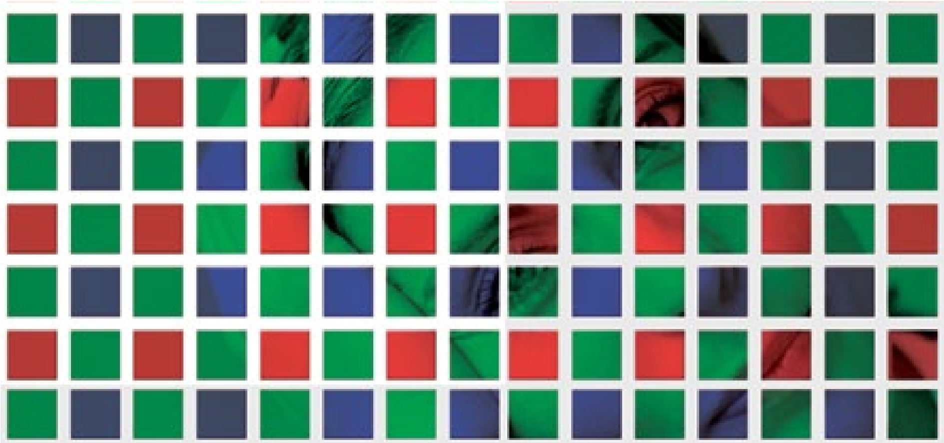
2. Color Spaces

The RGB color model includes most of the colors visible to the human eye. However, cameras, monitors, ink printers or imagesetters can never show all the colors visible to the human eye, but only some subset. The RGB model begins with a RGB working space in Photoshop which determines what colors will be available. RGB working space choices are based on those installed in the operating system or your imaging applications. There could be many, but for photographic purposes, only two color spaces need to be considered: sRGB and Adobe RGB. sRGB is the default for basic cameras and applications which offer no choices. For those editing images on the computer, but sending to a low cost photo lab or publishing on the internet, the sRGB color space is appropriate. Owners of more advanced cameras can choose whether they wish to take their pictures in the (slightly smaller) sRGB color space or Adobe RGB. If they choose Adobe RGB, they should set this color space as their working space in Photoshop. Basically your guide for the choice of Photoshop working space is the source color space of your camera. Those using more advanced cameras or working with people who do so, tend to use the Adobe RGB working space. However, it is recommended that data that is not in Adobe RGB on-delivery not be automatically converted on opening, but initially left in their original color space (change "Convert when Opening in the color settings to "Ask when Opening". The conversion, if it proves necessary later, be made using the "Convert to Profile" command in Photoshop while keeping an eye on the image during conversion to look for changes.

3. Color Profiles

The third area of color management is custom measured color profiles. Their task is to correct the characteristics of an input or output device, to make it compatible with the standards in the color managed workflow.

For example, a monitor profile is simply a table of measurement points in which the detected values of the device are recorded. The color management of the operating system and the application provides the necessary correction for each color, based on these measurements. These color profiles are used by the operating system, and by color managed applications. Individual programs access display profiles from the operating system. This was discussed in the Color Model section. While printers are technically reflective devices using CMYK inks (and often other inks as well) the files sent to them are left in RGB. Individual profiles are created for each printer. Not just a single profile for each printer, but one for each combination of printer, ink, and paper. Those who use multiple papers or ink sets must make corresponding profiles for each printer, ink and paper combination. The profiles are stored in a designated location known to the operating system and applications. RGB data is transmitted to the printer driver, which uses the custom profile to optimize color and output for all the ink colors in the printer. Users of Photoshop, Lightroom, and Aperture can also use these printer profiles for previewing output in Soft Proof mode.



JPEG *RAW* *Developed*

Photos in RAW Format

Many photographers are still skeptical about working with the RAW files. Although their cameras may have RAW capabilities, they may not have experimented seriously with RAW workflows. Their refusal has three simple reasons: First, RAW files are larger than JPEGs, so fewer images fit on a memory card. Second, years ago, RAW workflows required you to install additional, complicated, software from the camera manufacturer. And third, the RAW images did not always appear as sharp and as well colored as in JPEG format. Today 8 GIG memory cards can be purchased for ten dollars, and 64 GIG cards are available, so card cost and size is no longer an issue. Current versions of Photoshop, Elements and Lightroom support RAW files from nearly all cameras. There are still specialty applications from other companies including Capture One, Aperture, DxO Optics Pro or After Shot. And now initial views of RAW files tend to be much closer to the Jpeg results. For these reasons, in most types of photography there is a growing interest in RAW files and Digital Negatives.

RAW Data

To produce an image in standard formats such as JPEG or TIFF, the camera, after the image capture, must perform several operations. First, the measured color temperature is used to white balance on the image curve. Image sharpening is then required to adjust for the CMOS technology. This occurs because the imaging chip is actually grayscale, and requires color filters over each sensor to provide color information. Since each sensor has only one color of filter, much of the color information must be interpolated later. The result makes use of low pass filters to blur contrast, requiring a subsequent sharpening. This results in camera photos best described as “crunchy”. To ensure images will be pleasing to viewers, color contrast and saturation are enhanced. The lower the quality of the electronic and optical camera components, the more extreme the adjustments made by the camera firmware. To complete the operation, the results are converted to the target format. When converting to TIFF the 12-bit color is converted to the 8-bit color space. This can be a problem for high-and low-key images, but in most cases is acceptable. To produce Jpeg files, compression further destroys contrast and additional image detail, to save space. So images taken with the same camera, but saved in RAW format, contain more detail than TIFF or Jpeg versions. RAW files contain all the information the image sensor detects when shooting. RAWs are minimally manipulated in-camera. The file contains the original data from the image sensor, therefore, the memory required by most types of RAW files may actually be smaller than a TIFF file, as there are not three channels of data involved. A RAW file from a 10-megapixel CMOS chip may require as little as ten to twelve megabytes of memory compared to 30 megabytes for an 8-bit TIFF, or 60 megabytes for a 16-bit TIFF. All additional values, including the white balance, color correction or amplification contrast are just as EXIF information, so saved in a

From Image to Workflow

1. Exposure in RAW format   2. Developed in the RAW converter   3. Finalized in Photoshop   4. Output on an Inkjet Printer

small text file. For other recording systems without CMOS technology, such as the SuperCCDs from Fuji or the Foveon chips that are built into the Sigma DSLRs, the memory requirement of raw photos is less favorable, as more initial data is captured per sensor.

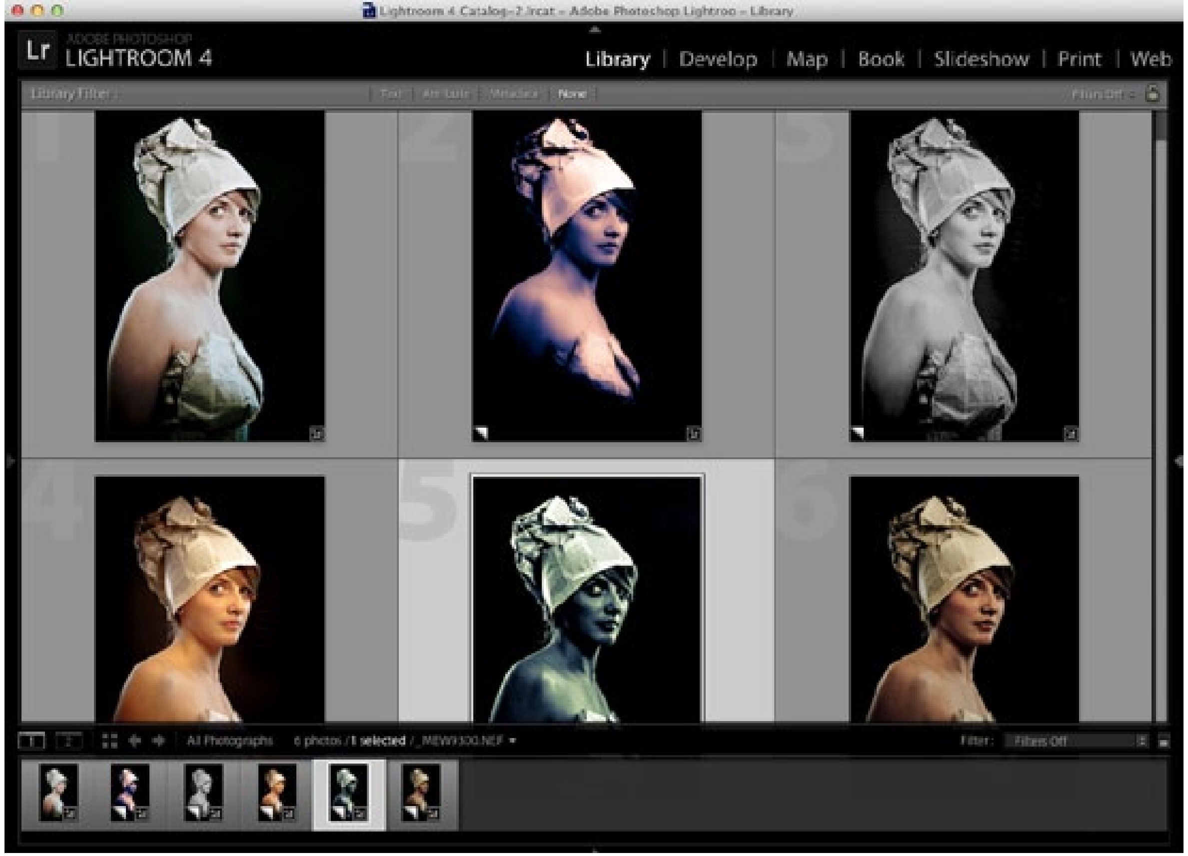
From Image to Workflow

When processing RAW images, the photographer can adjust virtually all parameters. Except, of course, basic factors such as over-exposure, focal length, aperture and shutter speed. Correction capabilities go far beyond what was previously possible in the chemical darkroom, all without working in the dark, or using chemicals. Instead, the photographer can now sit in a dimly lit room and and "develop" images with simple-to-use sliders adjusting different aspects of the digital image. This applies, in principle, to the other image file formats. However, RAW offers old-school photographers the wonderful opportunity to make settings adjustments that once needed to happen on the camera, after the fact in post-processing. RAW files also have the benefit of never actually changing or losing your original data, any adjustments are reversible, not permanent. Adjustments create different versions of the image, while never changing the original data. The result is image versions, for different print sizes or papers, for different uses such as press output, or the internet, all from a single master file.

Many RAW converters including Capture One, Aperture, and Lightroom connect these "photo-development" functions with a Image Management System, which further helps in the management of the files and versions. It is now possible, in a single operation, for images to be downloaded from the camera or from a memory card, renamed as desired, or according to IPTC labeling conventions, scaled, converted to multiple formats, set to desired resolution and the color depth, converted to chosen ICC color profiles for each use, and placed directly into appropriate folders and subfolders, with or without a watermark, as well as with digital copyright data. All these functions can be run on single images as well as in batch mode. Since Photoshop CS4, these operations are also available for Photoshop users through the Adobe Bridge utility.

Benefits for Photographers

Photographers with a high volume of images benefit from such workflows in several respects. They retain maximum control over the way the image is matched. This can be compared most closely to a specialized photo lab, where you work with a highly skilled lab technician - only without the cost, time, and communication problems. There are also features that allow the reduction of color noise, chromatic aberration, and lens vignetting. In addition, automations can be configured to create various TIFF versions, as well as automatically creating Jpeg previews for direct emailing or web uploading.



Working with RAW formats not only brings advantages in print quality, you can also, shown here in Lightroom 4 , create multiple versions of an image without using much disk space. These „virtual copies" will be saved in the relevant Lightroom Calatog, not in the settings of the image's RAW data.

If you investigate these processes with an open mind, its possible to create a RAW workflow custom tuned to your individual needs. It is also possible to save similar workflows for specific types of work or clients. A color workflow for studio photography might include a color conversion for uniformly warm skintones or to enhance the color of product shots made in a particular type of studio set. Another workflow configuration can be for pure image optimization. Such corrections can include timesaving automations of adjustments to tonal values, sharpness, and image color.

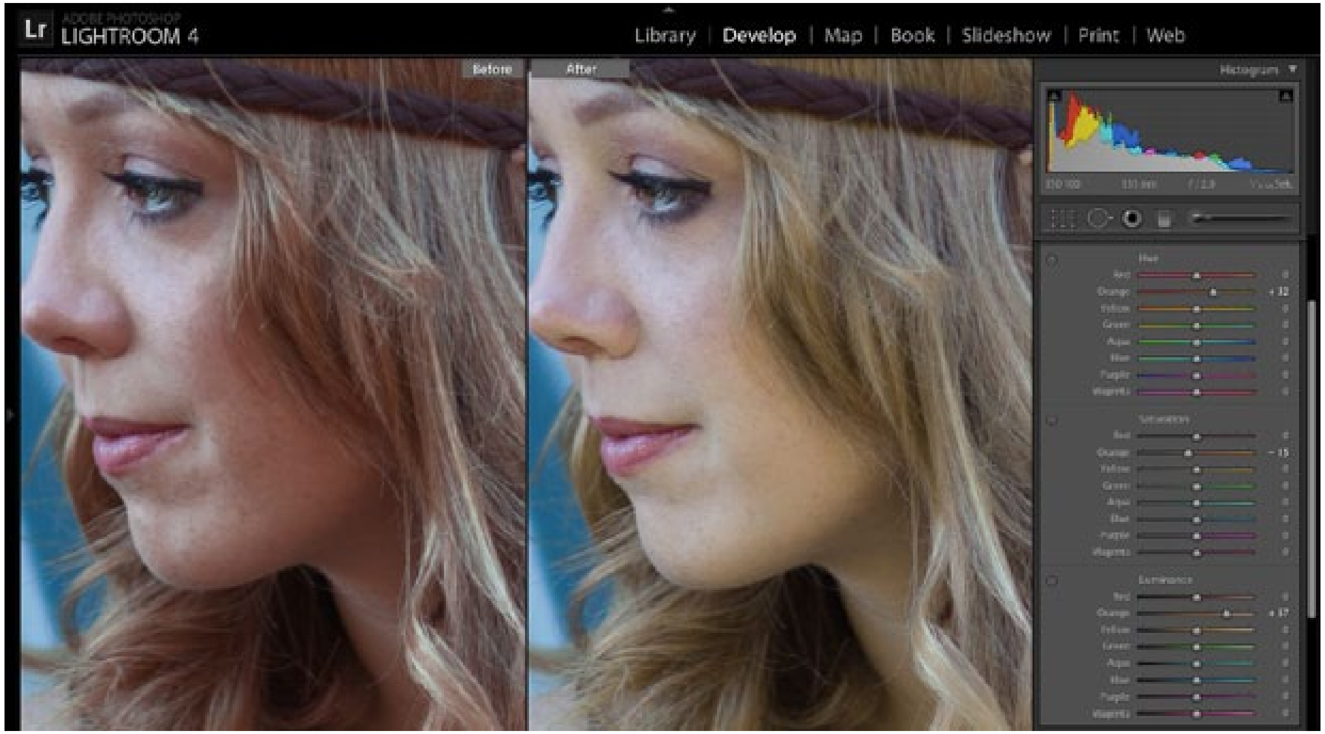
Benefits for Digital Artists and Designers

Creative Image Editors relocate the design aspect of shooting to the post-processing stage. One result of this, is that they photograph more items for later composing or compositing. Because of the lower resolution and quality of their final output, they often work with Jpeg files. With a few technical tricks they can hide weaknesses in images in the background where they go unnoticed. Since they spend much more time with the processing of individual images or photographs, a time-saving workflow is not the key to this type of work. Their first need is a good content-tagged image database to find the desired images quickly. The selected images are then easily managed in a project folder at the system level, outside of any Image Management Workflow.

But the creative designer should not underestimate the value of a RAW workflow. It can produce better quality results by allowing adjustments in exposure and gradients while avoiding the type of visual artifacts that occur from Jpeg compression. Since the compositing requires matching color temperature and exposure of the components, the value of adjustments made to the RAW files should not be underestimated. There are also areas on the border between image optimization and creative processing: RAW adjustment is ideally suited for conversion of color images to black and white. Final color correction of the composited images is often more easily managed with the toolset in a RAW conversion application then with the normal image editing toolset. RAW convertor tools such as lens and vignetting controls can be used to apply creative looks to images, as well as to remove lens effects.

Problem Areas

RAW is not a single format, but a generic description. It has nothing to do with the Photoshop Raw format. Since the early days of RAW, camera manufacturers have each used their own proprietary format, adjusted for each camera model, to meet their own needs; and only more recently have provided access to these RAW formats for outside applications. In the long run, the Adobe DNG format may become a standard, at least for the smaller camera companies, but until now, you still have to convert most RAW file formats with the Adobe DNG Converter. For the RAW user that has consequences. As long as the photographer works with the manufacturer's proprietary formats, and with the camera manufacturer supplied software, its only possible to access the intended, often very modest, correction parameters. Working in Photoshop, one will have more powerful capabilities, but not directly related to what was intended by the manufacturer. Exporting images into DNG, the manufacturer's applications can no longer process the images. Also, third-party software, particularly the image databases, offer support for DNG, but some databases are still incompatible. The IPTC captions of RAW files is currently problematic. Some editors may insert data into RAW files, but without much care, resulting in files that can only be read by the specific program that processed it. When RAW files are processed in Photoshop, the program stores the adjustments in an external XML sidecar file. Unless a proprietary RAW solution also works with special THM files, then you may now need to manage three files per photo: RAW, XML, and THM. If DNG is widely recognized and is supported by Photoshop and all the other RAW editors, these problems could be eliminated.



RAW processing is the only effective way to control "orange peel" skin textures in Photoshop or Lightroom. With this option you have a powerful but seldom appreciated form of digital makeup.

DNG (Adobe Digital Negative)

So far, each camera manufacturer has created proprietary RAW formats for each camera model. All these formats contain more or less the same information and metadata, but the small differences have led us to expect a plurality of formats. Formats differ not just between manufacturers, but between camera models. Such device-specific uncontrolled growth has had annoying side effects for the user. Although the individual RAW files are supported by the latest versions of the manufacturer's software, only these with long-time experience with a manufacturer and its software wish to use these proprietary applications. Some offer very few controls. Others offer an impressive range of functions, but are so processor intensive they bring even a powerful computer to a halt.

In late 2003 Adobe introduced the ACR plug-in for Photoshop 7. It allows us to process many common RAW formats using a fast, comfortable and option-rich application. But this limited foray into RAW processing by Photoshop 7 showed the disarray of the market. Many recent camera models did not have support. In practice, maintaining and adding support for RAW in ACR became a drain on Adobe's resources. Those who exported files directly to Photoshop 7, for example, from the supported Canon D60, found no RAW support for the EOS 10. Frustratingly, the only missing component was a small change to the header data in the EOS 10 files. Full support for this and other models from Pentax, Olympus, and Sigma, were only available months later, in a later version of Photoshop. Since then one of the driving forces assuring photographers will update their copy of Photoshop is the need to do so, in order to have RAW support for the most recent camera models.

DNG has been functioning in Photoshop Camera Raw from the CS 1 version and in Lightroom from version 1. We can access all newer RAW files, converted with the frequently updated, and free, Adobe DNG Converter into the DNG format. After this step they can be edited in the older versions of Photoshop, which otherwise do not support newer camera models.

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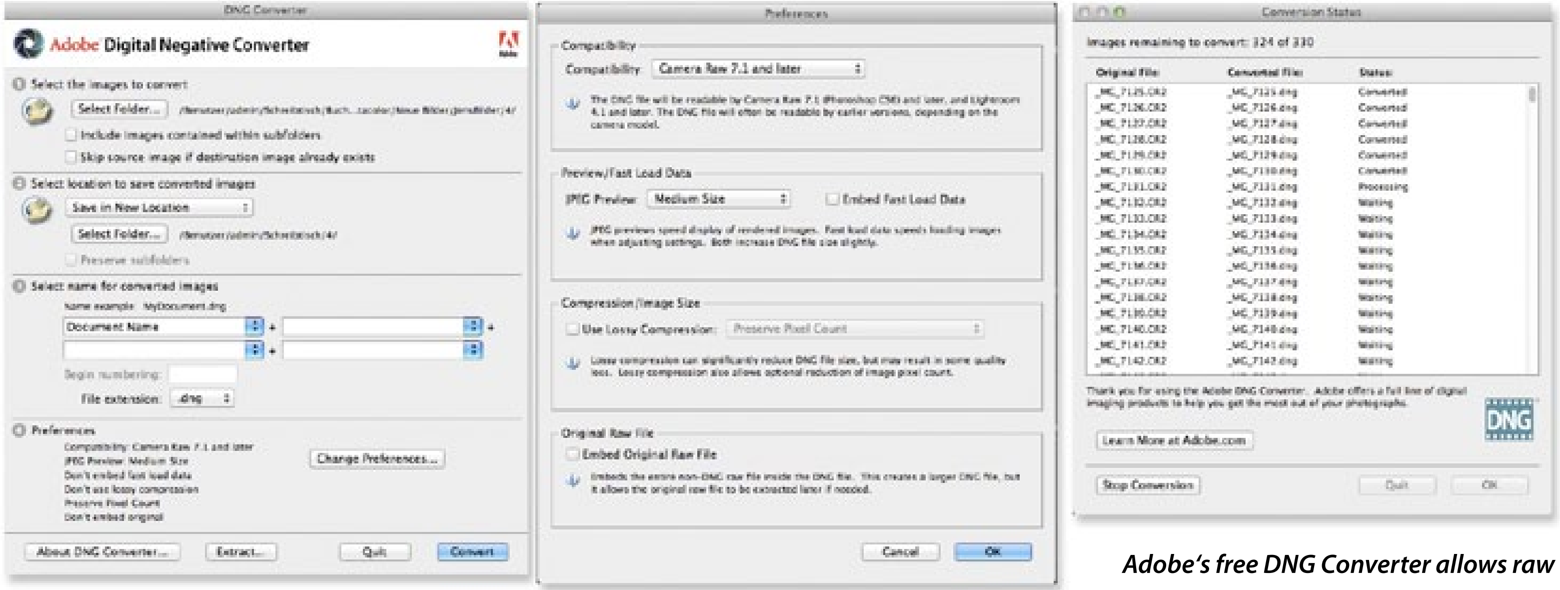
Adobe's free DNG Converter converts files to the DNG standard, so they can be opened in older versions of Photoshop which do not support the latest cameras

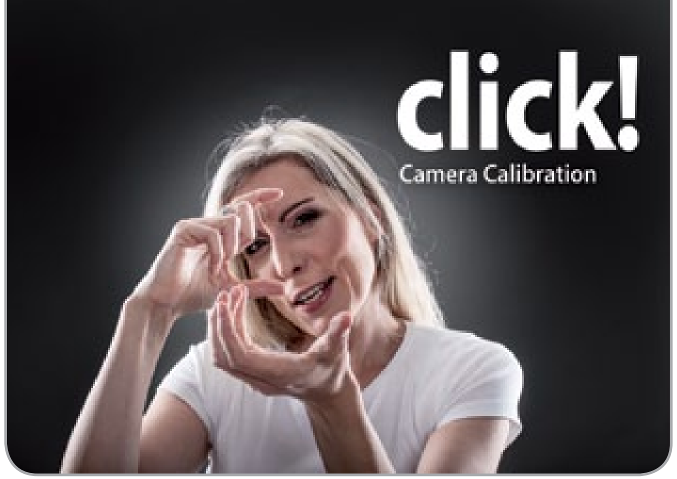


Adobe's free DNG Converter allows raw files in the DNG standard to convert and open in Photoshop without having to always be running the latest version of the image processing.

Conclusion

Photoshop users will benefit from the research and standardization of the DNG format. Adobe's position in the industry should provide continuity, allowing users to convert their raw files to DNG and thus have a high chance of being able to use the images in the distant future. An additional advantage is the reduction of the raw data to a single file, if users are willing to delete the RAW versions after DNG conversion.

Chapter 2: Click! Camera Calibration




click!
Camera Calibration
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Photo: Oliwer Mews

Camera Calibration

Color management should start when the image is captured. This is heard in each discussion about digital color. However, not all photographers use custom camera calibration, as this requires creation time and additional hardware.

This basic fact is true: Every digital camera model suffers from its own unique color deficiencies.

This has good and bad sides. When the colors in an image are displayed more saturated than in reality, many amateurs are pleased, since the enhanced color is pleasing to their eye. Many experts, however, turn away in horror from such oversaturated pictures. It's their goal that the color should be as neutral and faithful to the original as possible. If the image is to be made more colorful than reality, the expert should do it with full control on the computer display, using Photoshop.

Thus, camera calibration is not a first priority for digital artists, photojournalists working under time pressure, or other photographers who have great color freedom in their work. Custom calibration's value delivers where accuracy is paramount, such as art reproduction and product photography, but also facilitates the work of portrait photographers, helping to deliver improved skintones.

Camera calibration is the dot over the "i" of color workflows. In theory, to achieve maximum color accuracy, you must build camera profiles for each illuminant – the unique light of the scene being captured. With ICC camera profiles, calibration for each lighting condition is a basic requirement. With non-ICC processes, such as Datacolor's SpyderCHECKR, it is possible to create a single calibration preset that compensates reasonably well for almost all situations.

You may still choose to create several calibrations for standard situations or for best results, create calibrations for specific, color-critical jobs.

The use of factory profiles is only reluctantly recommended, because the manufacturing tolerances for the production of camera image sensors can vary widely. Thus, standard calibrations do not account for the individual camera sensor's specific behavior, nor do they account for different, unique lighting conditions.

To create custom calibrations, one needs special profiling software and a compatible color target, with an integrated light trap, if possible.

The extra effort required to create these custom calibrations results in a high degree of color reliability and accuracy. This applies not only to photography for fine art reproduction and product photography, but also facilitates the work of portrait, glamour and fashion photographers, helping to deliver improved skintones.

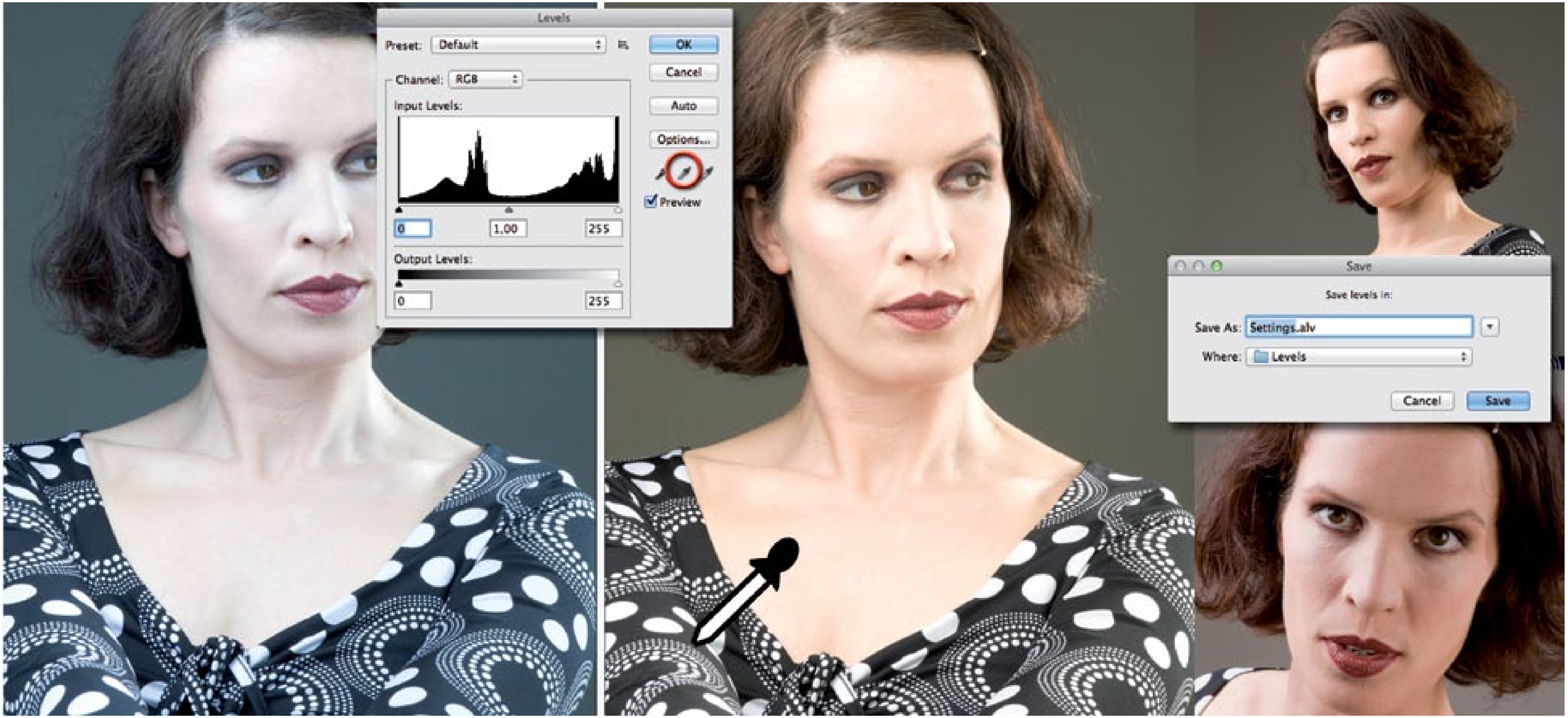
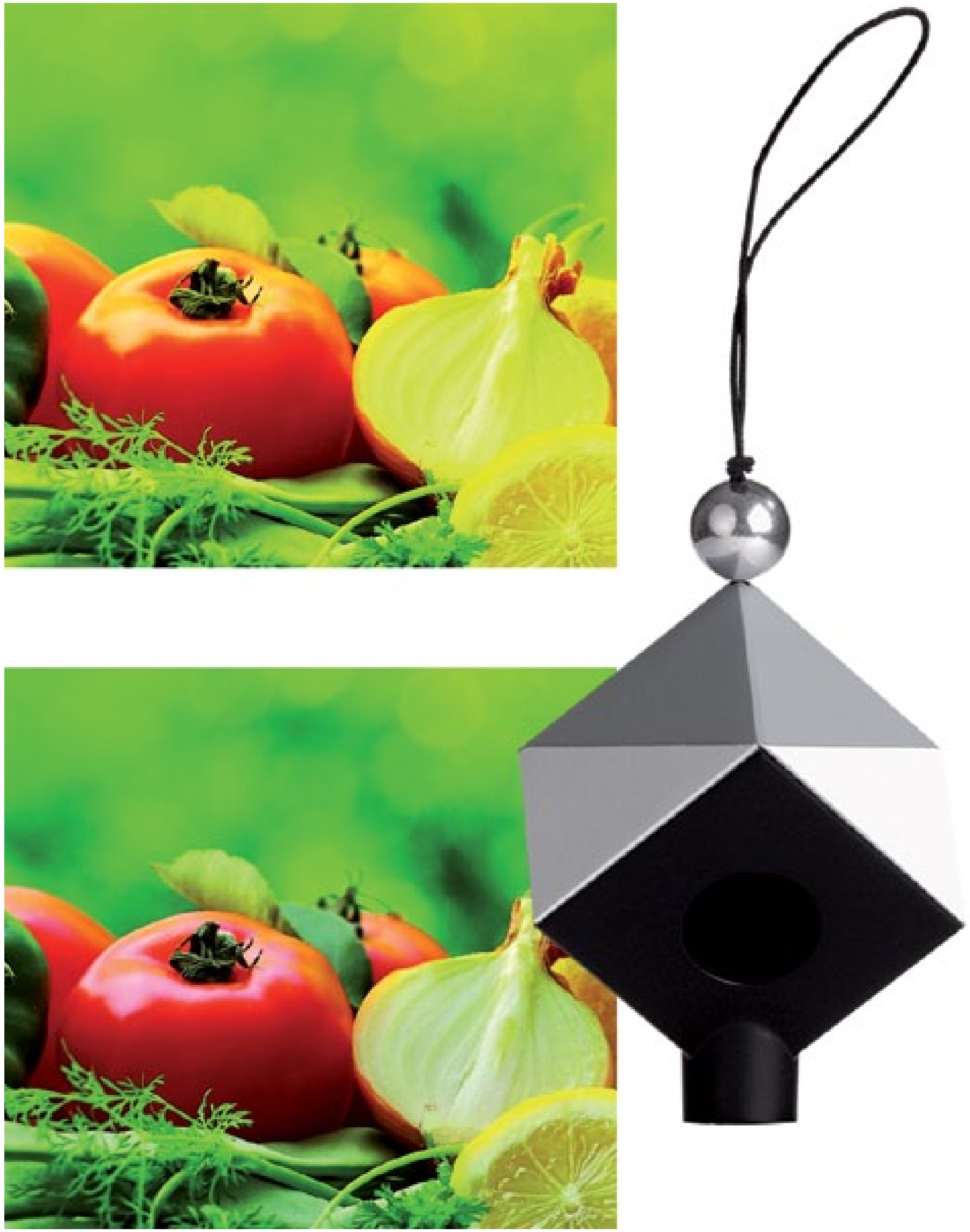


Photo: Jens Rufenach

Neutral Gray Value

The eyedroppers tools in Photoshop, Lightroom and other applications work quite well. You use the eyedropper to click on a neutral gray tone to color balance the image. The problem is finding an area of the image that contains a neutral tone. Metal surfaces are fairly good for this, but often contain a bluish cast, causing a cool tint.

Even gray garments such as the one shown above are far from neutral, due to optical brighteners in the detergent. A truly neutral gray can only be ensured by using a reference object, which is designed to be neutral gray under any light source. So, advanced photographers work with gray cards or other tools, such as the SpyderCUBE from Datacolor. For a series of similarly lit images, you can shoot the gray reference once and use Adobe Camera Raw or Lightroom to apply the same correction to all the images shot in the series simultaneously.



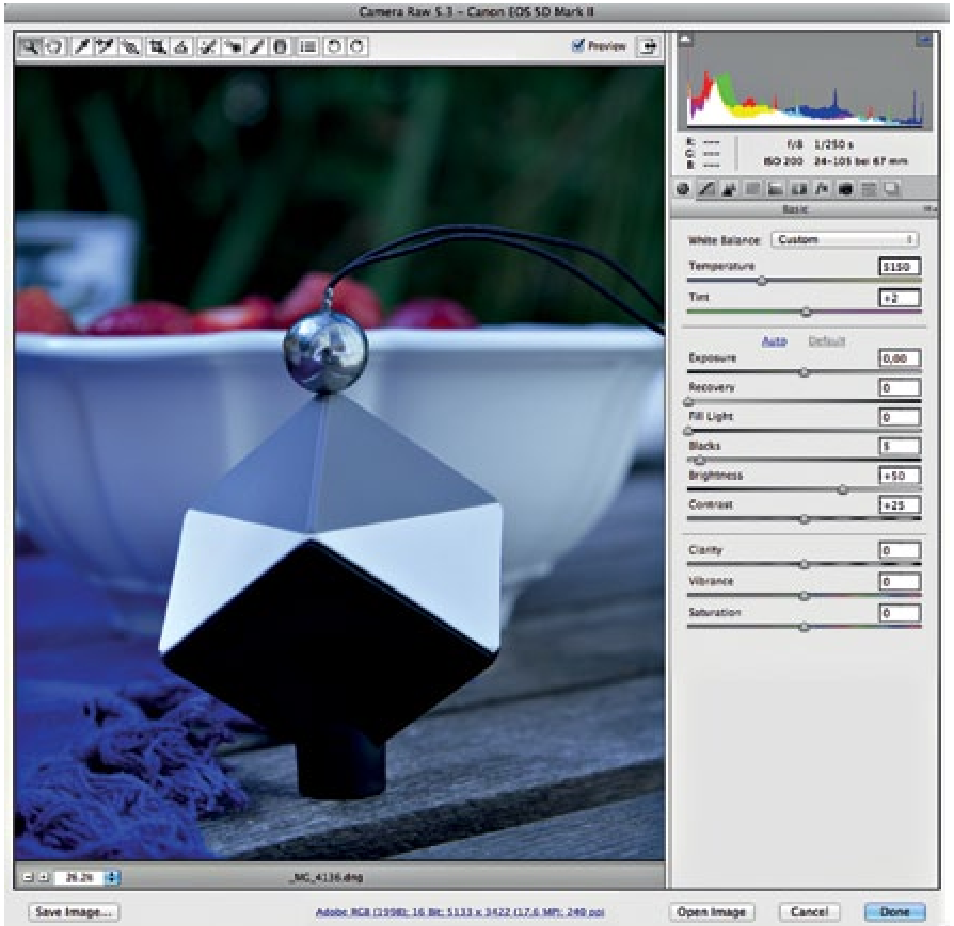
Balancing Contrast

From a technical standpoint, a good image has a balanced relationship between contrast values. Not only must the camera record many color values correctly, but it must also determine the correct exposure, find the optimal black and white points, and determine the neutral gray of the image. Since almost all cameras show deficiencies in these functions, there are tools to help find an accurate neutral value, and set the optimal contrast values.

For example, the SpyderCUBE captures the color temperature and light source data for precise color correction. It offers two neutral 18% gray surfaces oriented towards primary and secondary light sources, as well as black and white surfaces. There's also a small black hole that allows you to capture a nearly absolute black value. This "light trap" is used to set the black point in the image, while detail in deep shadows can be controlled by using the black surface surrounding it.

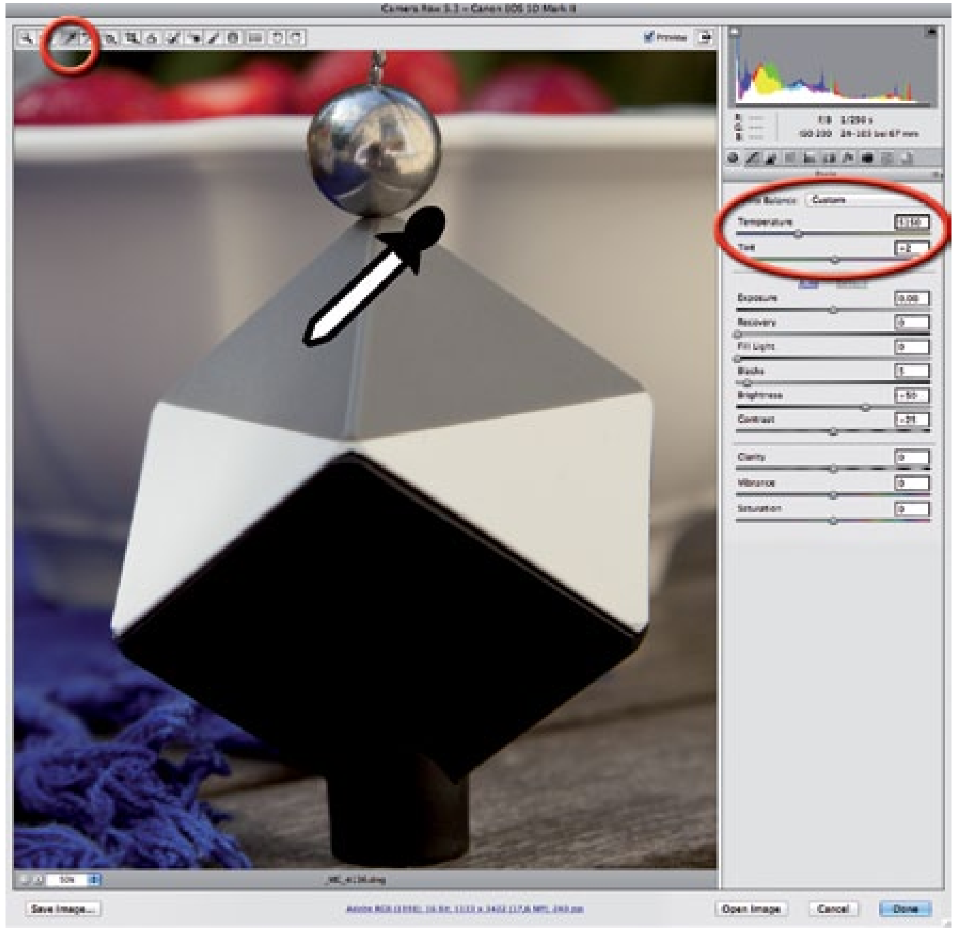
The top-mounted chrome ball reflects light sources, providing specular highlight samples. You use this to set "absolute white", in comparison to the highlights, which are measured from the primary and secondary light source white surfaces. You can use the SpyderCUBE with both JPEG and RAW images. To get the best quality from the workflow, we show the work being done with RAW images.

datacolor



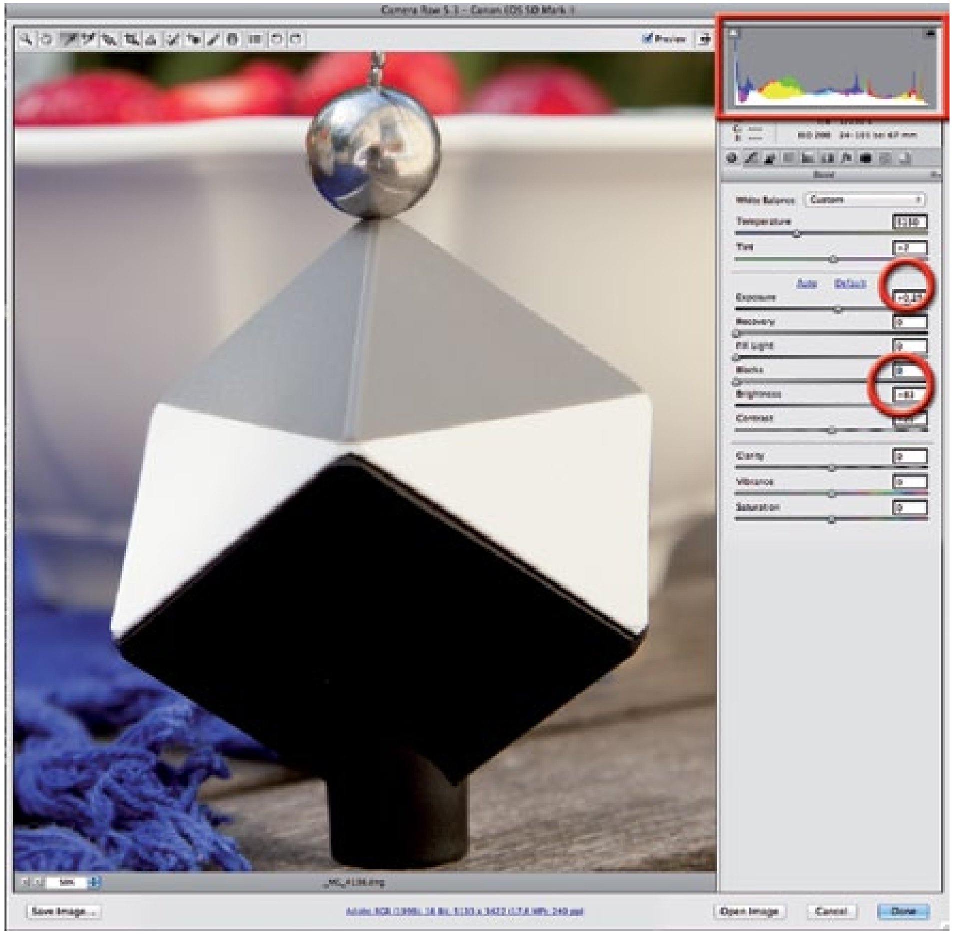
CUBE Position

The SpyderCUBE should be clearly positioned in the scene to be photographed. The "light trap" opening should be pointed directly at the camera, and both gray/white surfaces should be visible. Now, photograph the CUBE, and you can use this image to analyze and correct the light later. Optimizing camera settings now, from information gained from the initial CUBE shot, allows you to improve camera settings in advance of shooting. Once optimized, remove the CUBE from the scene and continue shooting. If you change the lighting or exposure conditions, do another reference image with the CUBE in a properly exposed section of the new light source.



White Balance

Both Lightroom and the Photoshop Camera Raw dialog offer a white balance tool to let you set the white balance manually. Find the lighter of the two gray surfaces. This reflects your primary light source. Click on this gray surface with the white balance eyedropper to redefine the color temperature and color tone. Avoid using the white surface, as it could be overexposed, and if so, will give an incorrect balance value. You can see the extent of the change by comparing the before and after values on the Temperature and Tint sliders.

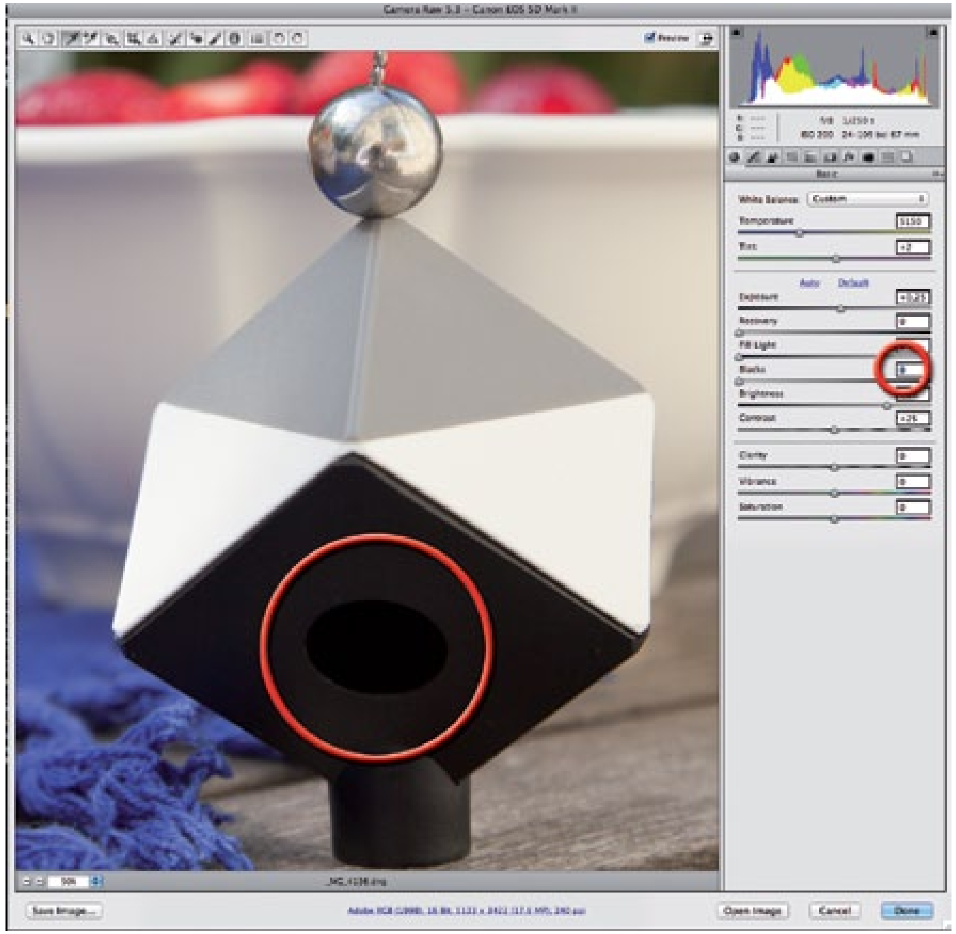


Brightness

Now, look at the histogram and adjust the exposure slider so that no color channel is clipped at either the highlight or shadow end. Keep an eye on the CUBE. If your exposure correction causes highlights to blow out or shadows to block up, correct these using the Highlights or Shadows sliders, circled in red.

TIP:

Use the chrome ball for a reference for specular highlight areas and blown-out whites. The flat white faces on the CUBE must always show detail. Optimal settings are white 90% exposure, black face (directly illuminated) 10%, otherwise: black 5%.



Black Level

If your software has a tool to set the black level, click in the light trap with it. If, as in Lightroom, there is no such tool, set black levels using available tools so that you can perceive a clear difference between the black surface on the CUBE and the black hole of the "light trap". If you have the black clipping warning turned on, this will show as filling most of the trap with the warning color. The resulting exposure value of the "light trap" should be 0%.

Transferring Settings

In order to apply the settings you just created to all the other images you captured under the same lighting conditions, there are different methods, depending on the software and user preference. Photoshop Camera Raw has two approaches. In the first, make all the adjustments to the image with the CUBE, and then close the image. Next, in Adobe Bridge, select all the images shot with the same lighting conditions. Right-click on the images, and select Previous Conversion. Adobe Bridge will apply all the settings you made to the image of the SpyderCUBE to all of the images selected. You will be offered the option to apply all settings, or various subsets. Be sure to include the adjustments made to the SpyderCUBE image.

In the second method, in Adobe Bridge, select all the images to adjust, including the CUBE image, and open these images in Adobe Camera Raw. Click on the CUBE image first, make the adjustments you want if you have not already, and then select all the other images. Click on the Synchronize button. All the other images will be adjusted to match the adjustments made to the image with the SpyderCUBE. The first method is recommended for a large number of images, the second will depend on the number of images and the amount of memory you have assigned to Adobe Camera Raw.

In Lightroom, similar results can be achieved by either moving to the next image, and choosing the Apply Previous button at the bottom right column of the Develop Module, or saving as a User Preset in the Left column, and applying that preset to all images shot under similar conditions.

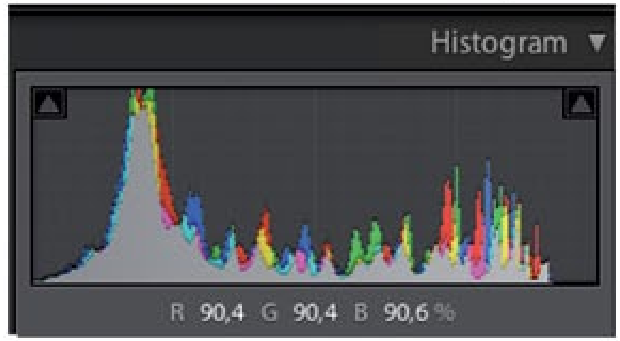
Camera Color Calibration

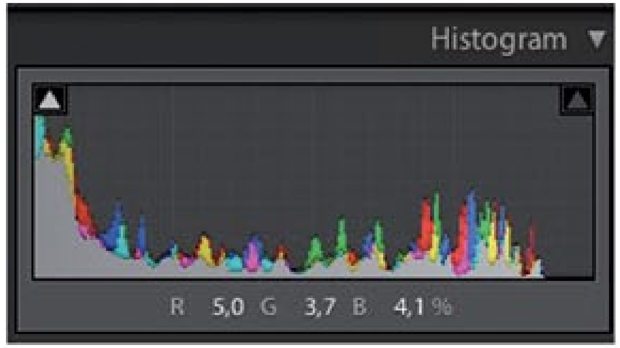
In addition to optimized contrast, which is achieved quite easily using the SpyderCUBE, the second major requirement in precise color photography is color calibration.

Some photographers try to manage color in their images by shooting a color target in the image, without then using target-specific software. They measure the target's colors manually, and use the color correction tools of their favorite RAW converter to manually create a color correction preset. This approach is not bad in theory, but can be very slow, making post-processing time very expensive; and the results often are relatively inaccurate.

To get consistent results, more quickly, one answer is the SpyderCHECKR solution, which works as a combination of hardware and software. The CHECKR offers reliable colors for the RAW workflow, color calibrations for each camera, and thus a reduction in the image processing time. In addition to options that compensate for color issues in skin tones, specifically for portrait and fashion images, it provides neutral gray targets to set the white balance in the camera. The supplied software works with Adobe Lightroom, Photoshop, and Camera RAW, as well as with Phocus, the Hasselblad RAW converter.

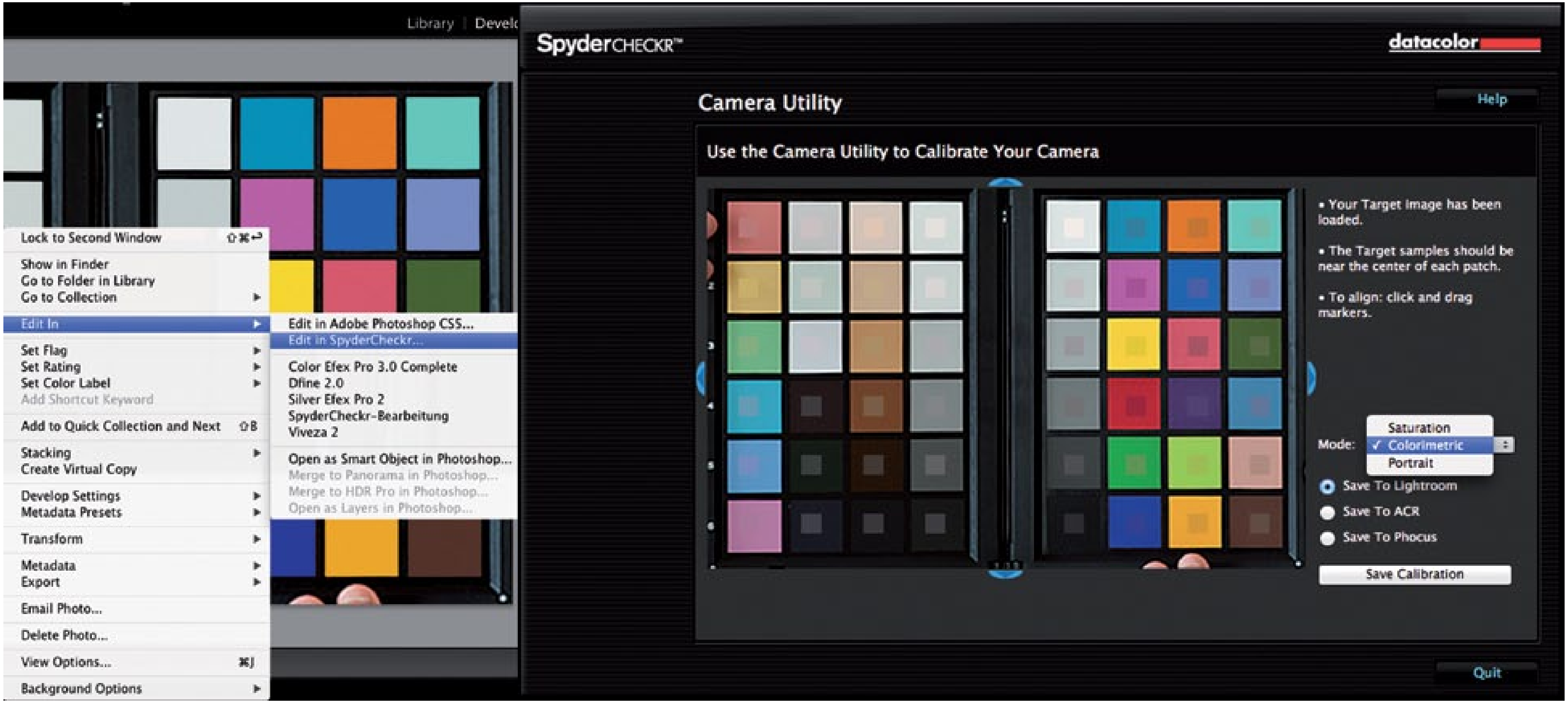
The software uses an image you create by photographing the SpyderCHECKR target in a specific lighting situation. You quickly create a color profile and can then correct a series of images with a single click. To use the SpyderCHECKR for scene specific calibration is quite simple: once you have completed the light setup for a series of photographs, shoot the CHECKR with the same lighting, positioned to face the camera, in Camera RAW mode, before you begin the actual shooting. This type of scene-specific calibration is only needed for the most demanding situations. A single calibration of most cameras, or camera-lens combinations, can be used for most images.





SpyderCHECKR Measuring

Install and activate the SpyderCHECKR software first. Then, open the image you created of the SpyderCHECKR in your usual application, as it needs to be balanced there first. Here we use Lightroom 4. Crop the image to the four white corner dots, to include only the target. (1). Next, use the Custom White Balance tool on field E3 of the CHECKR, to measure and balance the color temperature (2). Next, move the mouse over the field E1 and read the RGB values under the histogram (3). Use the Whites slider to adjust the brightness so that the field E1 shows RGB values of approximately 90% (90/90/90). Then, use the black slider to read a value for square E6 (4). Adjust the slider so that the black value of square E6 is about 4% (4/4/4). It's not always possible to match the exact values. In such cases you should try to get close, achieving an average as shown in the bottom histogram. These adjustments color-balance and exposure-compensate the target shot, to allow the most accurate calibration results.



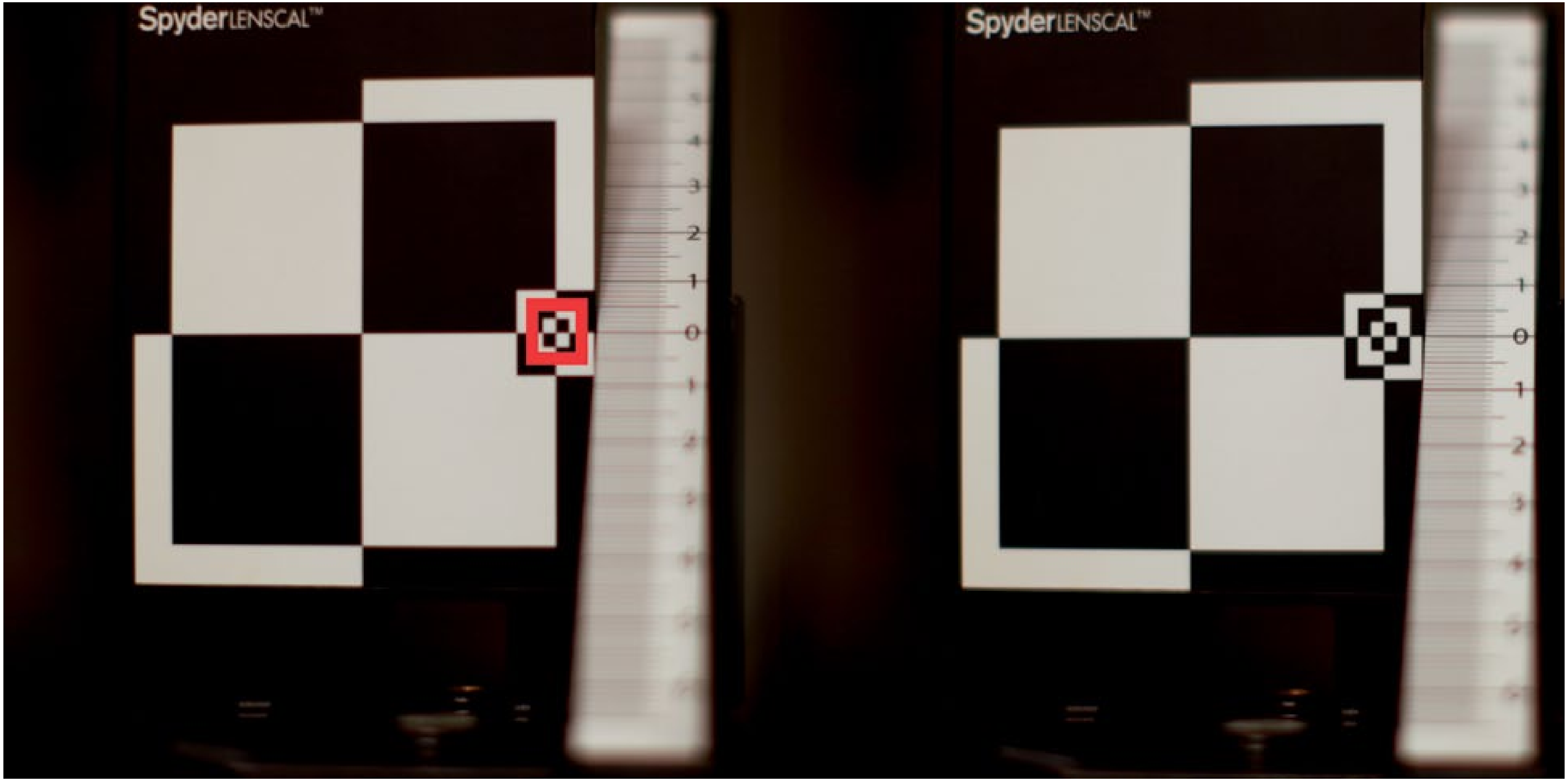
SpyderCHECKR Software

Next, in Lightroom, launch the SpyderCHECKR software to read the target values and build a color profile. First, right-click on the image of the target to show a contextual menu, and select SpyderCHECKR under "Edit In" (assuming that you have set up SpyderCHECKR as your optional external editor). If you are using Adobe Camera Raw instead of Lightroom, you must launch the SpyderCHECKR application externally, by clicking on its icon in the Applications folder. You will need to save the image of the CHECKR you've just adjusted as a 16-bit TIF file in AdobeRGB. Drag this saved file into the CHECKR software window. The software will display your cropped target image with an overlay. Adjust the overlay by rotating and scaling it until the squares of the overlay are roughly centered in the squares of the target, as shown.

Next, choose a mode for your color profile. For literal color, choose "Colorimetric". Choosing "Saturation" bumps the color intensity of images slightly. Using "Portrait" reduces the saturation of red and orange tones in order to make skin tones look more pleasing. Finally, save the profile for the application in which you wish to use it later. To use the newly created preset, relaunch Lightroom, Adobe Camera Raw or Phocus so that the new preset will be recognized. To see how the correction affects an image, look in the field "HSL". There, the channels change after applying one of the presets.

Auto-Focus Calibration

First, mount your camera on a tripod. If you have a second tripod, mount SpyderLENSCAL at the same height as your lens. Alternately, set the LENSCAL on a firm, level surface, such as a desk or table. Adjust your tripod until your camera lens is level with the LENSCAL, and is aimed perpendicular to LENSCAL's target. Set the camera to use a low ISO value, such as ISO 100 or 200, and a short shutter speed. This combination will have lower noise and higher levels of sharpness as a result. (You may need to use additional lighting to achieve these settings).

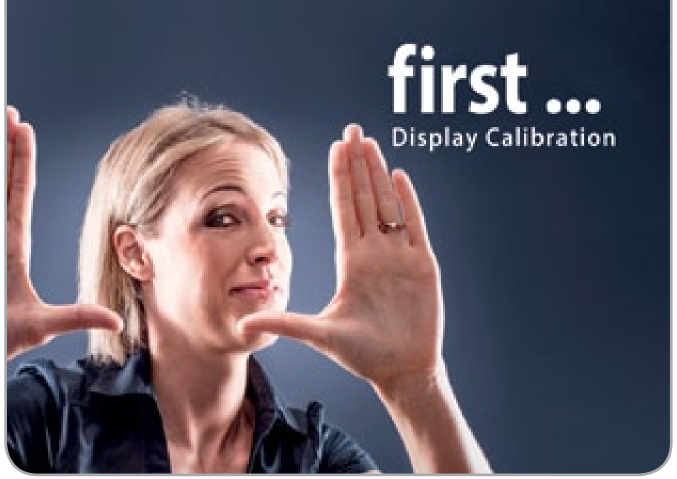


Focus the camera squarely on the center of the measurement field as shown, outlined in red, with the lens set wide open to the maximum aperture, and release the camera shutter. View the image on your camera's display, zooming in to check the picture of the LENSCAL on the screen of your camera. The area outlined in red should be sharp, as should the number zero (0) on the scale at the right of the target. If the small target and the number zero are sharp, your lens is working properly and you need to look elsewhere for the solution to any remaining sharpness issues.

If the target and the number zero are not as sharp as sections further forward or back on the sloped ruler, use the ruled scale to find the sharpest point. If your camera supports Auto-Focus Micro-Adjustment, you can use this feature to adjust your camera focus until it aligns with zero.

Once you are satisfied with the result, repeat the test routine with your other lenses. To see a selection of cameras that allow focus fine-tuning, see the Requirements section at **http://spyder.datacolor.com/portfolio-view/spyderLENSCAL/**

Chapter 3: First … Display Calibration




first ...
Display Calibration
datacolor

The Subtle Differences between Displays

In the display, photo editors find the most important interface with their work. Until a photo is printed, the display remains its "frame". It is the place where the image is evaluated, and the place where corrections are carried out. Thus the display must be able to correctly represent the most subtle color shades.

Even those who are only slightly concerned with "color management" learn early on that in a digital photography workflow, they must calibrate and profile their displays.

If the screen is correctly calibrated, you can rely on the presentation of colors – at least for a while. LCD displays don't age at the same rate as CRTs did, but still need to be calibrated nearly as often, because of color and luminance fluctuations.

Depending on the device, these changes are of differing degrees and often are not perceived by the human eye without direct side-by-side comparison.

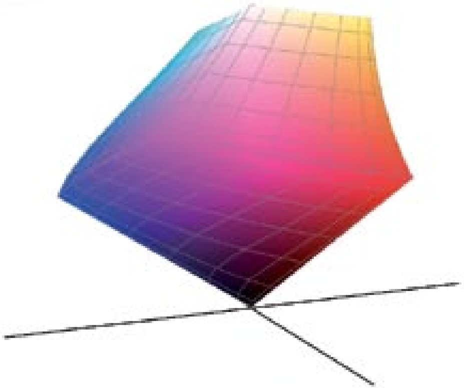
Using display profiles provided by the manufacturer is, at best, a temporary solution. Custom profiles can be created in two ways; a visual calibration or a calibration performed with an instrument. For home use, one can try to calibrate using visual adjustment tools. This type of software asks you to make a series of visual choices on-screen to improve the state of your display. At the end, it creates a display profile that helps to display neutral color. Unfortunately this process only offers single-point gamma and gray balance adjustment; it does not measure and define the display's color primaries, or perform multiple point adjustments to gamma or gray balance.

To improve color accuracy and consistency over the long term requires a colorimeter. This type of device is hung

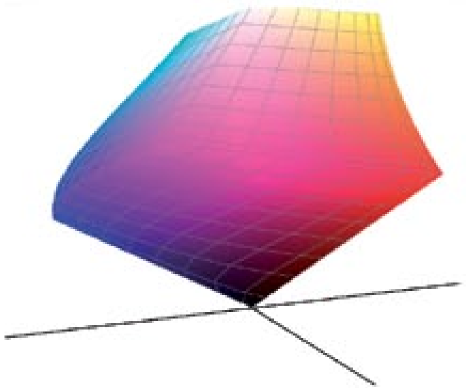
Photo: Jens Rufenach

from a cable, in front of the screen. Using dedicated software provided with the instrument, the colorimeter accurately measures the display's color and luminance and creates a correction profile for the display. Such devices are available for prices starting around a hundred dollars. A user who wishes more advanced calibration options should be looking at a device in the $200 range.

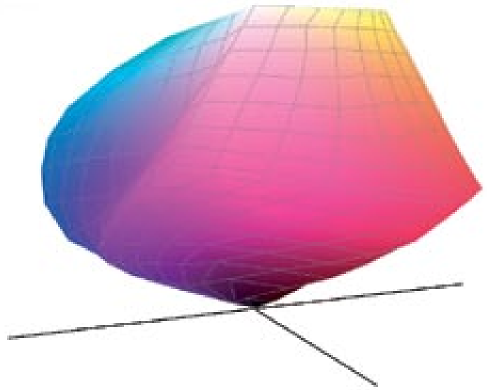
Regular calibrating with these devices assures consistent color security. In the end, to borrow a colorimeter for one-time-use or to have your workflow set up once by a service provider is not enough. In the following pages, we'll show the calibration process, using the Spyder4ELITE from Datacolor as our example.



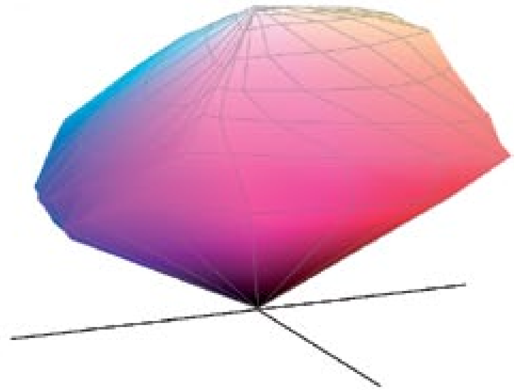
Low Cost Display



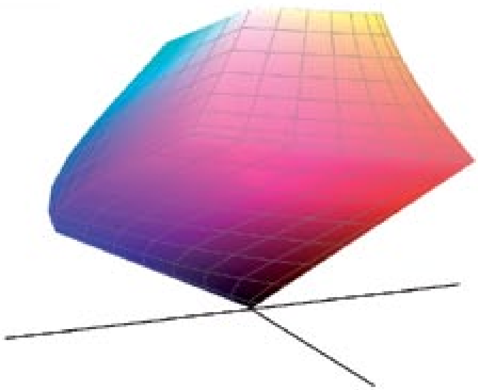
Wider Gamut Display



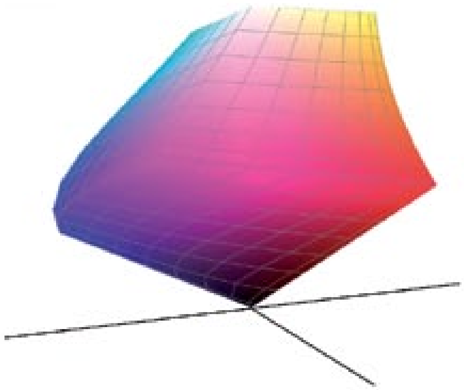
Canon EOS 60D



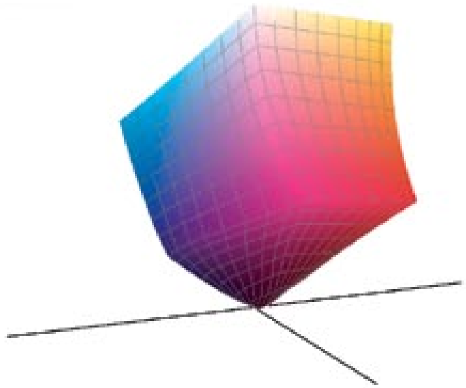
Kodak Photo CD



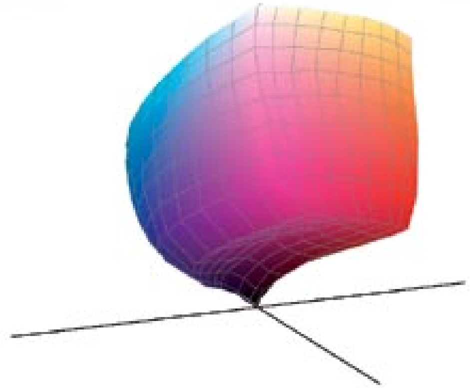
AdobeRGB (1998)



sRGB



Printing Press



Glossy Photo Paper

Color Gamuts

These pages show the colors that can be captured/displayed/printed by various sample devices. This color range, or gamut, differs from camera to camera, display to display, and print paper to print paper.

Comparing differences between displays and color spaces is revealing, especially when comparing them to AdobeRGB (1998), a color space used widely for photo capture and editing. The goal in developing AdobeRGB was to represent the range of colors possible from most color printers. The AdobeRGB color space includes about half of the colors defined in the L*a*b* color space and expands the amount of cyan and green tones compared to the sRGB color space.

Inexpensive displays can show a range of color adequate for standard office work, but a larger gamut has advantages for image editing. Some types of LCD displays now offer a significantly larger color range (gamut) approximating AdobeRGB.

TIP:

There are tools to display color gamuts from ICC profiles under Mac OS X: the "ColorSync Utility". Windows users can download this a profile-viewing tool here: http://www.color.org/profileinspector.xalter.

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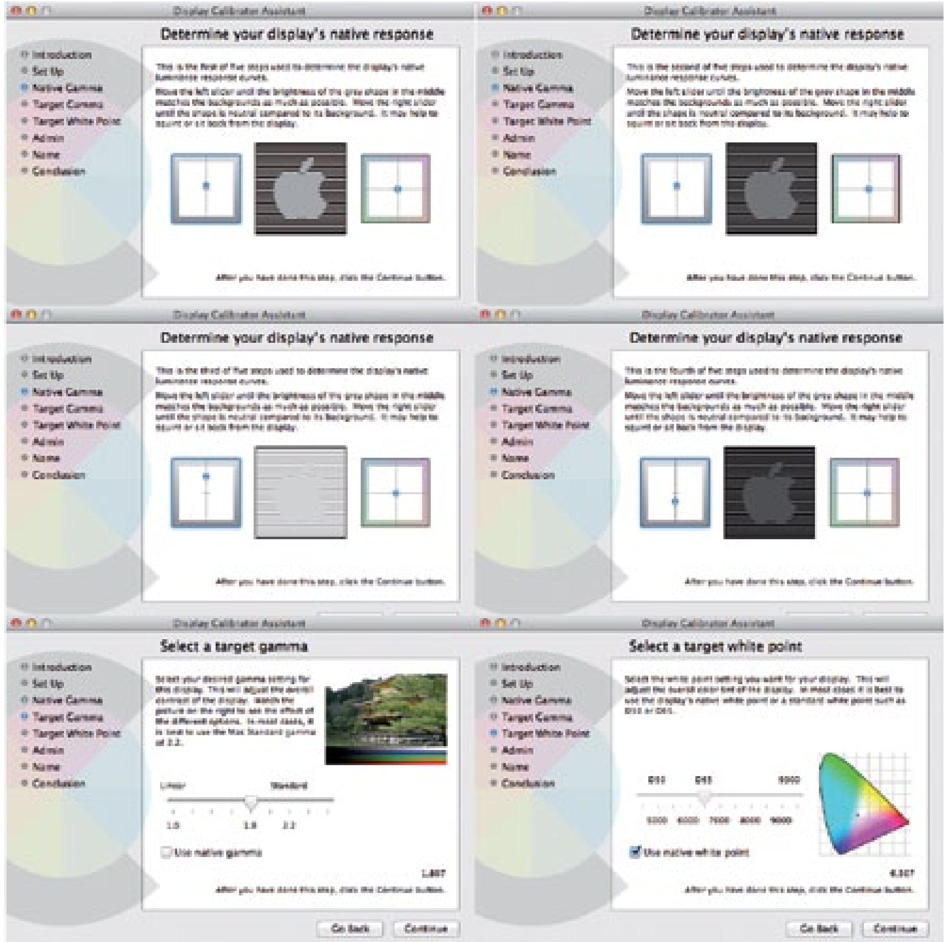
Photo: Gianluca Colla



Colorimeter, or Visual Adjustment?

Do I really need hardware calibration? All ambitious amateurs ask this when they realize that the colors of their prints don't match those of their displays. The person who has a reliable color-eye and is not afraid can invest much time and effort, as well as making a large number of printed proofs, can attempt to work without hardware calibration. An acceptable result is sometimes possible. When reliable screen colors can't be obtained using this method, it's quick and relatively easy to get a hardware-based solution that fits the budget.

For professionals, the question doesn't even come up. They need to work to a proof standard, and can't avoid the use of a color sensor, assuming they don't want to compromise their work. Their only consideration is how extensive the capabilities of the device need to be.

TIP:

Visual calibration software is less precise and less consistent than hardware solutions. Even the experienced eye, under many conditions, can't detect color nuances nearly as accurately as the sensors in a colorimeter.

The Initial Calibration

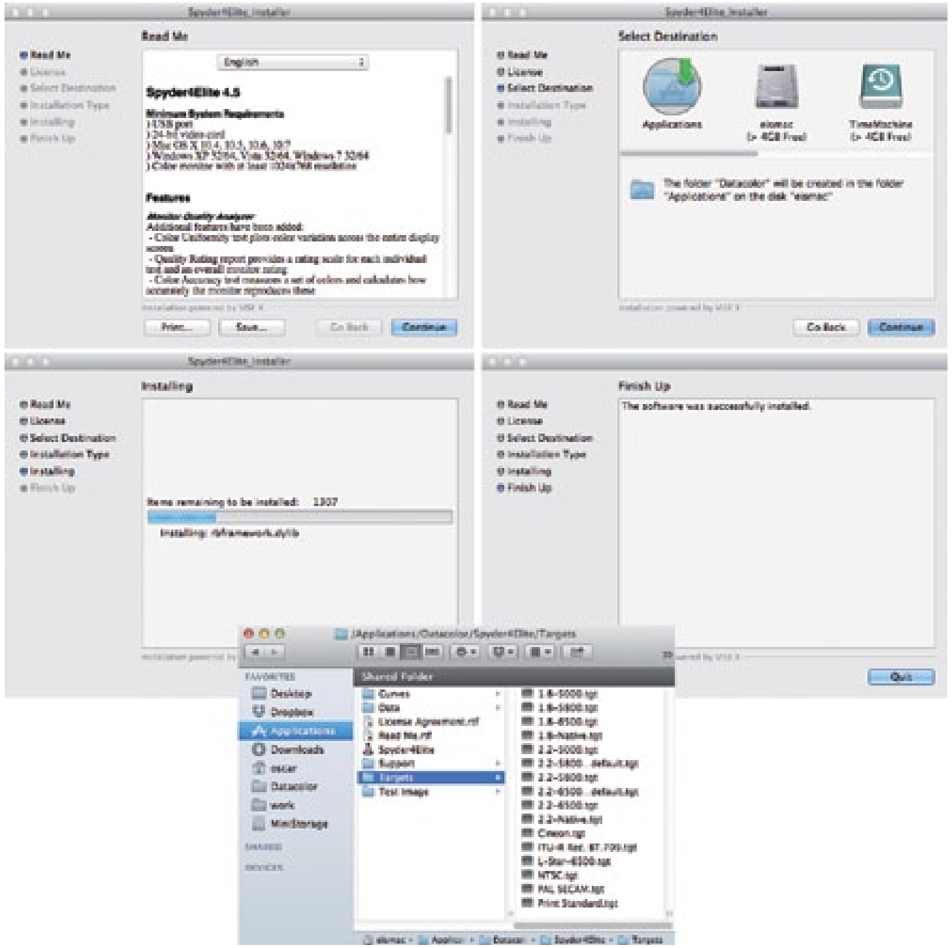
For a long time, calibration software did not distinguish between initial and subsequent calibrations. Each time the display was profiled, the user had to answer all the same questions, resetting parameters that were, in most cases, exactly the same for both hardware and the desired conditions.

User-friendly programs now do things differently. They distinguish between a first calibration, subsequent calibrations, and changes in measurement parameters necessary only because of wear and aging of the display over time.

The first calibration has a special status here. It is the first time the device is measured, so, to be sure the software works effectively, the user must provide some information. For example, what type of device you would like to calibrate? CRT displays, LCD displays, video projectors and notebook displays require different technical approaches and different standards. Spyder 4 now includes a database that matches display types to display models in order to optimize measurement accuracy. This means the user will seldom have to provide this information; the process is usually automatic.

However, you still need to manage the hardware adjustment options.

Modern LCDs offer few controls when used as a computer display. In many cases the only control is a backlight adjustment called Brightness. However, LCDs sometimes offer multiple modes to chose between, and even dynamic modes, where the display's brightness is constantly changing based on ambient conditions. Combining this automatic behavior with a custom color profile leads to suboptimal results, so it should be disabled.

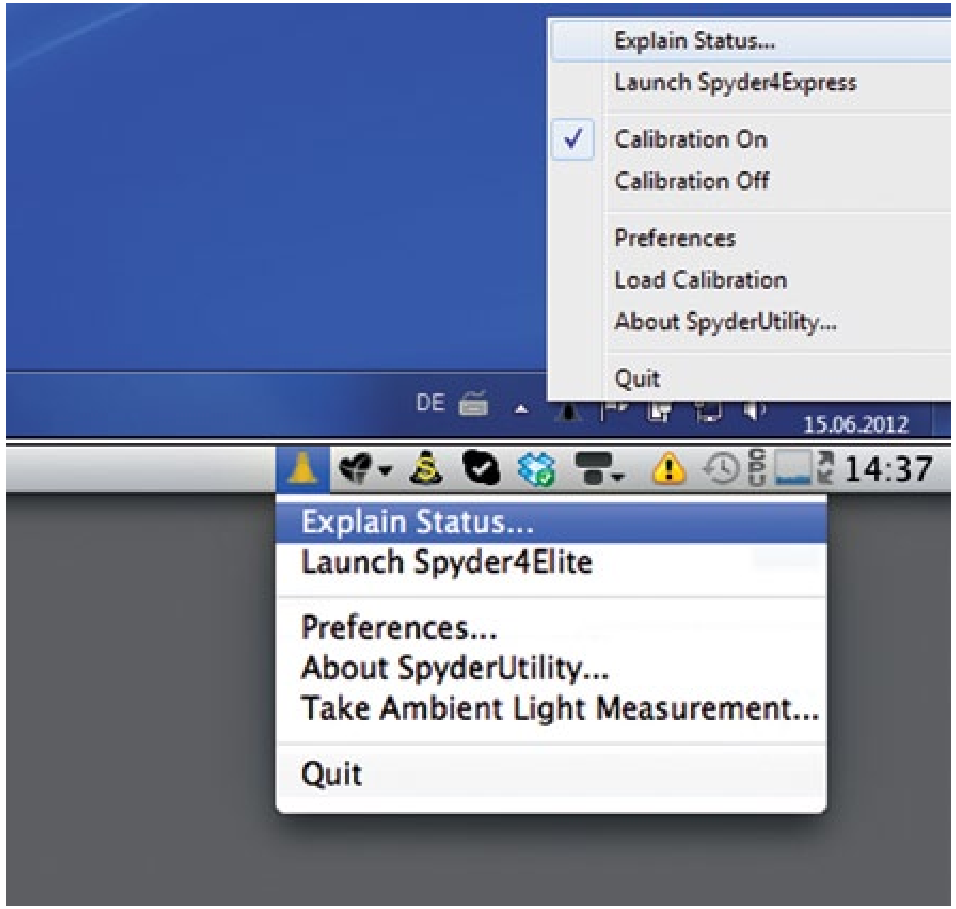


Installing the software

Insert the supplied software CD and follow the instructions on the screen. The default location for the installation puts a folder named "Datacolor" in your Applications folder. Next, launch the Spyder4Utility from the Start menu in Windows, or from the folder "Datacolor" in the Applications folder in MacOS X.

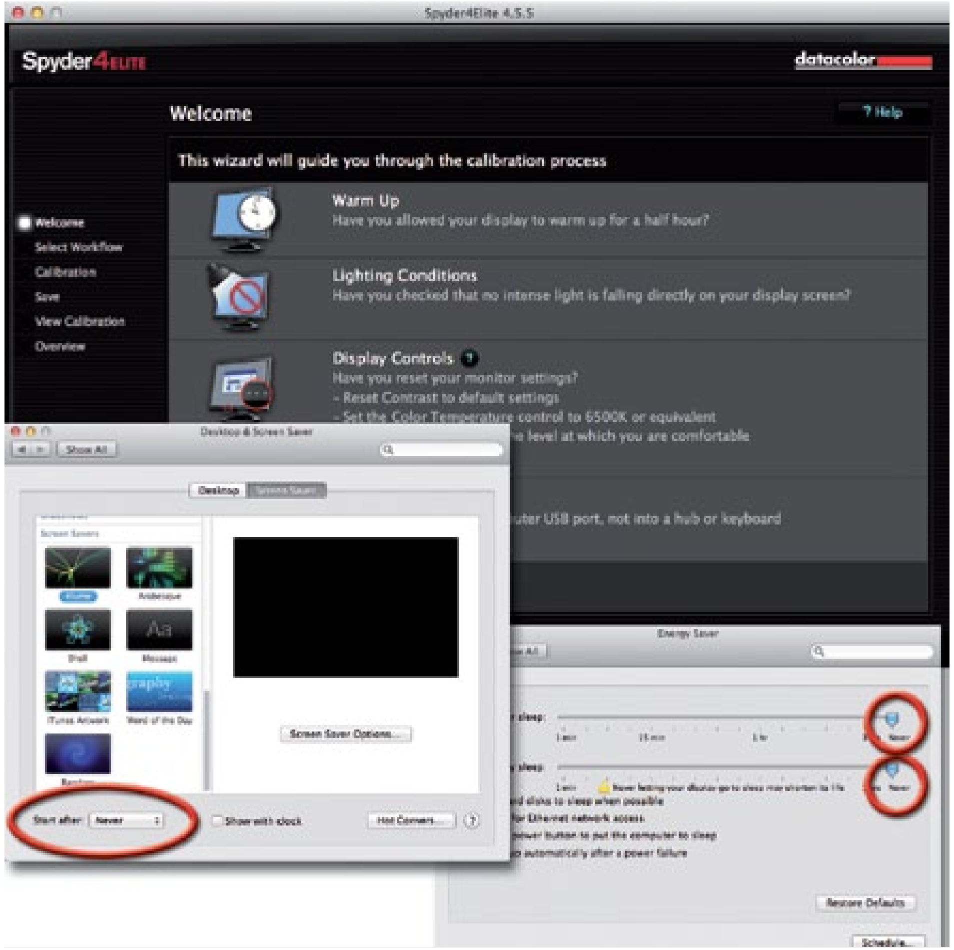
TIP:

Its possible to visit the website of the manufacturer (www.datacolor.com) for the latest version of the software, but the applications can check for updates automatically, if you enable that feature on installation, or from Preferences.



Launching the software

The Spyder 4 colorimeter uses two applications. The first, named Spyder3Utility, launches automatically at startup, and runs in the background. It monitors the interval between calibrations, and ensures that the profile generated by the profiling process is also used by the operating system. The latter is necessary because other programs sometimes attempt to change video LUT data that is part of your display calibration. Start the Spyder 4 calibration application from the Start menu in Windows, or from the "Datacolor" folder in the Applications folder in MacOS X. You can also launch the software from the menu bar as shown. You can use this software to calibrate and profile your display as well as measure ambient light affecting the display, using the ELITE or PRO versions.

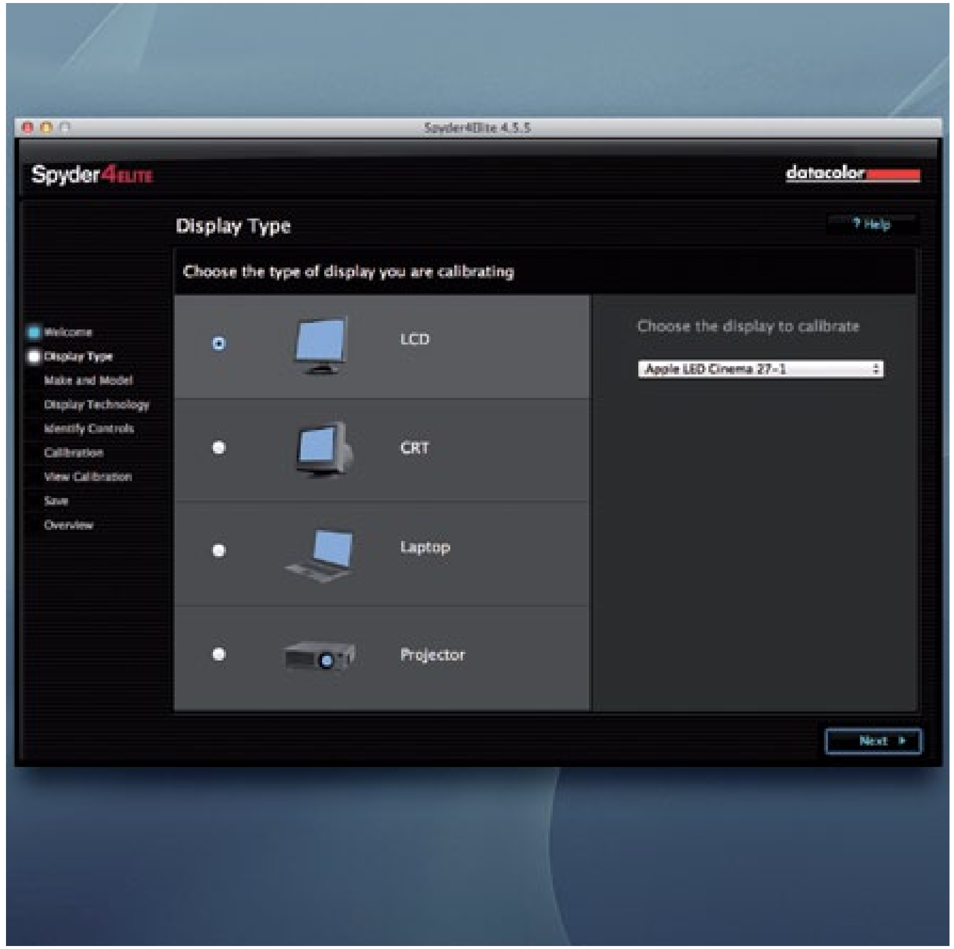


Initial Screen

To avoid problems during the calibration and profiling process, you need to follow a couple of common sense guidelines. Let the display warm up for a half hour before measuring. Disable screensavers and energy conservation routines that would disrupt the accuracy of the readings. Keep the display at a constant operating temperature.

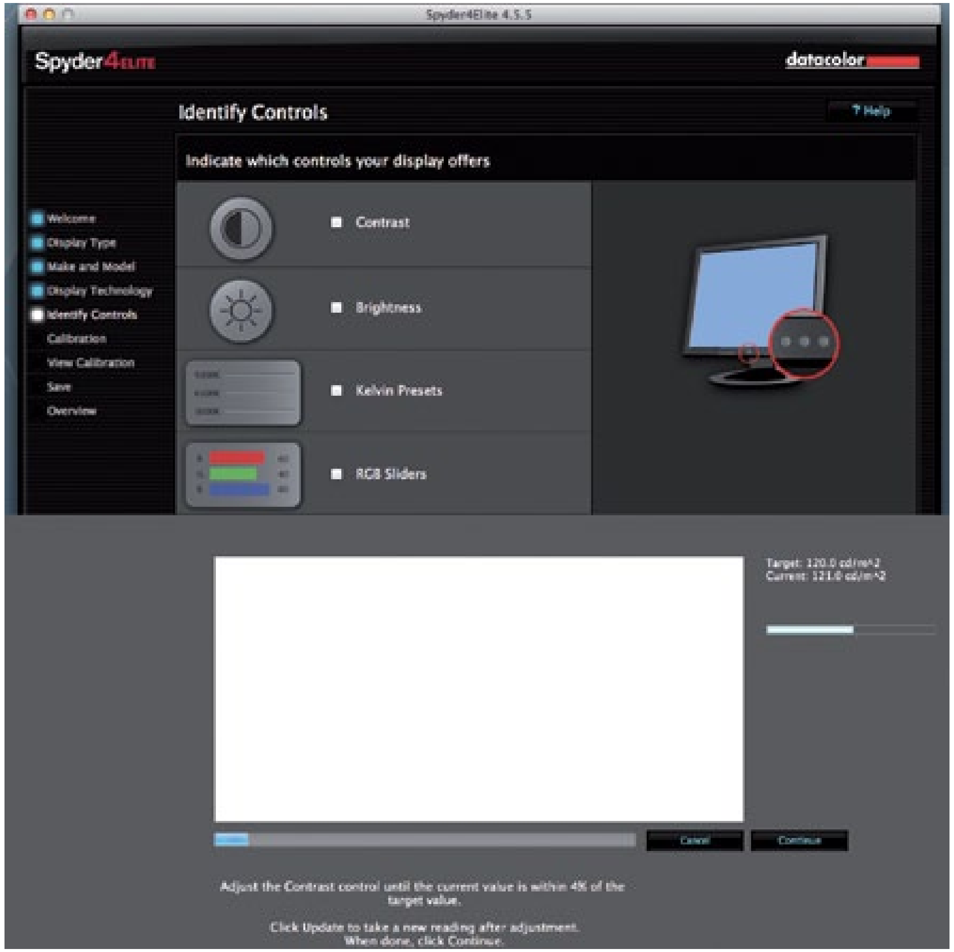
PRO TIP:

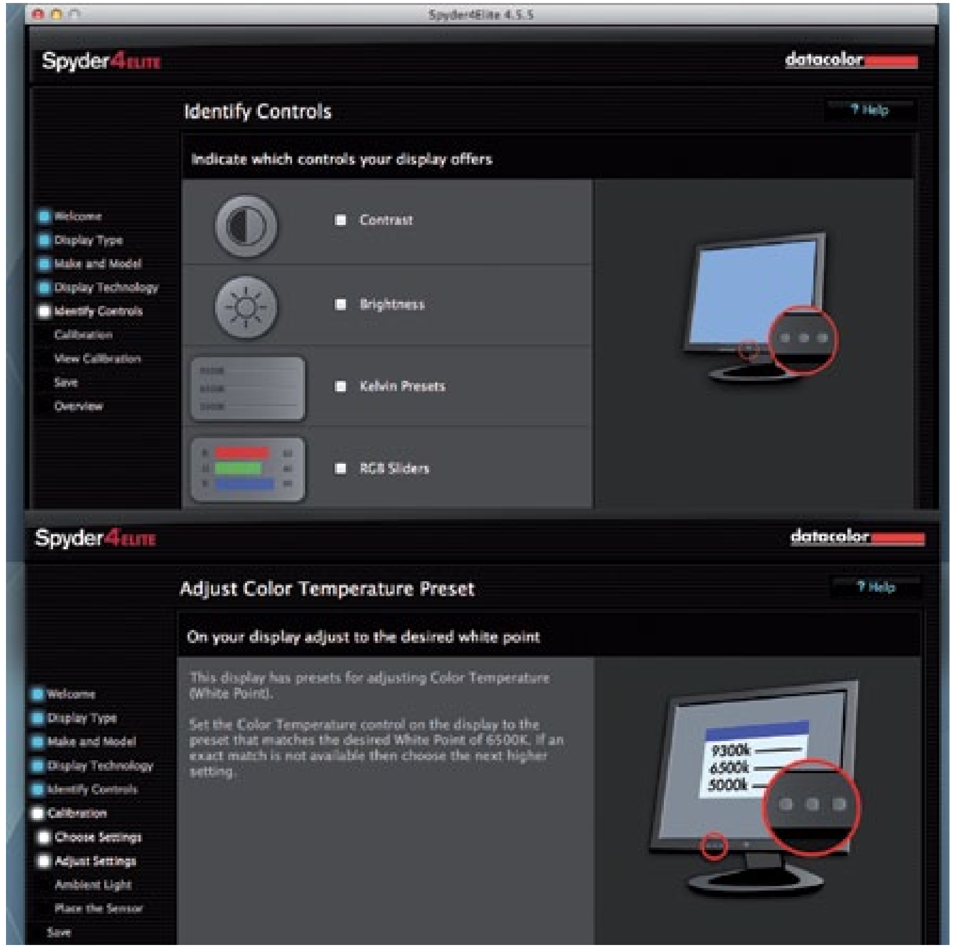
If you want to be able to trust your color at all times, you should permanently switch off your energy saver setting, to ensure the display is always at a constant operating temperature.



Display Types

Next, you can define what type of device you want to calibrate. Typically, this will be an LCD or Laptop. For a discussion on how to work with these devices as well as how to profile video projectors, please refer to Section 4.





Controlling Contrast

On many displays, you can change the hardware settings. Check to see whether your display's features include controls for brightness and contrast. Mark the correct settings for your display and very carefully read the instructions that are shown on the display in the following screens.

TIP:

If you determine that your display is no longer able to produce sufficient contrast to distinguish each patch of a stepped grayscale, make plans to replace it.

Controlling Color

Color and white point settings are commonly changed using an OSD (on-screen display), which is invoked for different displays in different ways. The closer the settings of the hardware are to the target before calibration and profiling, the less changes the calibration process needs to apply, which can improve the results.

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Calibration Settings

Before starting the calibration process, you must choose Gamma, White Point, and Brightness targets. If you already know what settings you want to use, simply follow the software process. If not, the built-in presets are designed to be optimal for most users. This includes users who build their workflow using AdobeRGB, sRGB, or both.

Advanced Calibration Settings

For Expert Users: Clicking on the Advanced button takes you to the Advanced Settings screen, where you can access three additional functions target functions. You can choose a combined preset for the settings you chose in the previous dialogue. You can also turn off the functions that measure ambient light, gray balance calibration, and Spyder certification. To see exactly how to optimize your calibration settings, please see the next section: and now! … Fine-Tuning Displays.

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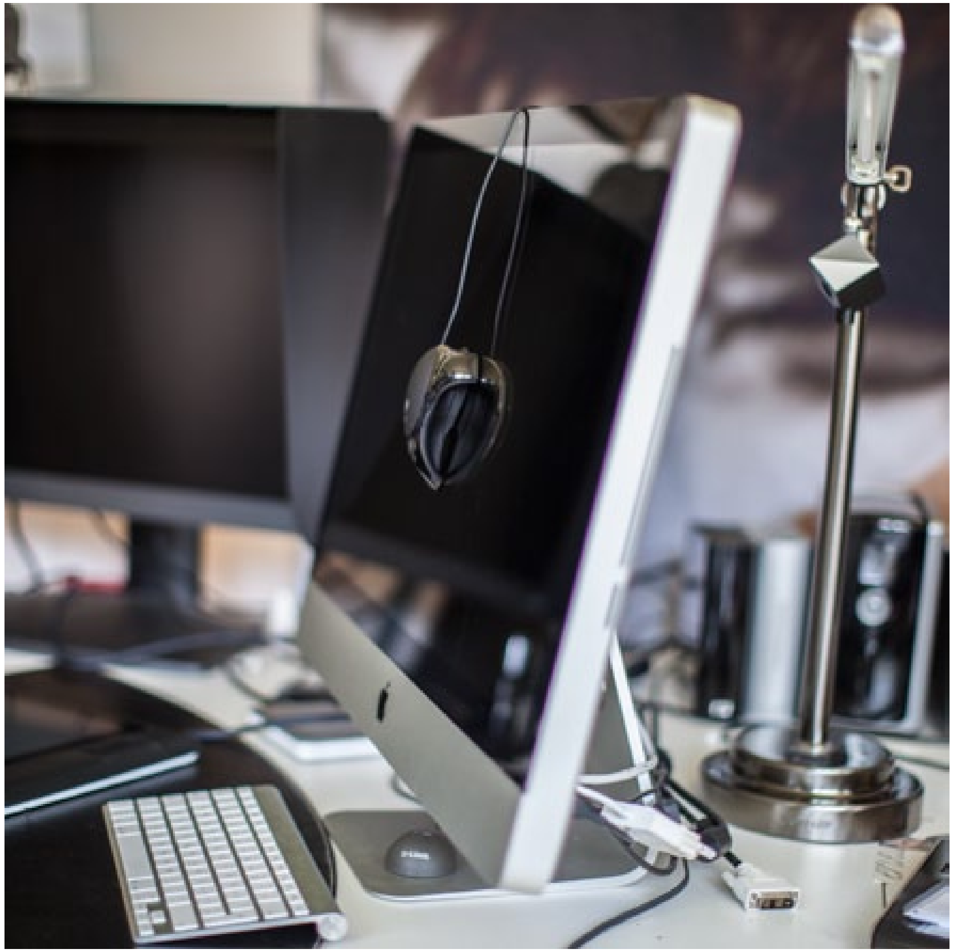
Photo: Jens Rufenach

Measuring Colors

This is the point where you use the instrument. After you've been guided through the initial steps by the software, the Spyder handles communication with the display. Ideally, this will take only a few minutes, and will end with a fresh calibration and display profile.

Unfortunately, conditions are not always ideal. To guide the process, the software uses a step-by-step wizard to help you address items that could reduce the quality of your calibration. The software will tell you, for example, if the sensor detects that your work area is too bright, or if the chosen brightness for the display is too high. In such cases, you'll be invited to change your display settings (or even your working environment) in order to optimize your results.

Once the profiling is finished, there are also interesting features that will show you what the calibration and profiling process has changed compared to the default device settings. In a selectable matrix, the Spyder 4 software shows a variety of photos of different types. Viewed together, or zoomed-in on individually, they give a much more accurate idea of how colors and photo content will appear after calibration and profiling. Don't be surprised—the images don't always look "prettier". However, almost always, you'll see better neutrality and enhanced detail.



Measurement Settings

Hang the Spyder on the face of the display. Adjust the counterweight on the Spyder cable so that it is hanging behind the display to best advantage. Then, place the Spyder4 on the clean surface of the display. To be sure the Spyder stays flat. If possible, tilt the display slightly upwards, so that the weight of the sensor stabilizes its position.

Measuring

On initial calibration, you must wait five minutes while the colorimeter calibrates and profiles your display. During this time, the measurement field displays ramps of red, green, blue, and gray at the center of the screen. After the measurements are completed, remove the Spyder from the display. If you have activated the Ambient Light Compensation option (and you should!), there are additional dialogs that will be described in the following four pages.

Measuring Ambient Light

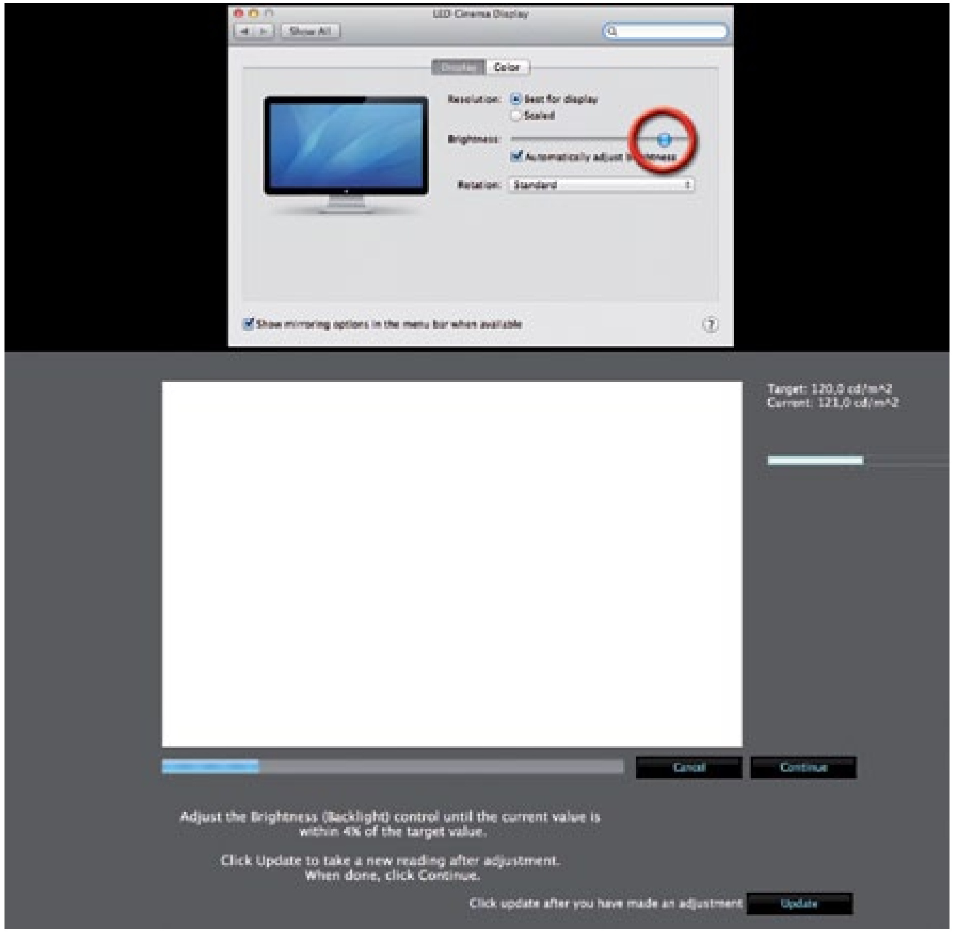
The lighting conditions in the workspace are very important for optimal display calibration. Therefore, the Spyder4 has an ambient light sensor on the front of the unit, as well as a blue LED that indicates when the sensor is measuring. If you have selected the Ambient Light Compensation option in the preferences, the Spyder takes a measurement of the light in the room as well as reading the display.

TIP:

The ambient light level can be continuously monitored to warn you about changes. You can access the ambient light status functions from the Spyder Utility icon in the Mac menu bar or the Windows tool tray.

Analyzing Ambient Light

After the measurement, the software assistant informs you of the results, and suggests changes to the ambient light, or to your target values. These changes ideally would involve dimming or raising the lighting in the area: and assuring it is consistent over time. If you choose not to correct the workspace lighting, then the suggested changes to your target values for display luminance, and possible display whitepoint, should be accepted, to coordinate with your ambient conditions.



Adjustments

After you have decided whether you want to accept the suggested changes or remain with your original target values, continue with the calibration process. Luminance results will be displayed. If this brightness value does not fit within the range of values determined by the software, you'll need to change the display's brightness, either by using the on-screen display hardware controls for the display, or, as shown here for a Mac, using the brightness control slider in the Mac OS X System Preferences.

MAC TIP:

For finer control of display brightness under OS X 10.7.4 or higher, hold down the Shift & Option keys, to provide 64 adjustment increments, instead of 16.

Discussion: Ambient Light

The working surroundings are an essential factor that many forget when calibrating their displays. A good workspace will have consistent, unchanging, lighting conditions. Blinds or black out shades are recommended. Failing that, working on color critical work only in the evening, once it is dark outside, is suggested.

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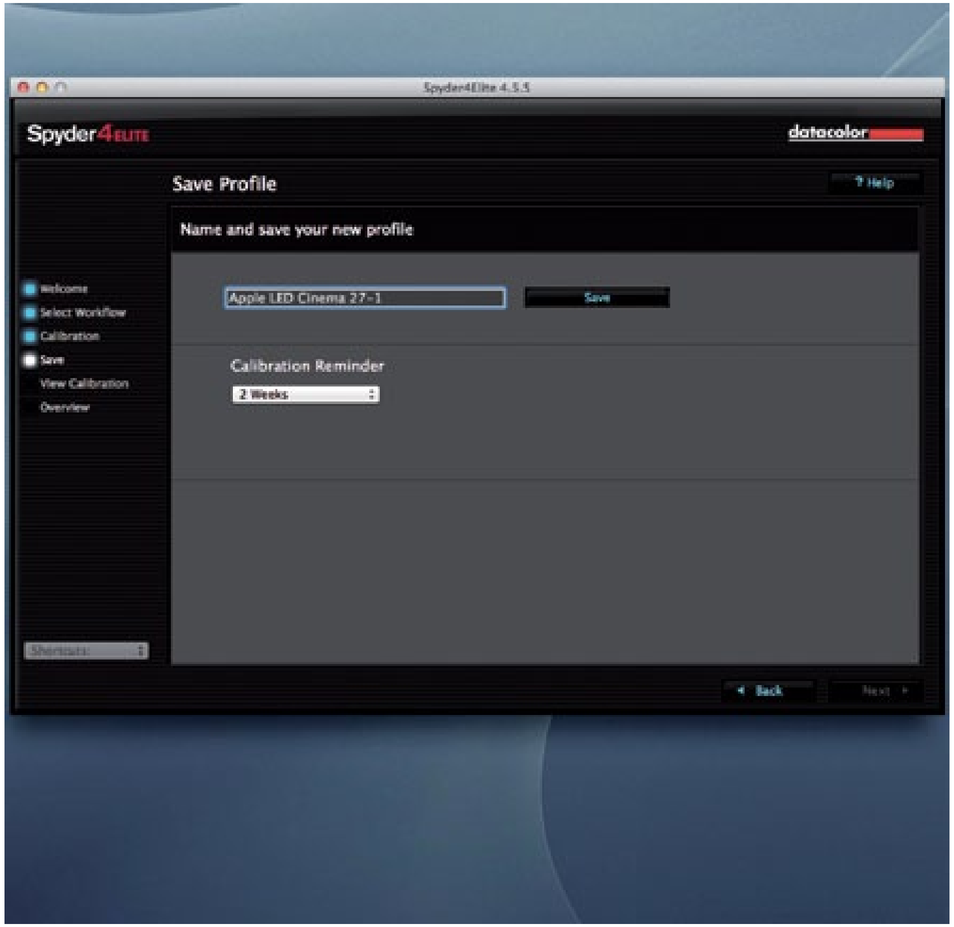
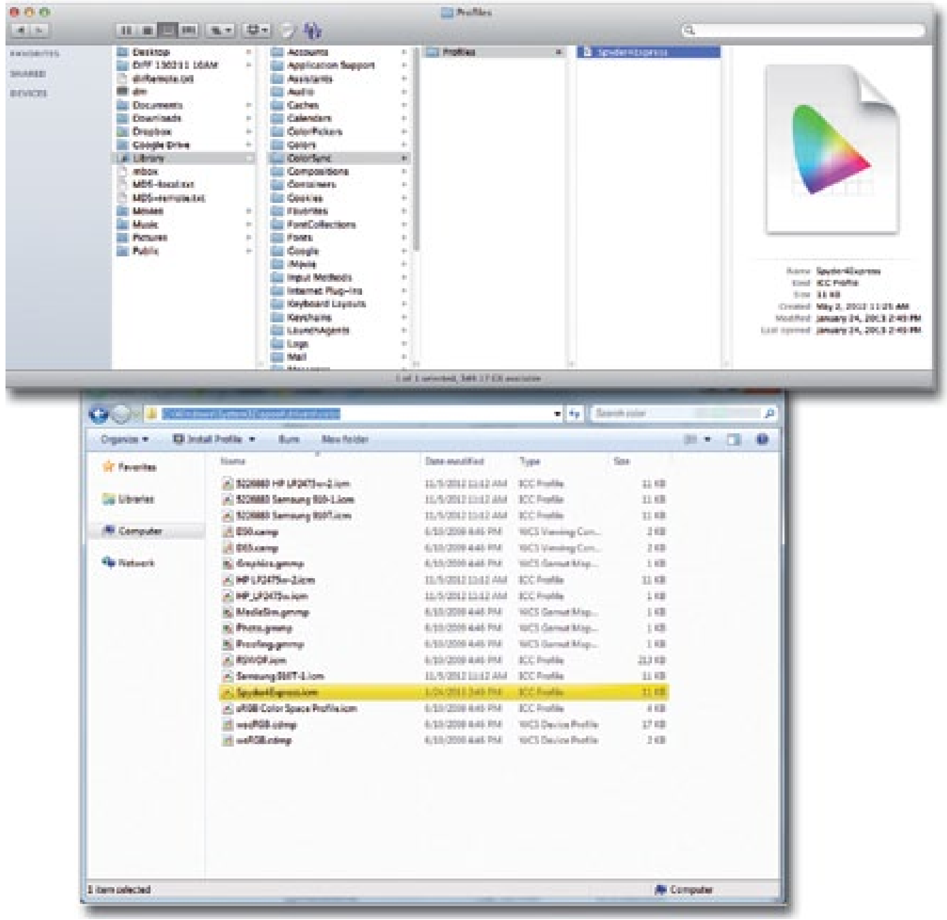




Profile Name

In this dialog, accept the default name, or create your own. Descriptively named profiles make it easier to find the right profile quickly when necessary.

Under Windows, the directory for storing ICC profiles is at: C:/Windows/Sys-tem32/Spool/Drivers/Color. For Mac OS X is in the folder: User Name/Library/ColorSync/Profiles.

TIP:

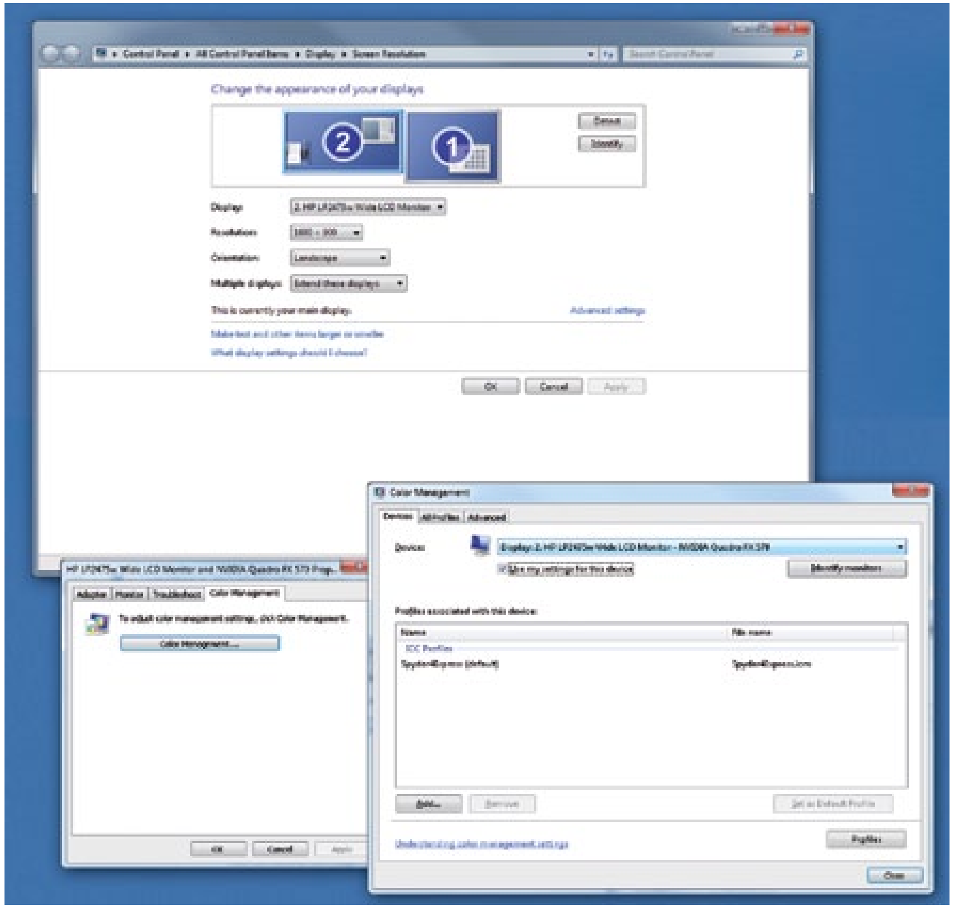
Your User Library will be hidden in recent versions of OS X. To make it visible, locate the Terminal utility on your hard drive in Applications/Utilities/Terminal. Launch Terminal, and into it's window, past the following text:

chflags nohidden ~/Library/

Hit: Enter, and your Library will be visible.

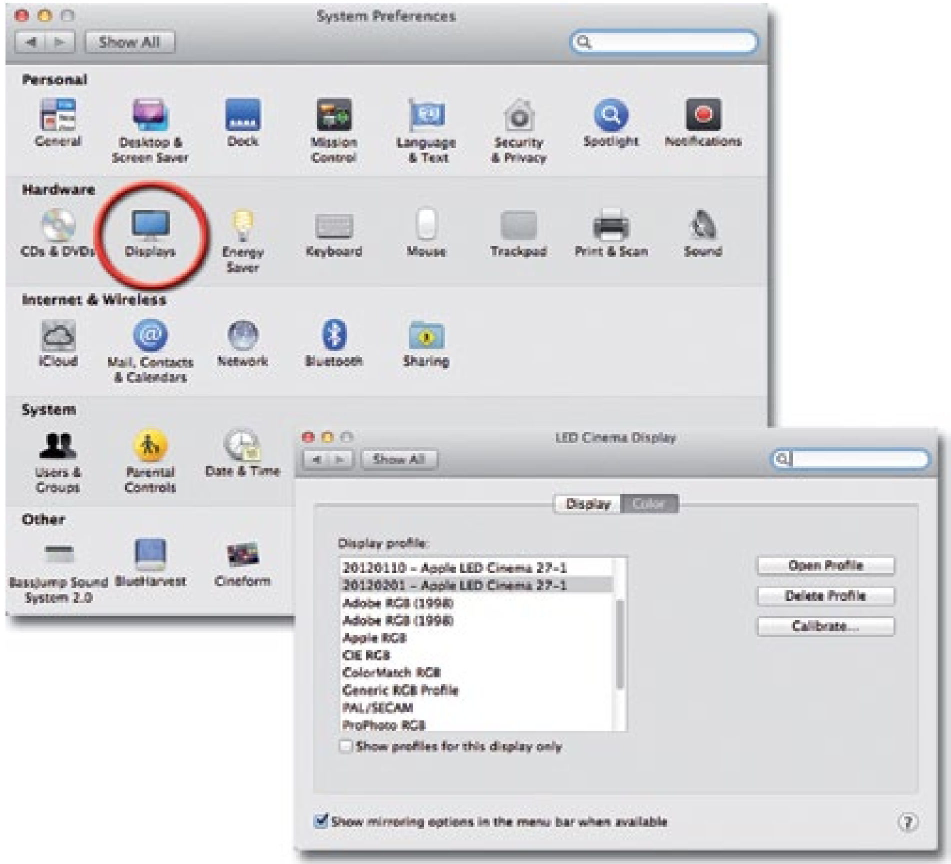
Location

You should restart a Windows system after installing a new profile. Most applications on the Mac will be able to use a new profile immediately, but a few will require a system reboot. There are Two color tools you may find useful: Mac ColorSync Utility,which provides info about any profile, or Datacolor's ProfileChooser utility for Windows, which allows switching between different Spyder profiles, and flashing the correct calibration data for the profiles as they are changed.



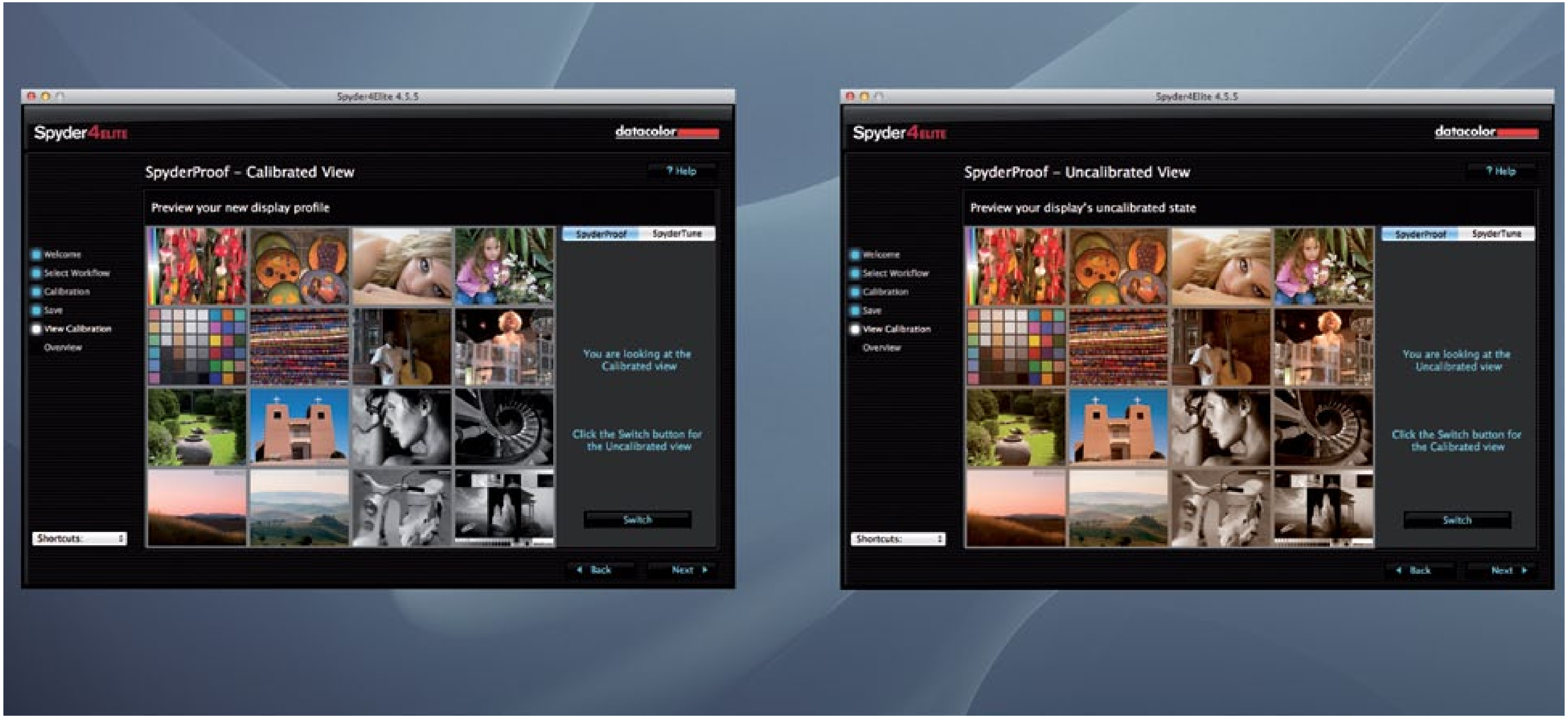
Switching Profiles in Windows

The Spyder 4 software installs the newly generated color profiles at the correct location in the operating system automatically, for immediate use. However, there are times when you might like to switch between profiles. To change a display profile in Windows, launch Settings/Control Panel/Display in the monitor configuration dialog, selecting the tab "Settings", where you can then select the Advanced button to enter a new dialog. Select the tab "Color Management" and select from the available profiles. Under older Windows OSes, applying the profile this way may not flash the necessary calibration data to the video card. So it is recommended that you use the Datacolor tool "Profile Chooser", described earlier, for profile changes.



Switching Profiles in Mac OS X

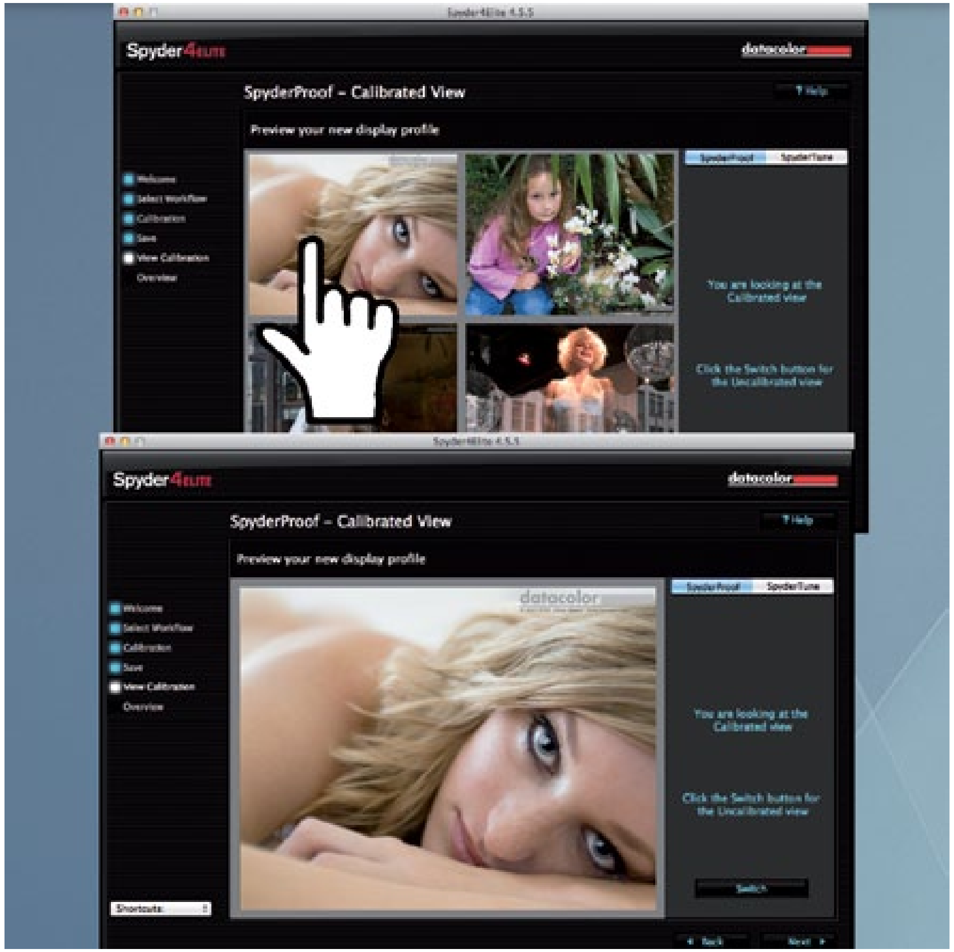
The procedure on the Mac is user-friendly. Under the Apple menu, select "System Preferences", click on "Displays", and select the tab "Color". Then, select from the list of profiles to change your display's assigned profile. This will automatically update the video card data as well as change the profile.



SpyderProof

In the before/after view in SpyderProof, you can compare the reference image's appearance before and after calibration. The After view is displayed initially, to show the results of your calibration. A click on the button Switch shows the image in the Before view. Please note that Before does not refer to the previously loaded profile, but an uncalibrated state, showing the original appearance of the display with no video card adjustments.

Typically the largest differences will be in densities, noticeable in highlights and shadow details, and in white balance. Wait a moment after switching, and your eye will adapt to the new white balance. Switch back, and it will adapt to the other. This is why a device should be used to define white balance, instead of doing it by eye.

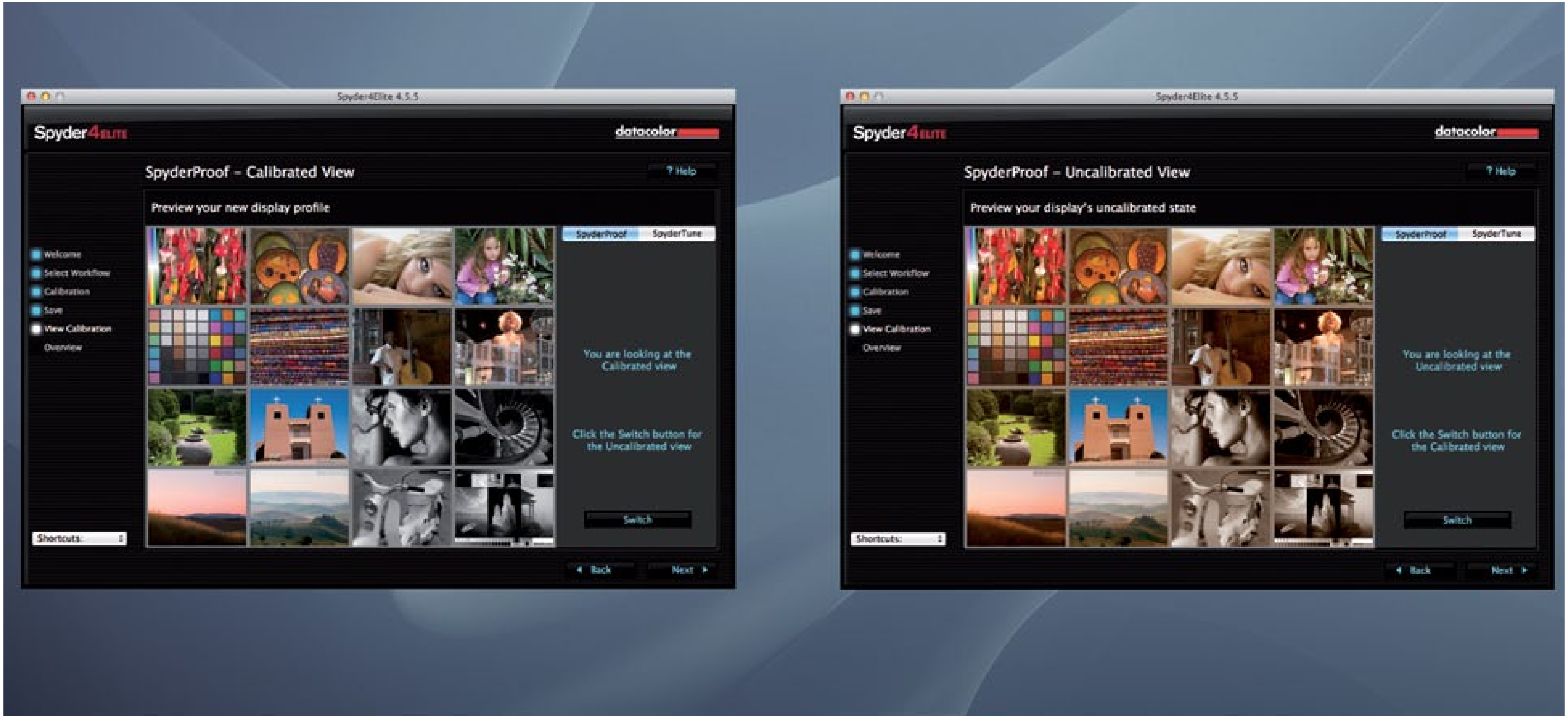


calibrated

Monitor profile from manufacturers

In the SpyderProof view, the sixteen images displayed are divided into four quadrants: saturated colors, skin tones, landscape, and black & white. Each of the 16 images shows certain characteristics, which are explained in detail in the online help of the program. You can click on a quadrant to zoom in on the four images in the quadrant, and click to zoom again to an individual image. For analyzing gray balance, use the B&W quadrant, so that bright colors do not distract your eye. The Switch button switches the calibration state, so that you can compare the Calibrated and Uncalibrated views.

Two of the 16 images will be shown, with two copies of each image side by side. In the sample shown here, the top image contains a synthetic gradient of magenta, blue, cyan, red, yellow, green and black. These can be used to verify any out-of-gamut colors, to learn which shades can be shown by your display. The Datacolor B&W Test Image shown below the color image contains a wide range of pictorial and graphic elements. View the enlarged section, above each image, to check highlights and shadows.

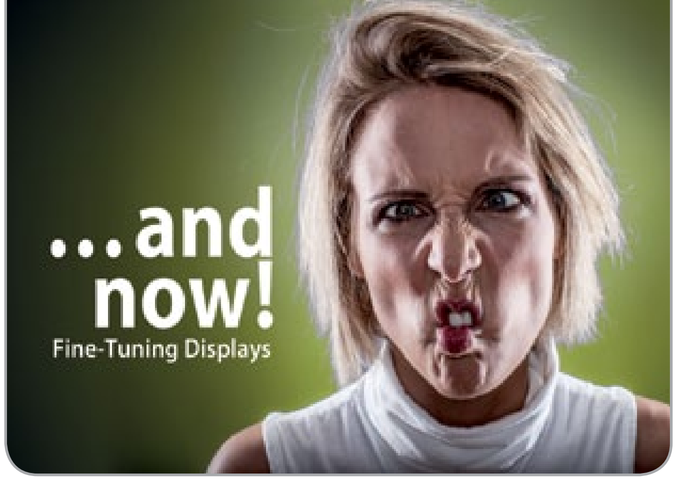


Profile Overview

At the end of the calibration process, a graph of the display profile is shown. This allows you to compare the color range of your display with the photographic color spaces sRGB and AdobeRGB, as well as with the video color space NTSC. You can also load other display profiles, and compare their respective color gamuts. This helps in comparing displays when making purchase decisions, and also in deciding how to color manage multiple displays in one environment.

Some displays may not meet the standard chosen for studio, and these displays should be moved to supporting uses where color is not critical. Otherwise, in order to match all displays, the best displays would have to be brought down to match the least capable display. If you are considering such actions, be sure to read the next section, Fine-Tuning Displays.

Chapter 4: … and now! Fine-Tuning Displays



...and now!

Fine-Tuning Displays

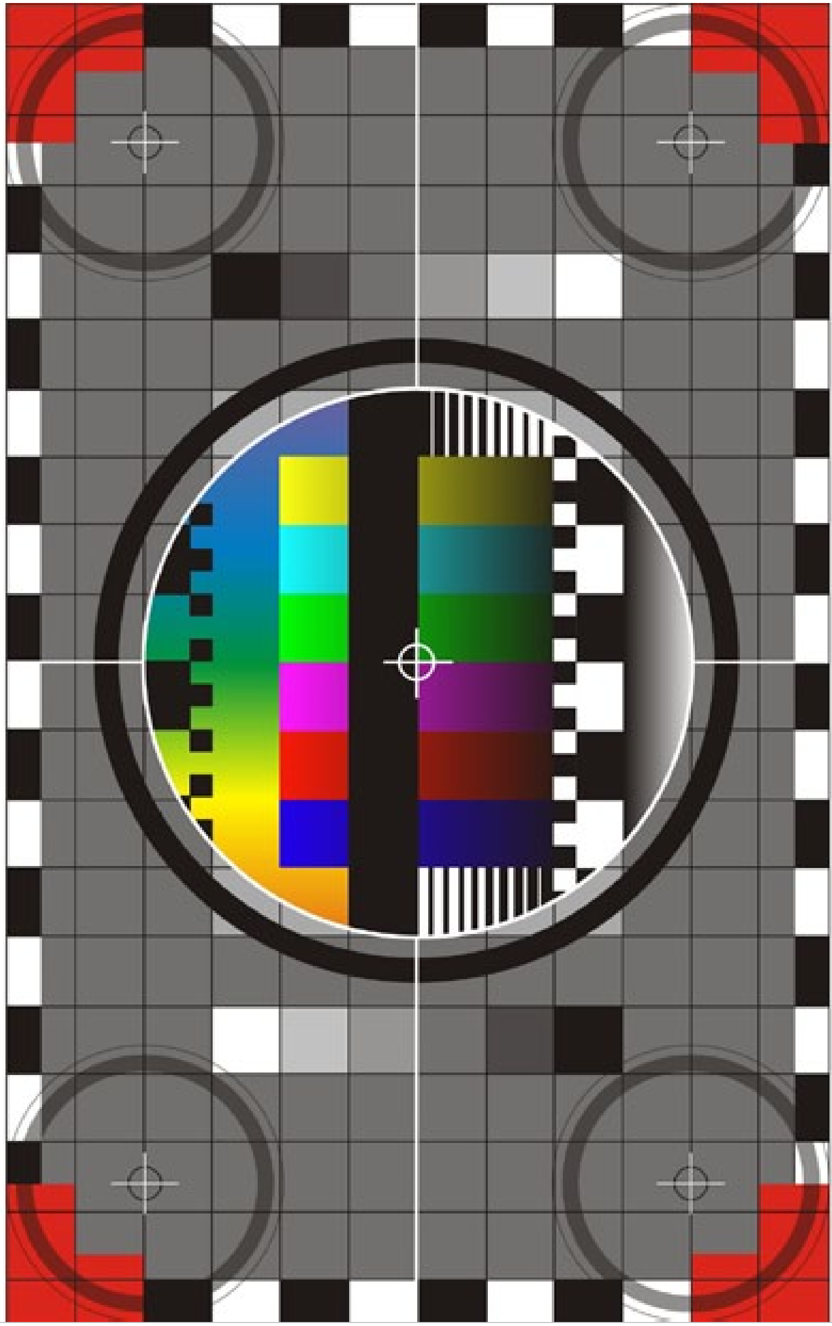


Photo: fornok_de-fotolia.com

Calibration Requirements

A display is not simply calibrated; it is calibrated to a standard. The standard is chosen during the calibration process, according to the needs of the user's specific workflow. Someone who uses the display for editing photographs to be printed later on an inkjet, dye sublimation printer, or at a photo lab has an easy job of selecting the target for the display's calibration, because the color space of the workflow defines an obvious choice for the display calibration target. The standard calibration is then done for a typical photographic workflow: gamma of 2.2 and a white point of 6500 Kelvin.

The same applies to photos being prepared for the Web or mobile uses; for example to present as an online gallery or PDF.

It's more complex if you have to edit photos for photo printing, plus the Web, as well as for offset printing; such as magazines, books or newspapers. In some cases, this complex workflow might work best using two different display profiles; one for the photographic workflow and a second to use for evaluating images for prepress.

The reason for the use of two different display profiles is that different workflows have different standards, and our goal in evaluating images is not only to see them correctly on our own displays but to prepare them correctly for sending to various service and output providers. These other providers may use different standards.

If you want to edit video, you might even choose a third display profile that matches one of the standards for video. There are also a few specialty applications, such as output to film writers, who use their own special workflows and standards.

TIP:

To learn about the advanced settings mentioned above, go to Advanced Settings from the Calibration Settings screen, then select the Help button, and see the section Help that discusses display calibration settings in detail.

Target Settings

You can see the list of available standards in this dialog. Here you set the combination of color temperature, the setting for how warm or cool the colors are displayed; and the gamma, which controls contrast. Both sRGB and AdobeRGB use a combination of 6500 Kelvin color temperature (corresponding to daylight at noon) and a gamma of 2.2 (or a slight variation of that in sRGB). For those who work in prepress, where standards are based on the color temperature of the D50 standard, you may calibrate 5000 Kelvin (if your work space is very dim; in brighter environments this will appear slightly yellow), and in certain cases a gamma of 1.8 (which is becoming less common over time). A click on the “Advanced” button allows further adjustments.

Pro Feature: Gamma

In most cases, the gamma is set to 2.2. This is also the default value for both Windows and Mac OS X. In prepress workflows, in order to bring out more detail in the shadows on the display, a gamma of 1.8 may be used. Higher gamma values result in a more saturated color reproduction; so one solution is to use L-Star instead of a numerical gamma curve, to open shadows, without significant change to color saturation. Softproofing can compensate for color saturation issues, but has difficulty adding shadow detail, which is why some workflows use L*, gamma 2.1, gamma 2.0, or in some pre-press workflows, gamma 1.8.

Profile Settings: Custom Gamma Settings

If the preset gamma values do not match your needs, you can define custom gamma values in the Advanced section. Any value between 0.5 and 3.0, including two digits after the decimal point can be used.

Glossary: Gamma & Tone Response Curve

Gamma describes the increase in the mid-tones in the image. Black remains black, white remains white, and all other values follow the gamma curve. Gamma refers to cases in which this curve can be defined by a single number. More complex cases, such as L-Star, are called Tone Response Curves instead of gamma values.

Profile Settings: White Point

When setting a custom white point, you're offered a selection from various presets between 4000 and 9300 Kelvin. Either use the factory default setting, or choose the settings closest to the gamma you will be using. Custom whitepoints can also be selected by x,y values, which allow adjustment in the red to green axis, as well as the yellow to blue axis covered by Kelvin values.

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Pro Feature: Luminance

When setting a custom white point, you're offered a selection from various presets between 4000 and 9300 Kelvin. Either use the factory default setting, or choose the settings closest to the gamma you will be using.

Pro Feature: Spyder Certification

The Spyder Certification setting defaults to Off, but color-critical users may choose to use it, especially for larger studios with multiple computers. Spyder certification enforces strict standards for calibration status, ambient light levels, and profile use, to assure that what you see on screen is correct.

Pro Feature: Gray Balanced Calibration

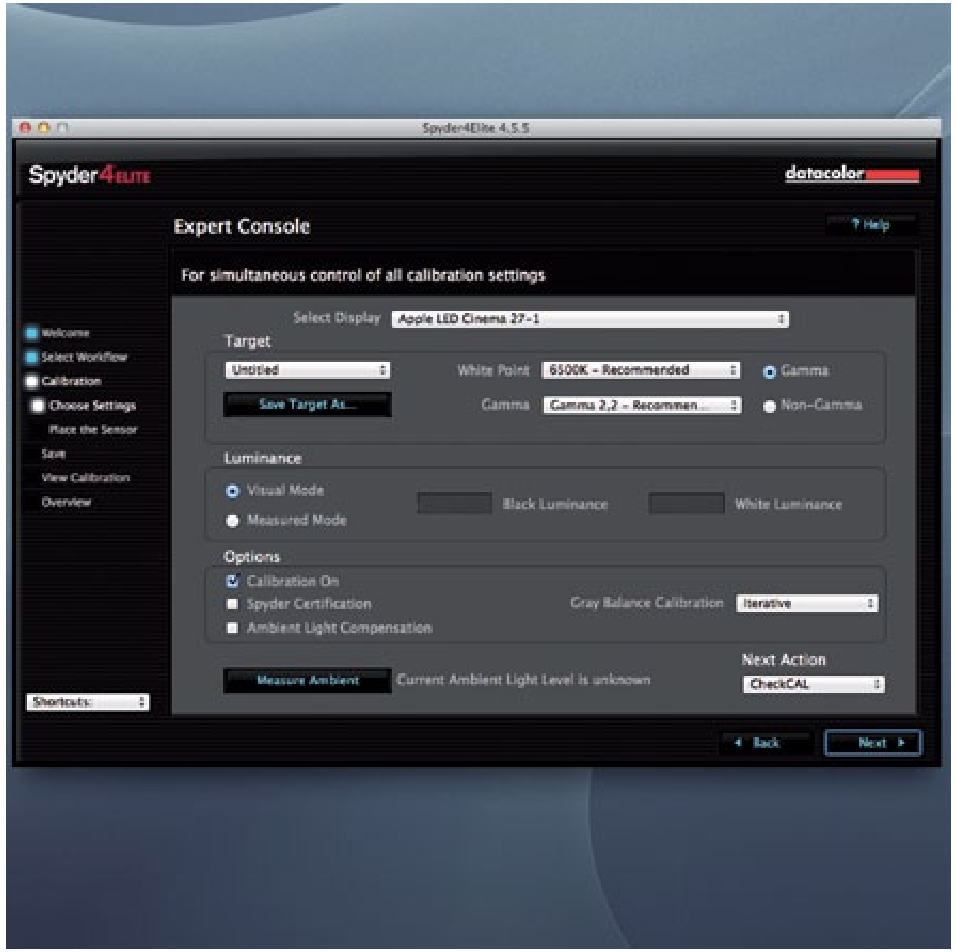
Color representation, especially for neutral tones, improves considerably when using the Gray Balance Calibration option in the Spyder software. There is also an advanced Iterative Gray Balance option, which offers even smoother, more neutral grays, at the cost of a slower calibration process. For projectors with LCD technology, optimizing gray balance improves the image quality. However, DLP technology does not work with this option, so it should be deselected when profiling DLP projectors.

Pro Feature: Ambient Light Compensation

Compensation for changes in ambient lighting is particularly important for people working long shifts, because ambient lighting can change significantly, affecting correct perception of the display. If you enable the option, the program uses the Spyder to measure the ambient light in the room, and warn you when it changes significantly. It is possible to make different profiles for different lighting conditions as you need them; but controlling the ambient light is the ideal solution.

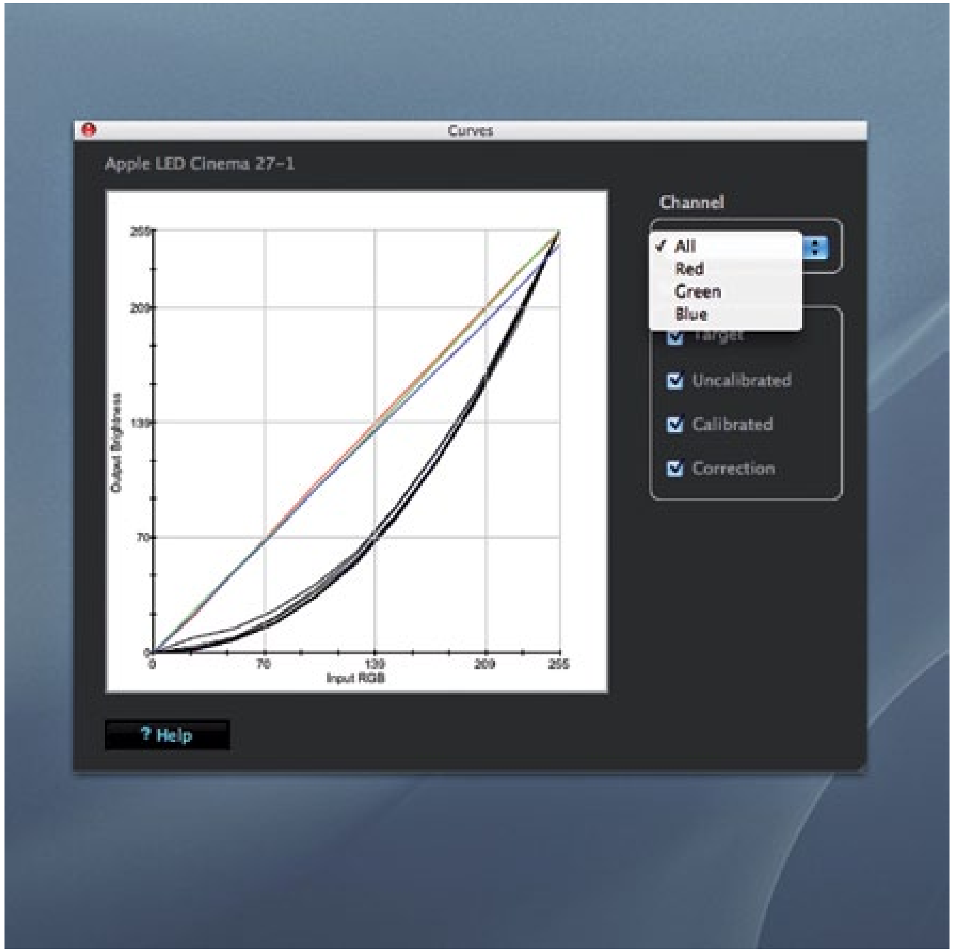
ReCAL & CheckCAL

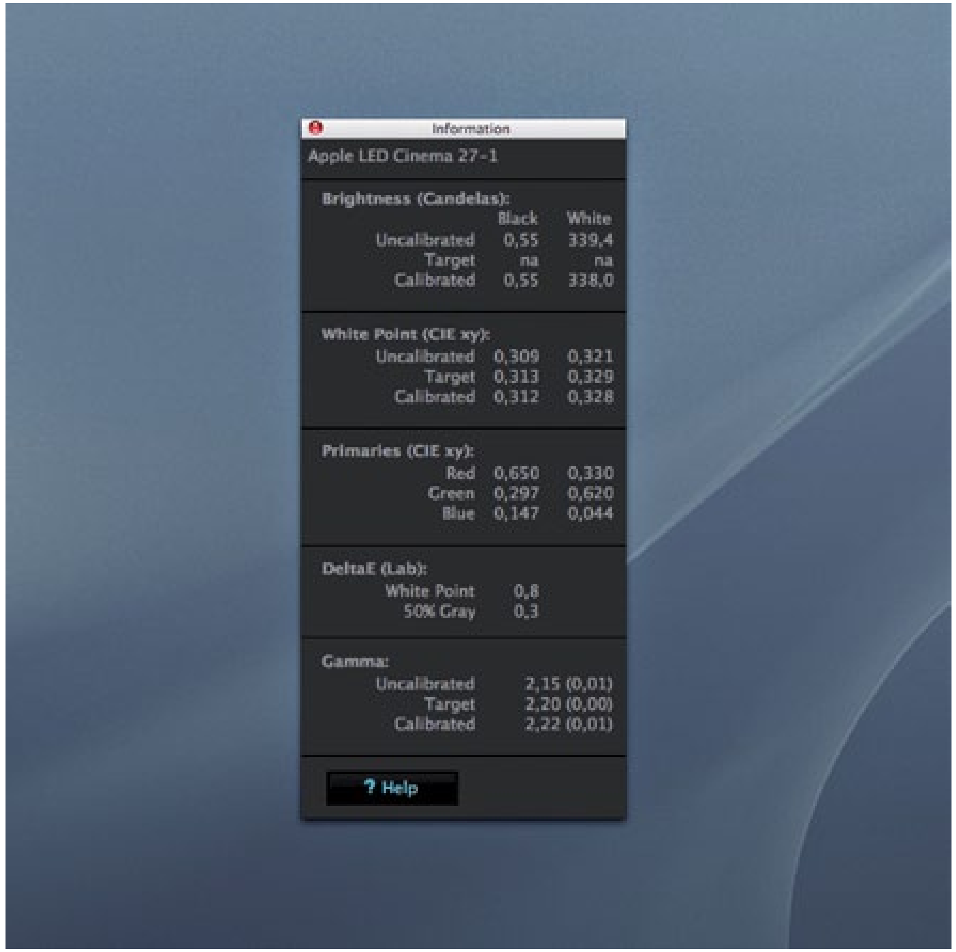
Once the display has been calibrated for the first time, you can use Check-CAL and ReCAL to shorten future calibration times to a minimum. If you retain your previous target values, it's possible to run a calibration check in about a minute. The result displays a current value for key parameters such as gamma, white point, black level and white level, compares it with the previous measurements and displays a Pass/Fail recommendation as to whether the differences are acceptable.



Expert Console

This console is designed for people who know exactly what they want to do and don't wish to follow the step-by-step process. On a single screen, you can access all the functions from the entire wizard-driven interface. This is a design typical of earlier color management software, designed by technical engineers for other technical engineers. Today, it's used mainly by system administrators and experts to save time.





Curves

The Curves dialog lets you compare uncalibrated, calibrated, correction, and target values for each channel or all channels together. It provides a technical overview of what happens during the calibration process. Here, you can see how far the output curves deviate from the ideal gamma setting and how far calibration can be adjusted to compensate. Also, you can see, after clicking on "Correction", which channels had to be lowered at white to get this result

Information

The measured values of the selected display are shown in the "Information" window. It displays information related to the black and white points. This information will not be useful to all people, but it can be used to track the luminance capabilities of a display, to know when it may be necessary to replace it.

TIP:

The values displayed in the information window can be printed by using the Print information command under the File menu. For even more info about your display, run the Advanced Analysis tests from the final screen.

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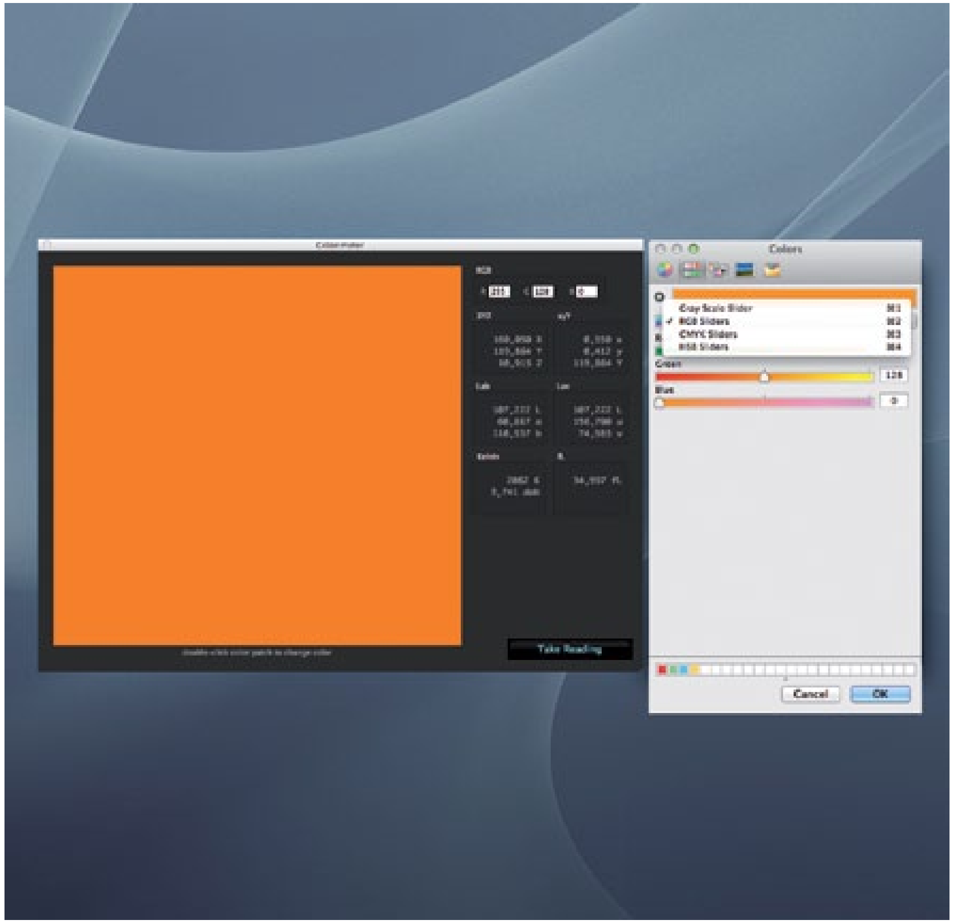

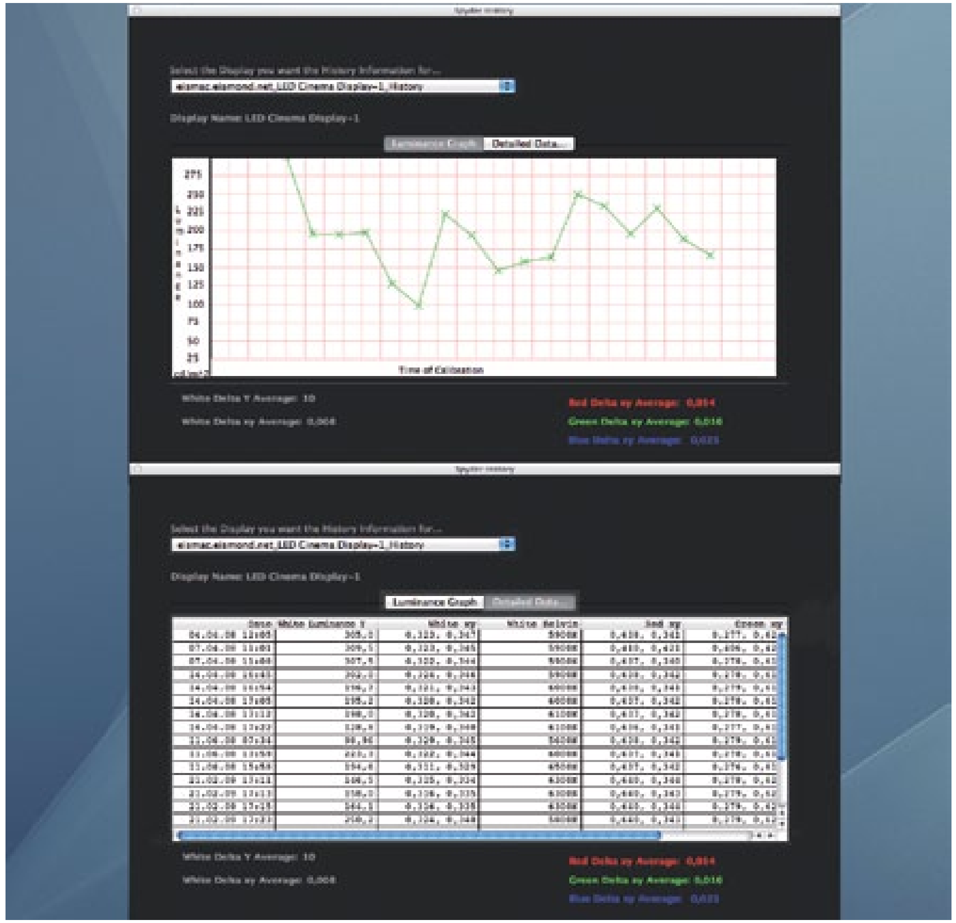

Colorimeter

The colorimeter measures any color which is entered as an RGB value or sampled onscreen using the color picker. You can use this capability to check color range and uniformity of a display yourself. Type in a maximum RGB value (such as 255, 0, 0 for red) and measure the result to see the display's color range, or use white (255, 255, 255) and measure first in the center of the display, then at the edges and corners, moving the sample window to different locations. You will see that the Kelvin value varies on a low quality display, up to 1,000 Kelvin. There are automated tests for these characteristics, and more, in the Advanced Analysis tests accessed from the final screen.

History

The chart shows the changes in the display over time. It shows a loss of quality as the display is used. Some variations in the timeline may be caused by measuring the display before it is adequately warmed-up.

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Photo: svedoliver - Fotolia.com

Advanced Analysis

To calibrate displays within the context of their individual capabilities, with or without fine-tuning, is the main goal. We should calibrate each display, so it will show everything it's able to show.

Yet, even with the best calibration of the display, what the display is physically incapable of showing is not revealed. Typically, this does not affect users, because they don't see what the display can't show.

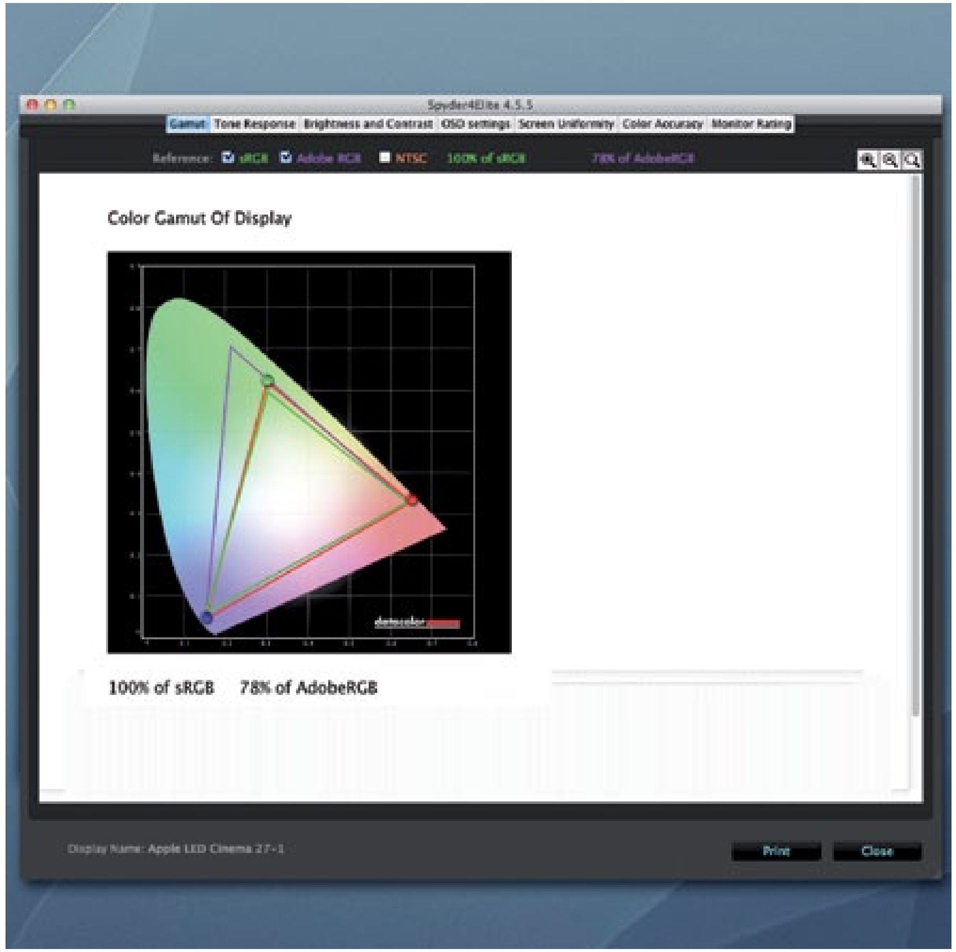
Advanced users already have a sense of what can and cannot be viewed on a display of a certain quality. They will also be aware that variations occur with different locations on the screen, and that this occurs to larger degrees, with lower cost displays.

Also keep in mind that displays age. Over time screens lose brilliance, color fidelity, brightness and contrast. This is not welcome news, but accepting it, and tracking these changes, allows a reasonable schedule for display replacement to be planned.

Those who are seriously concerned about color accuracy should examine their display's quality. The tools the Spyder provides for this examination will be shown in the next pages. Find these functions at the end of the calibration cycle after SpyderProof under the heading Advanced Analysis.

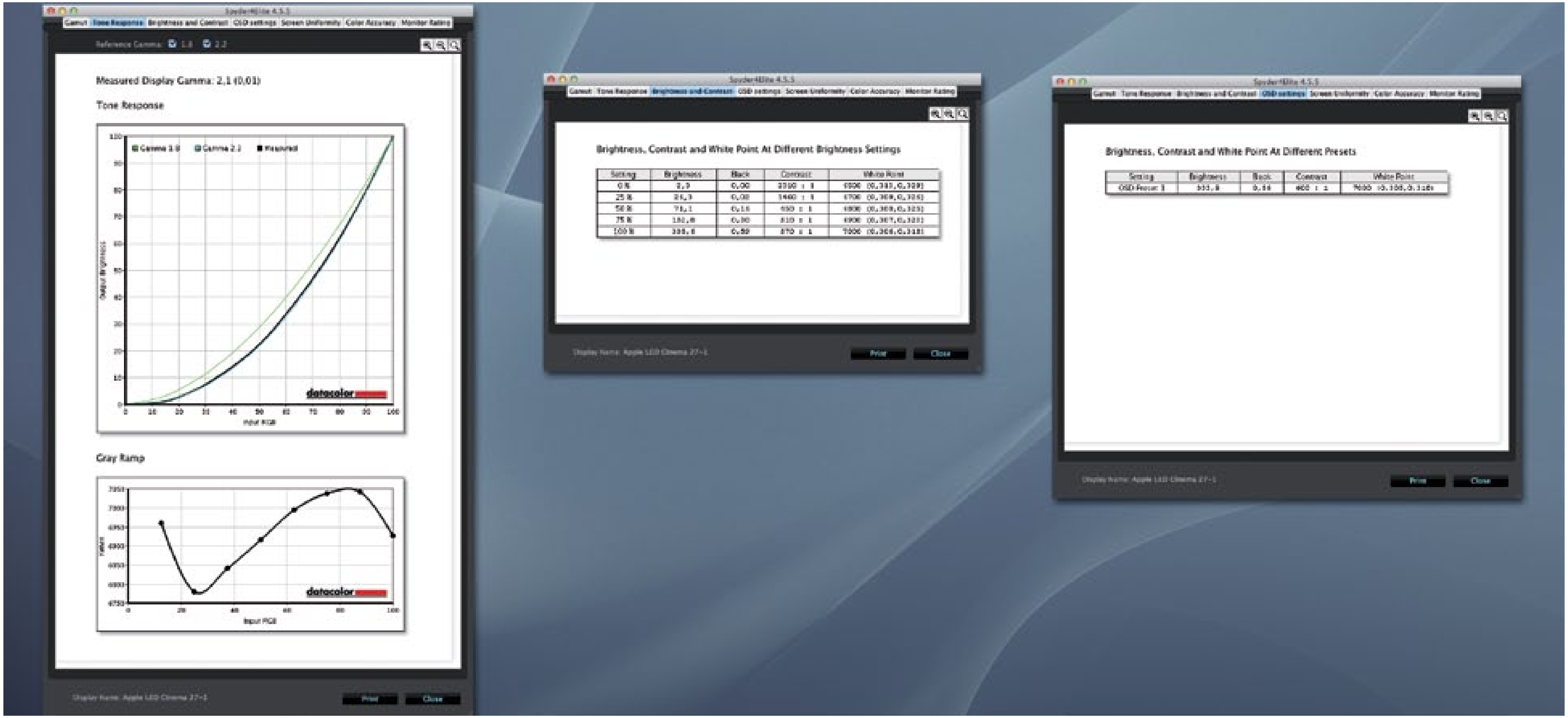
Advanced Analysis tools

The Advanced Analysis tools offer six different tests: for color gamut, representation of tone, brightness and contrast, the white point at various OSD settings, screen uniformity, as well as the color accuracy of your display. These tests can be performed individually or sequentially. Please note that performing all the tests takes at least 15 minutes. Investing this time will give you a very specific idea of what your display can do. Comparing this to the results from a year later will show you how your display has aged.



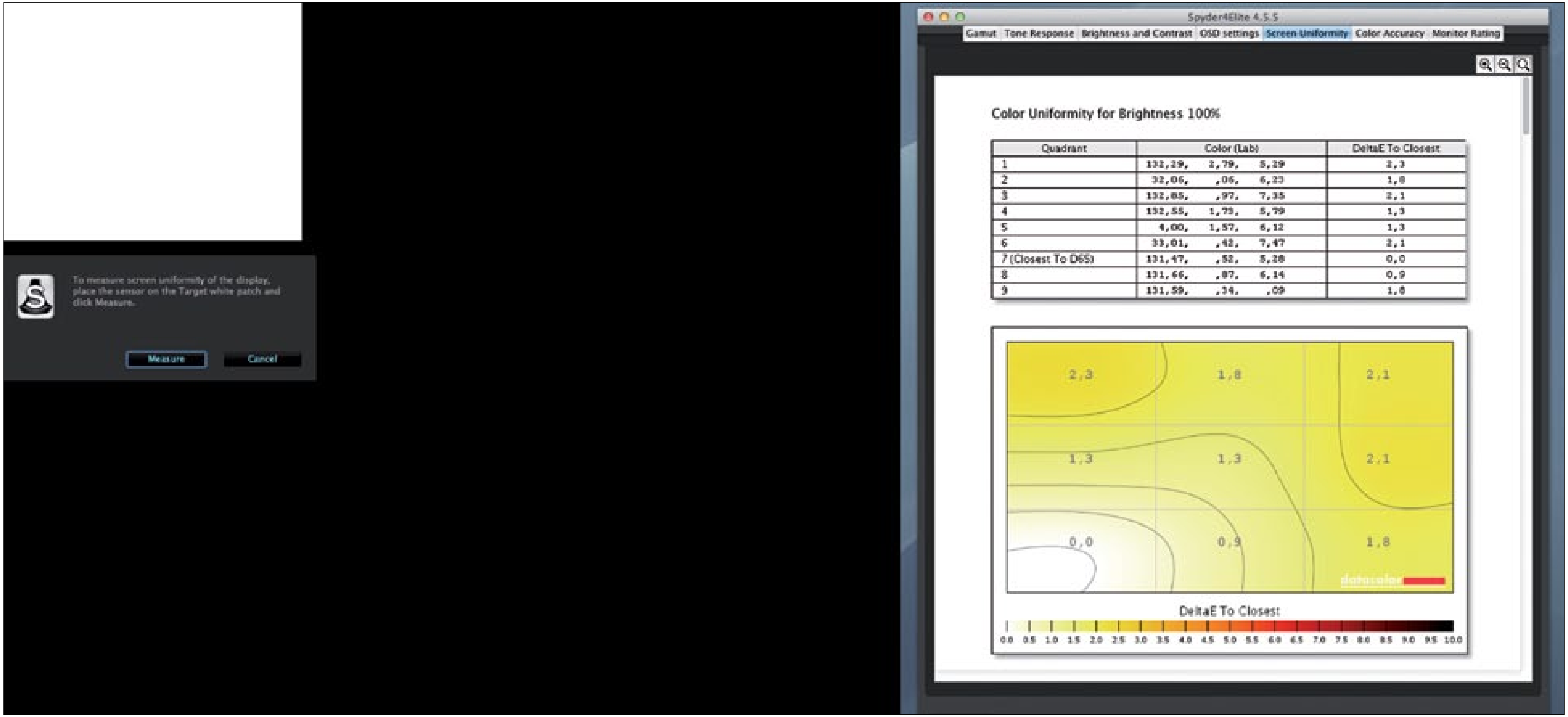
Color Gamut

Over time colors are not as bright or intense as when the display was new. Loss of display brightness causes reduced luminance and contrast values. This window shows the percentage of our color reference spaces that the display can show us.



Tone Response, Brightness & Contrast, and OSD Settings

In a nutshell, the following three tests for tonal brightness, contrast, and OSD (on-screen display) settings are best done together, because they give a good sense of how your display has been affected by the aging process. Special attention should be given to measuring the white point using various display presets, accessed through the OSD, on initial calibration. These presets adjust the display firmware. In many displays, you can select factory presets for video games, office work, photo editing or other applications. Although these presets are often targeted to the consumer, and are not calibrated to the specific display, they also provide an important aid to the advanced user. This analysis function can be used to determine which preset is closest to the desired calibration goal. Choosing this setting means the custom calibration and profiling have to do less work and can bring out the maximum tonal gradation from the display hardware. The result is a better quality display profile, and better image-display on screen.



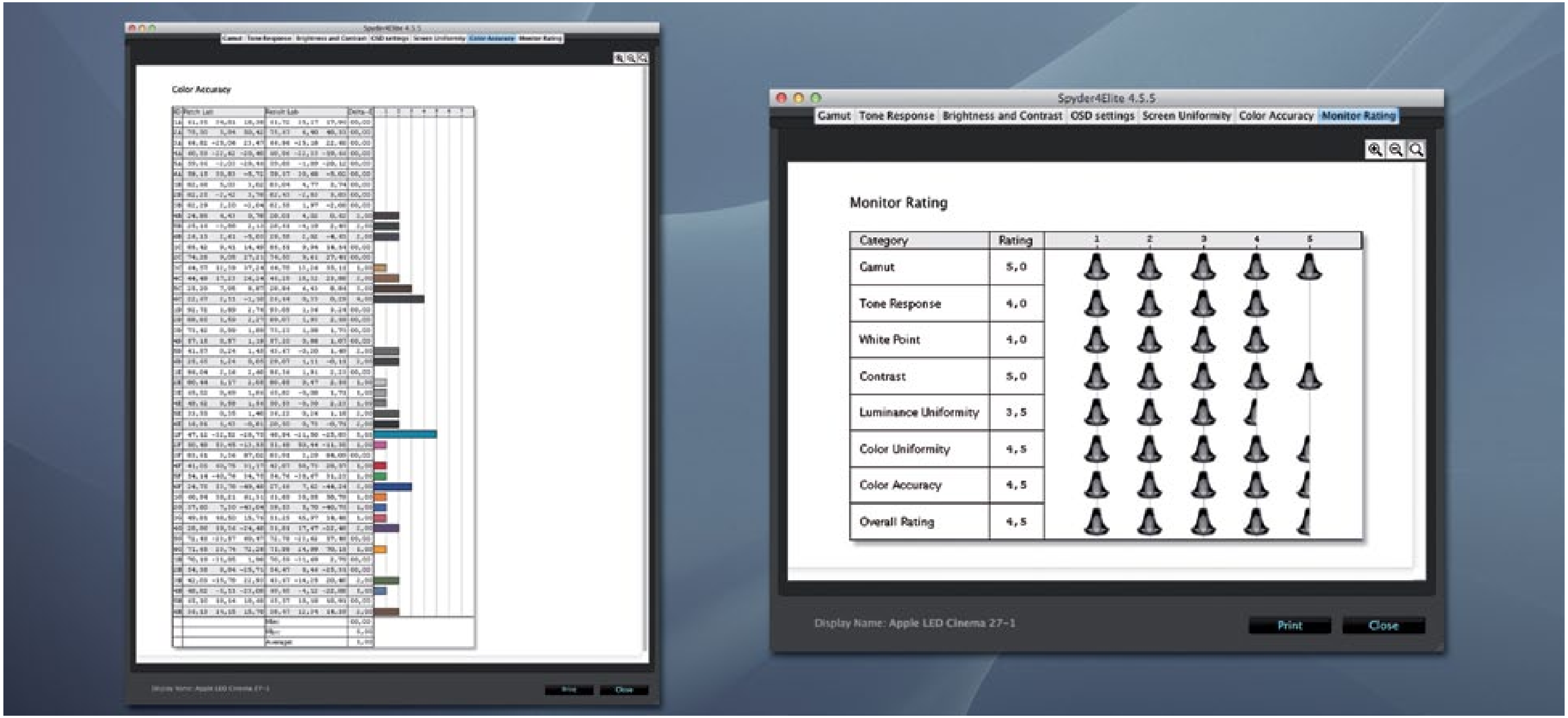
Screen Uniformity

To properly judge the color and densities of an image you should know your display from the center out to the edges. This way, if necessary, you can move the edges of an image to a more central location to be certain you're making good judgments and appropriate adjustments.

The uniformity of the screen refers to the evenness of the color and brightness from center to edges and corners. Displays vary considerably in how evenly backlit they are. One of the justifications for the higher cost of advanced imaging displays is improved uniformity.

TIP:

By being aware of your display's brightness and color uniformity, you will know if you need to shift images on-screen to evaluate image color and densities in areas displaying in corners of the screen.



Color Accuracy

This test will show how accurately specific colors are reproduced on the screen. It includes three sequences: of 12, 24, or 48 colors, derived from the Datacolor ColorCHECKR target. The selected set of colors are displayed and measured, then analyzed to show the deviations for each color. Results are numerical, as well as visible: the longer the bar, the worse the deviation from the desired color.

various categories, complete with visual ratings. It offers a convenient tool to compare different displays to determine which offers more accurate color.

Calibrating two displays

Many photo editors and graphic designers work with two displays. It is not uncommon to use both screens for color critical work, instead of reserving one just for palettes.

Even two identical displays may not match visually, without calibrating and profiling both displays. However, in order to use two displays with two different ICC profiles, you will need a video card designed to work with two displays and to manage two different color profiles.

Alternatively, one can also work with two graphics cards, although, when used in older Windows systems, these cards should be identical. Unfortunately, under Windows, many video cards support attaching two displays, but only one color calibration. Technically, they only hold one "color lookup table" (C-LUT) to give to the operating system for both displays, which can be overwritten by calibrating either of the displays. There are cards that operate with two LUTs, and you should check to see that your card is one of them. When testing, be sure you have the latest version of the driver for your graphics card.

The use of multiple, profiled displays, with a few issues noted above, is supported in Windows operating systems since Windows XP. Apple has supported multiple displays for much longer. There are new challenges in multiple-display profiling in recent OS X versions. Using the latest Spyder software helps assure that these issues do not affect your results.

It is important to check that both displays are set to the same target values, so the same color temperature, gamma, and brightness will be used. If the system or the hardware is not willing to accept two different profiles, then the compromise is to calibrate only the main screen. However, to assure that the "palette" display does not bias your color perception, set it to a lower brightness than the main display.

The SpyderTune feature can be used for visual fine-tuning of two displays. Even though both displays are calibrated, your eyes may perceive them differently, due to the different technologies used in different displays; and in some cases even in displays of the same make and model, as parts may come from multiple suppliers.

Calibrating a Studio

Most studios have a series of older and newer displays. In a typical studio there are three basic computer setups: One or more relatively new, fast workstations with higher quality displays, one or more decommissioned computers with older displays, which run mainly as office computers or batch servers, and one or more notebooks used for travel or presentations, as well as office work. On each of these devices, the photos will appear differently, even if they are calibrated and profiled.

Higher quality, newer displays often have a wider color gamut and smoother color transitions. Calibration does not improve these factors, it simply standardizes the presentation of color. When a poor display is calibrated, it is now neutral, but it still has gamut and smoothness limitations.

All displays can be adjusted to the same brightness and contrast, but this requires matching them all to the lowest quality display in the group. After such calibration, the displays will look similar, but the better displays will be limited to the brightness and dynamic range of the least common denominator. So choose wisely when deciding what displays to include in a Studio Standard to avoid excessive reductions in the better displays. Laptops are best calibrated separately.

The function used for this process is StudioMatch. It measures the luminances of each display you wish to match, then brings them to a common denominator. All monitors will then show colors uniformly, but with the brightness and contrast of the weakest display.

Photo: Jens Rufenach

Projector Calibration

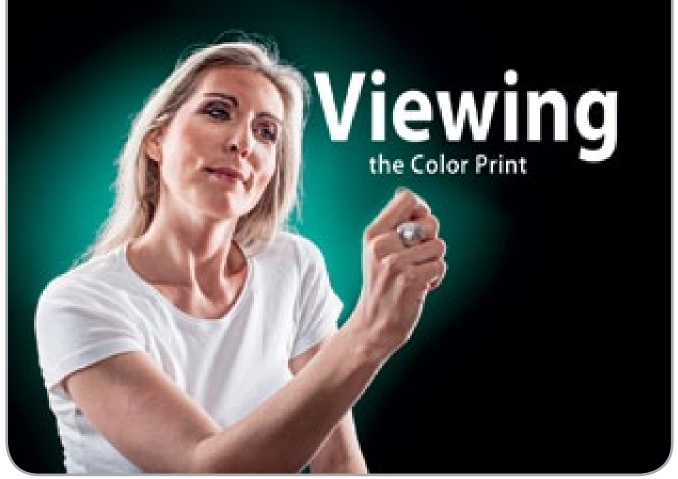
Calibrating a projector functions similarly to calibrating a monitor. Ideally, when you connect a calibrated projector to another computer, you should recalibrate and reprofile; but moving the ICC profile from one laptop to another using a USB stick can be done, especially with Mac laptops, where the video standards are more consistent.

Spyder4ELITE is the only level of Spyder product that calibrates projectors. The Spyder is mounted on a tripod or light stand, and placed 12 inches from the screen, with its sensor pointed at the screen. The Spyder will not only measure the colors of the projector, but at the same time take into account the screen's color properties. When calibrating a projector, the software throws a cross hair on the screen, for aligning the Spyder. The Spyder will cast a shadow on the screen. The sensor measures a large screen area, so the shadow is not a problem.

TIP:

There is an option available to build three versions of the projector profile, the standard one, and two others for increasing degrees of ambient light in the room.

Chapter 5: Viewing the Color Print



Viewing
the Color Print

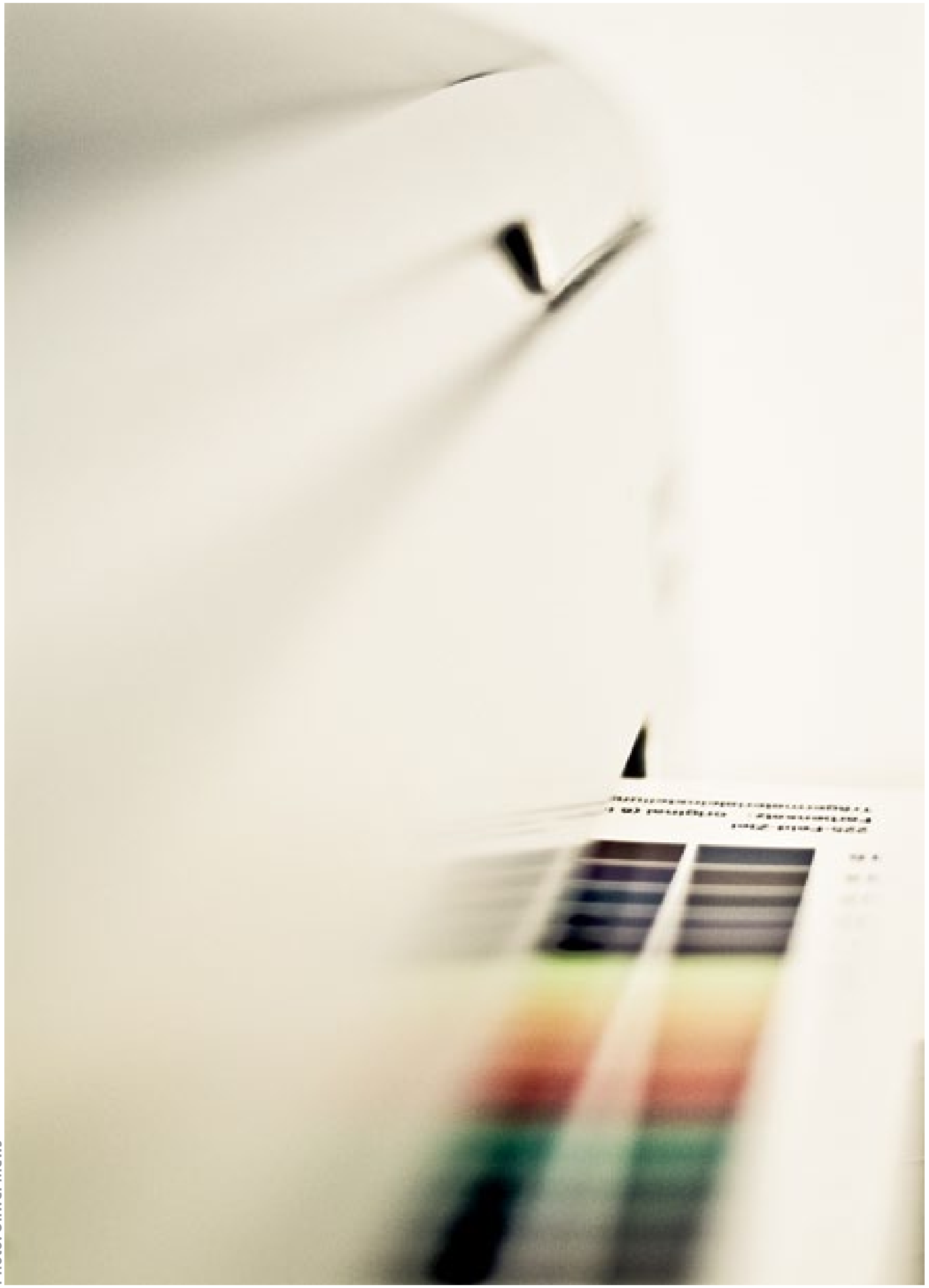


Photo: Oliwer Mews

Making Custom Printer Profiles

Unlike displays, which require frequent recalibration, most printing devices are consistent over time and their profiles can be used indefinitely. Changes due to head wear or ink settling may require eventual reprofiling, but in the short run, printer profiles are valid as long as the paper and ink don't change. The exception to this rule is laser printers, where toner density can vary with humidity.

Depending on the needs of the job and the aesthetic preferences of the photographer, resin-coated photographic papers, matte fine art papers, coated canvas, or offset press-proofing papers can be used in inkjet printers. These media are often changed frequently, from one to another and back again.

Working with different papers on a high quality photo printer requires custom profiles for each paper types. Unfortunately, generic profiles for general paper types are insufficient. Unique profiles are needed for the slightest differences in paper type, quality, and coating. At first glance, this may sound extreme, but think how differently an ink drop behaves on an open porous newsprint paper, compared to a smooth photographic paper. When the drop hits the photo paper, it keeps its shape and dries. On newsprint, the drop soaks in, spreads, and becomes less intense.

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Using different inks must also be considered. Original manufacturers' inks may or may not produce better color than less expensive replacement inks or popular refill systems. But there is no question that changing ink brands will require new profiles.

At first it's best to work with the original inks, papers and profiles provided by the printer's manufacturer. These are well coordinated with each other, and produce relatively reliable results in combination with a calibrated display. When there aren't any available profiles for a particular paper, such as when you buy different inks or choose to print on special papers, it's necessary to make custom profiles for every paper and ink combination. While it's possible to find profiles on the Internet for many printer and ink combinations, the most exact results are achieved with custom profiles, as these can be edited by hand and take into account the very individual characteristics of each printer.

Profiling a printer is very simple in theory: a special test chart is printed and the colors on the chart are measured. The measured values are compared to the original values sent to the printer, using special software, and a profile is generated from the comparison. In practice, printer profiling has a number of details that make it more complex than display calibration.

With the approach described here, printer charts with 225 or 729 color patches, with an option of 238 additional gray patches, are used, depending on the type of printer, and type of printing to be done. Be sure to use the EZ targets, if you are going to read them a strip at a time, instead of a patch at a time.

After printing the desired chart, it's measured with the spectrocolorimeter. A spectro, and profiling software such as Datacolor's SpyderPRINT, costs more than a display calibrator; but a combined display/print profiling bundle can reduce the individual costs.

This is certainly not for casual photographers, but will pay for itself quickly when used by advanced users, or anyone printing large images.

Best of all, modern color management solutions make it easy to return as quickly as possible to the real work – photography.

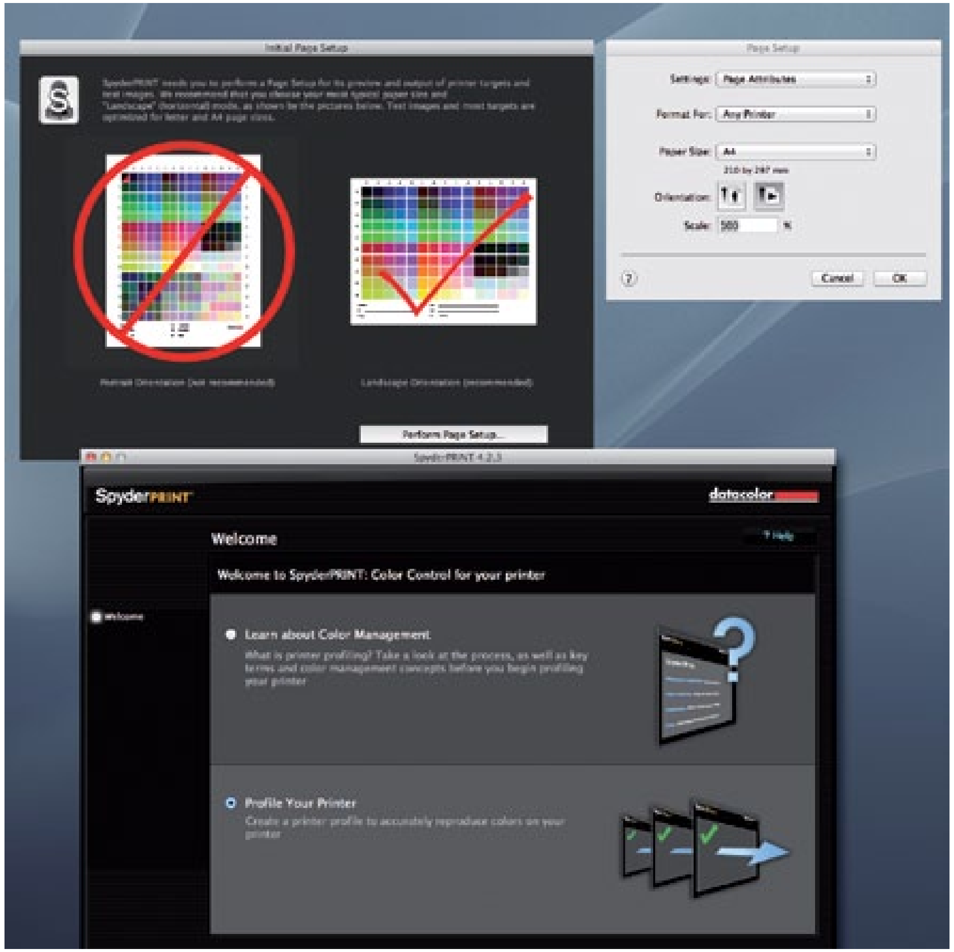
Photo: Oliwer Mews

When creating custom profiles, each strip must be read by hand. It takes a bit of practice to acquire the technique.

After installation, the new App will appear in your Applications folder. Checks for software updates occur automatically, if you allow that option on installation, or from the application preferences

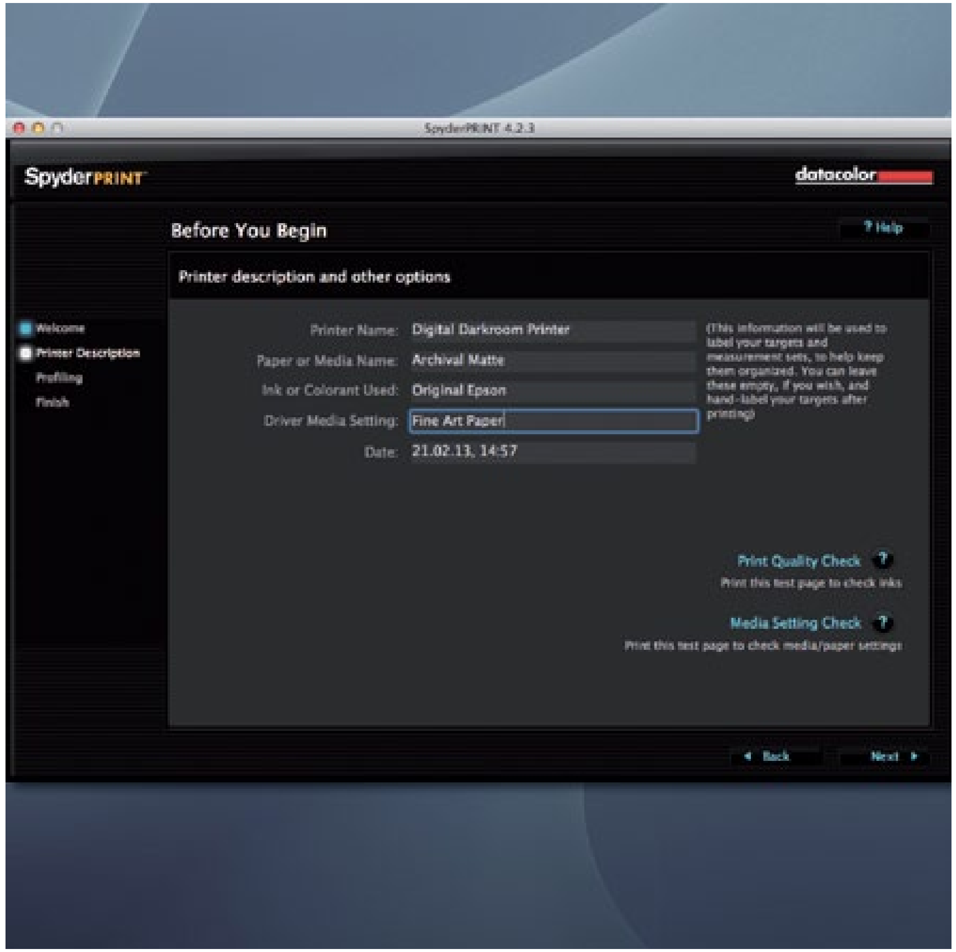
Difficult comparisons

FIf your print doesn't match your display despite careful printing after profiling, there can be various reasons. If the display is too bright, shadows will be artificially open. You should lower the display's brightness to a recommended 100-120 candelas when calibrating. In the end, displays still have different visual qualities than paper. In order to make your display's representation of the print more faithful to the original, you should use the soft proofing option in your editing applications. Using an appropriate proofing light will also improve results and consistency.



Page Setup

To start, the software asks you to adjust the page setup to print in landscape (horizontal) mode. If you are working on a larger format printer, it is simplest to use Letter or A4 size sheets for profiling. This avoids paper waste, and simplifies setup. Following page setup, follow the wizard, which will lead you step by step through the process of profiling.



Printer Specifications

You begin by entering the printer information needed for printing the target, which will be useful later. Ideally you will fill in four items; the printer name, the inks used (such as: matte black or gloss black), the paper being profiled, and the media setting used (which you will also need to use when printing through the profile). The date and time are selected automatically by the operating system. You then start the printer check routines.

TIP:

For those who know the process well, its okay to skip the Print Quality Check and Media Setting Check options, if your printer is in good shape.

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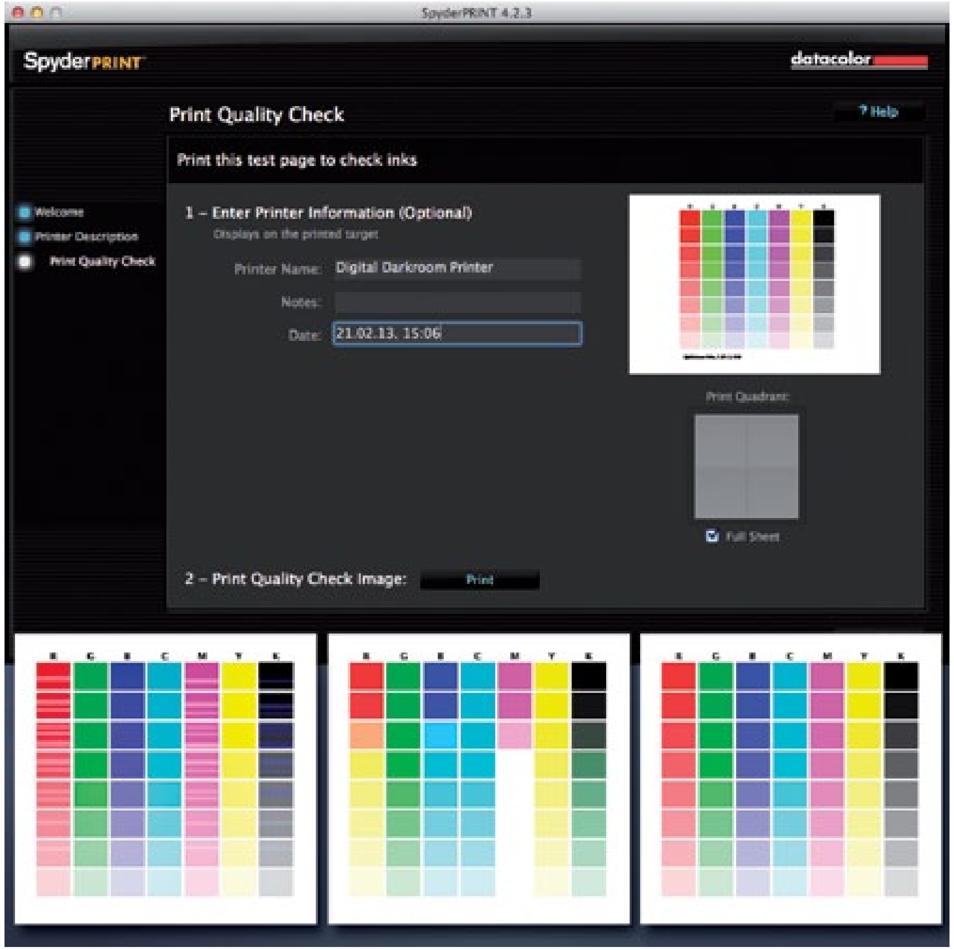
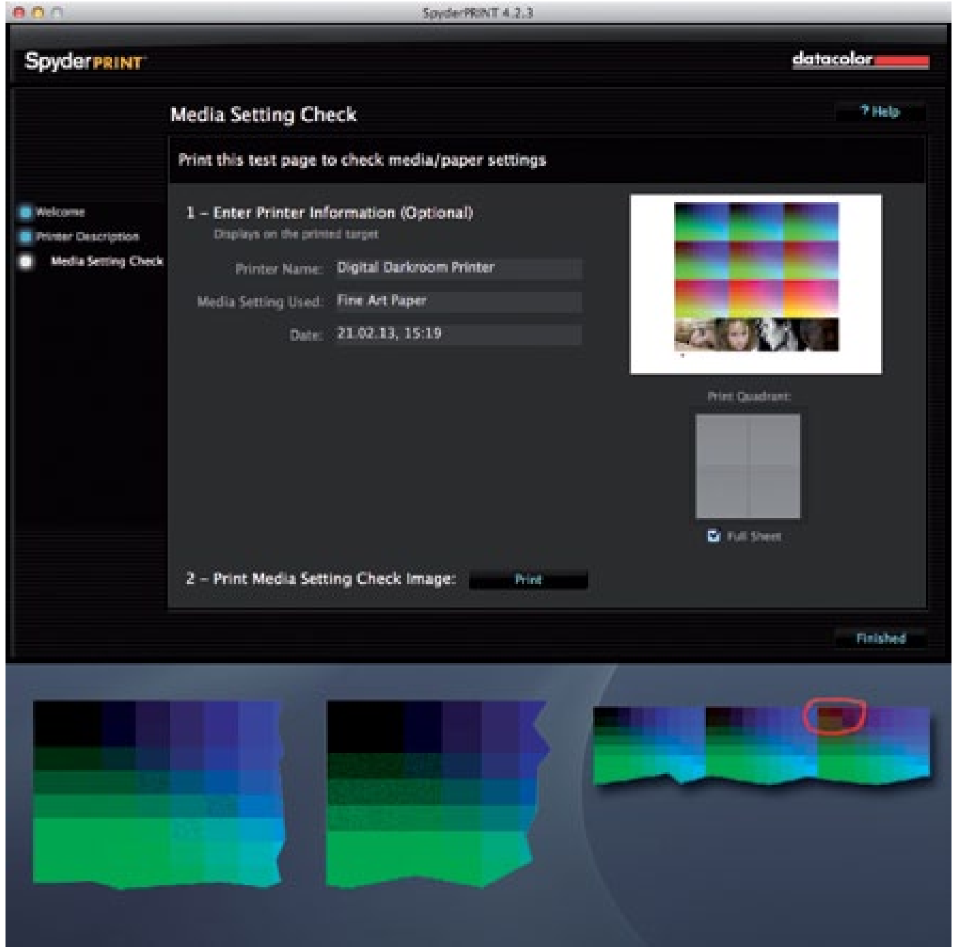


Checking Print Quality

If you have not used the printer for a while, you should test the print quality before profiling, to detect any clogs or problems in advance. You can choose to print on the center of the sheet of paper or on one corner in order to economize on media, and allow four tests to be run on the same sheet. In the images shown, on the left, the test image shows the red, magenta and black ink nozzles are clogged and must be cleaned with a printer utility. In the center, the magenta cartridge is almost empty. At the right, the print is correct.



Media Preference Test

If your printer driver offers you an option to set different media types, you can print up to four test images on a sheet with this dialog, to find out which driver setting gives you the best result. Experience has shown that the best media setting is not always the obvious one.

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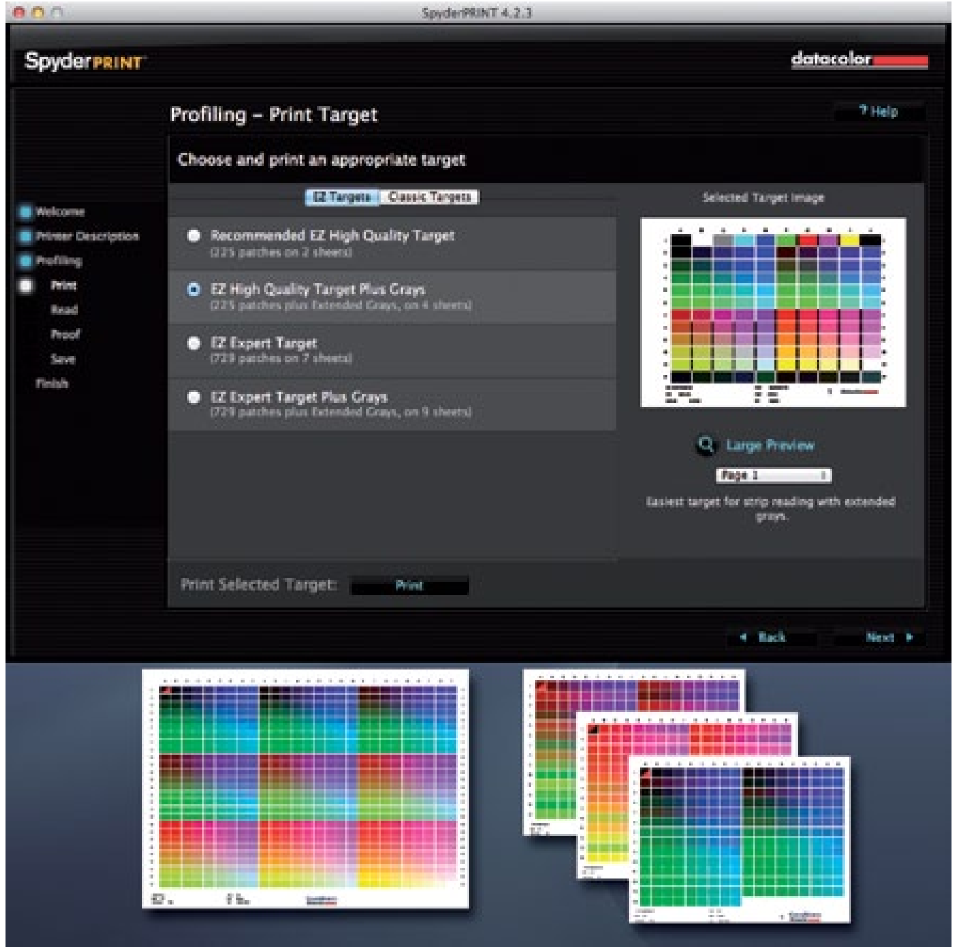
Starting a Profile

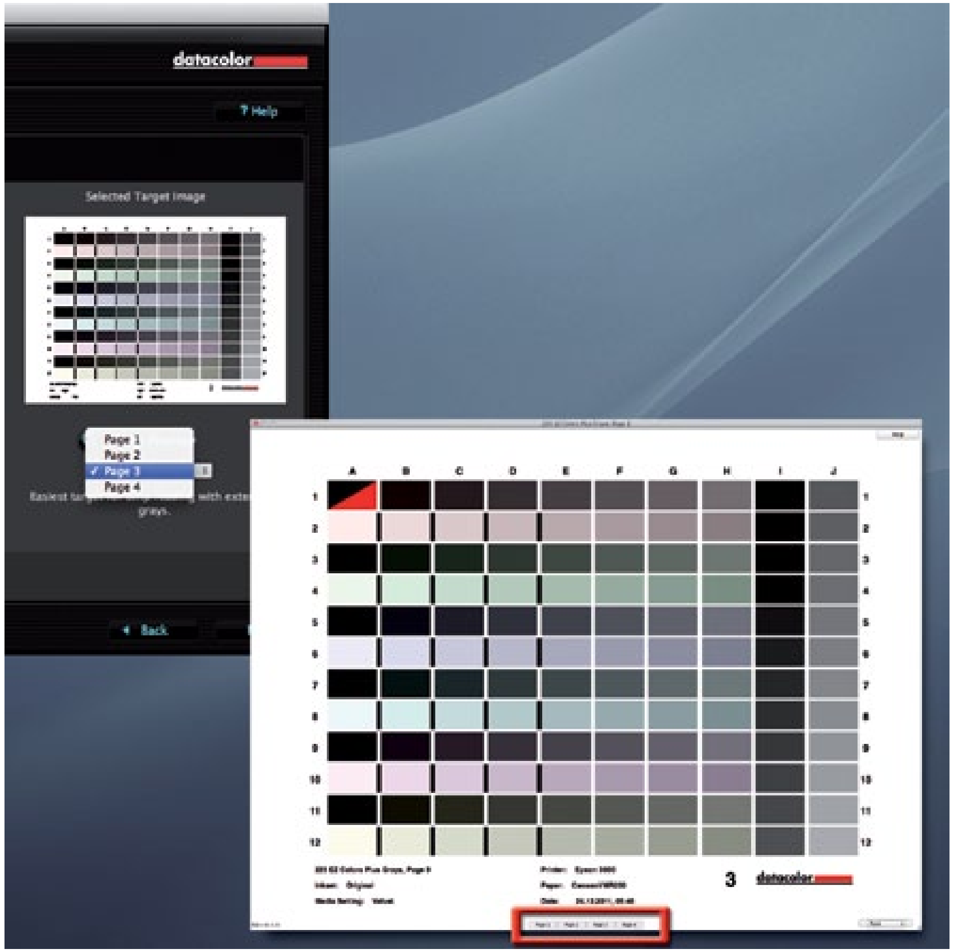
After you've checked your printer for functionality, in the next screen you choose to print a test chart or to continue measuring a previously printed and partially measured chart. It's also possible to reread a chart if you discover measurement errors that you'd like to correct.

In this dialog you specify how many patches are printed on your test chart. Some demanding uses or problem printers need 729 patch profiles, but 225 patch profiles work well with recent graphics-quality inkjets.



Choosing a Target

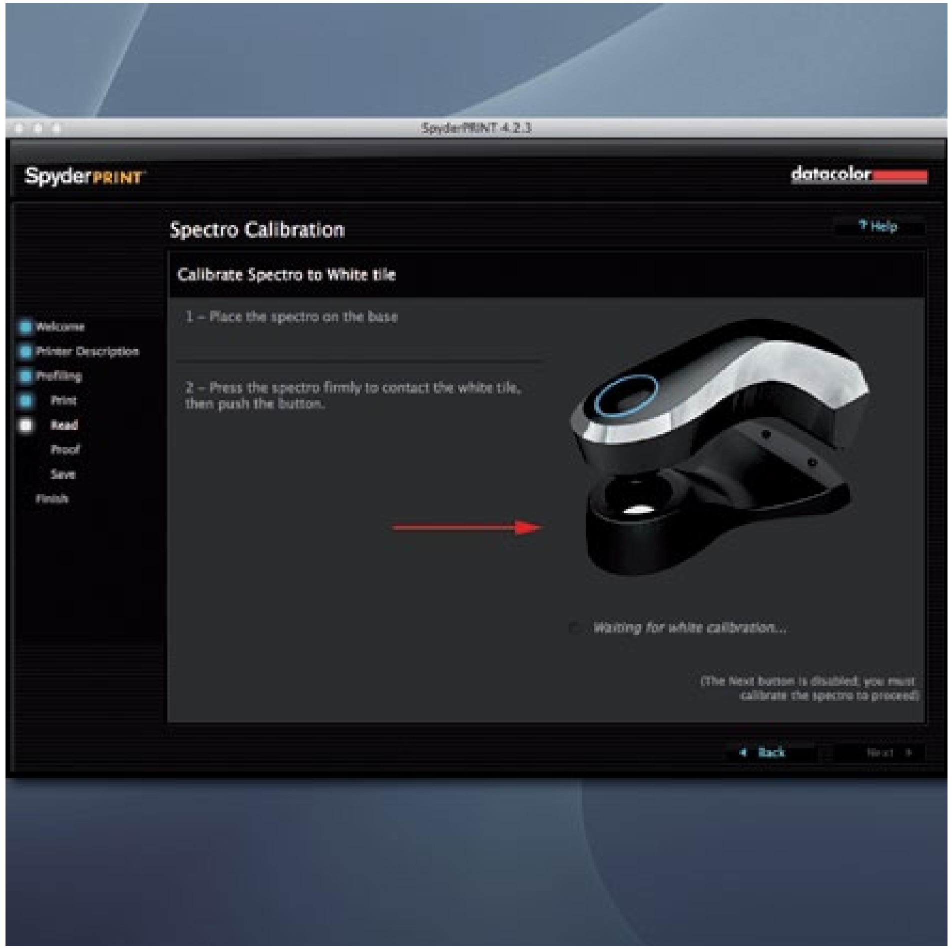
Those printing in black and white should add the "Extended grays" option, totally either four or nine pages. The EZ Targets are prepared for fast strip reading. Classic Targets are designed to read each patch individually, which takes more time but saves paper, through reduced patch size.



Previewing

The preview function on the right side of the dialog box is very helpful. Using it, you get a clearer idea of what is printed, at which setting. For example: for a view of the targets for Advanced grayscale, select "Page 3". Use the buttons at the lower edge of the screen to move between sheets.

To calibrate the spectrocolorimeter before use, set it on the supplied calibration base. Set the head of the instrument over the white reference tile, and make sure the rear of the instrument rests correctly on the base.



Device Calibration

Press briefly on the front of the device to read the reference tile, and if the measuring has succeeded, you will hear a click tone to confirm the completion of the calibration process.

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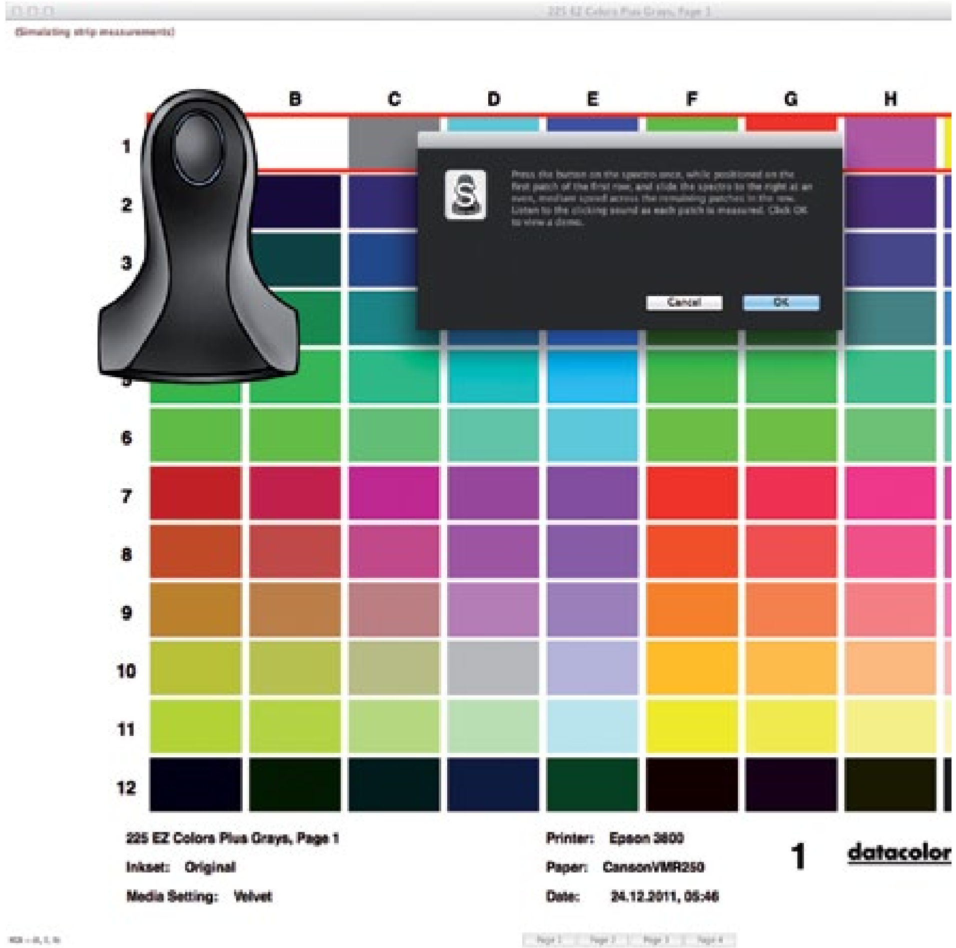
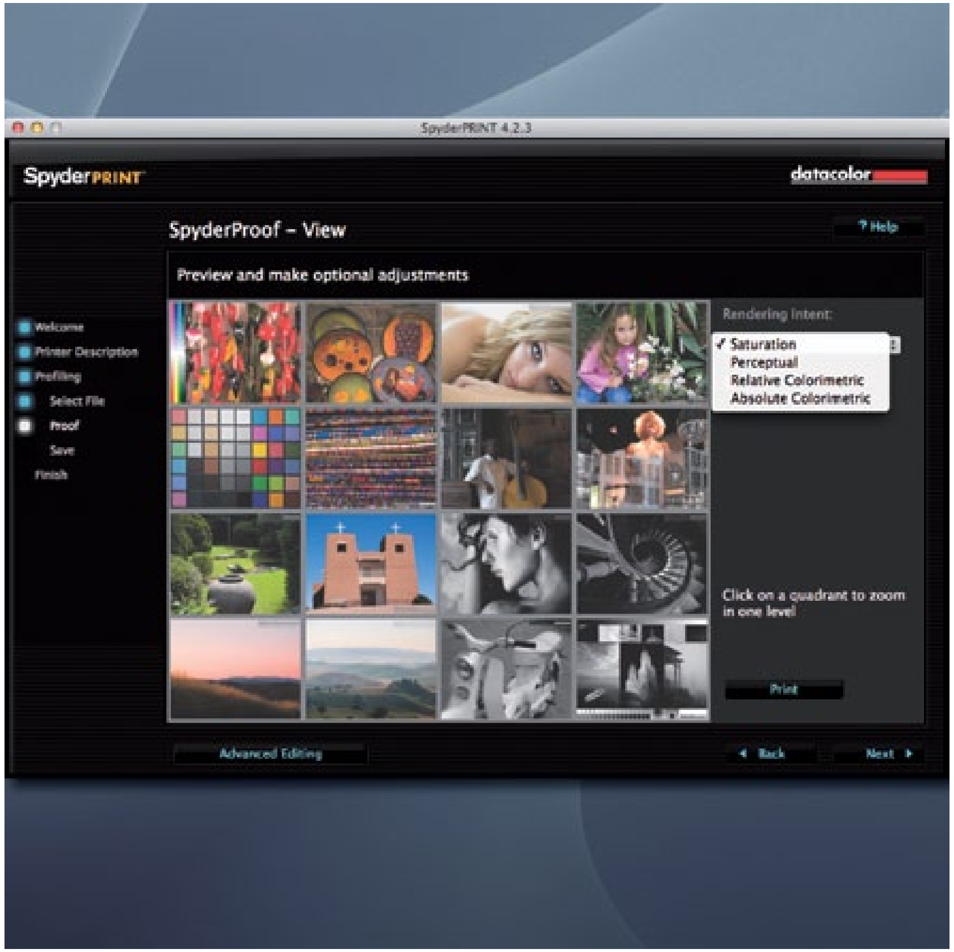
Safeguarding measuring

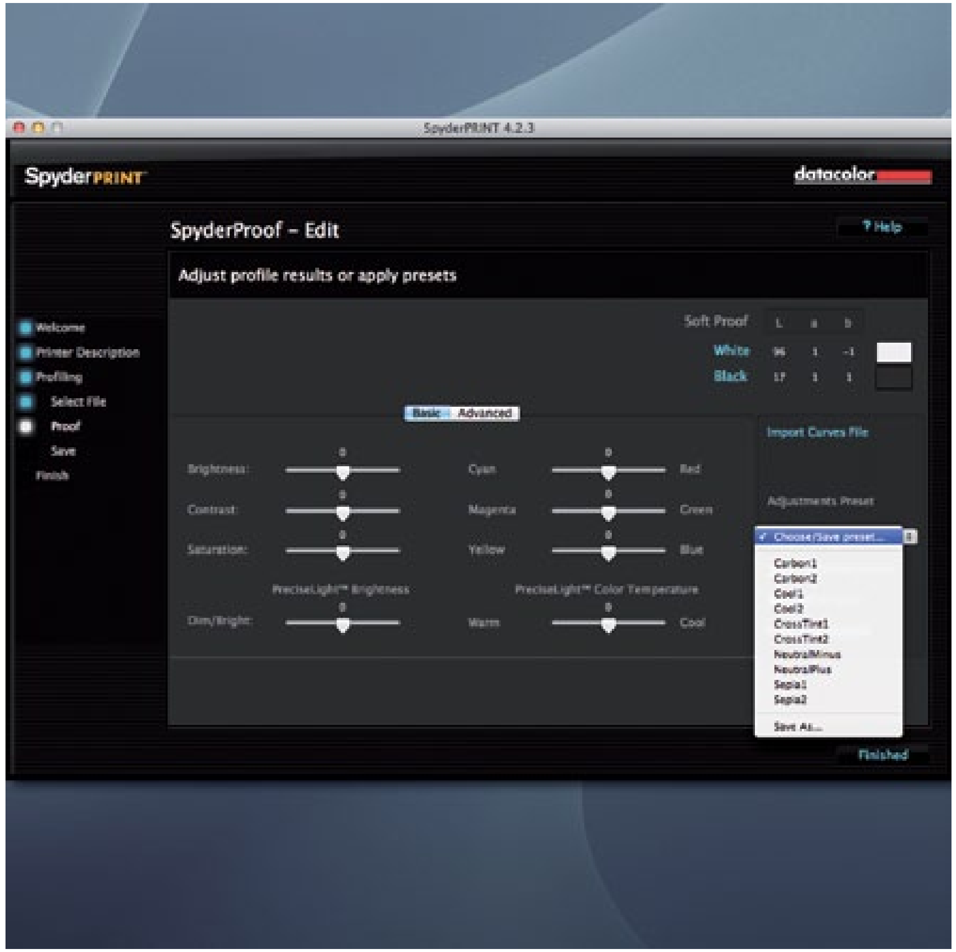
Before measuring the patches, choose a descriptive name for each data file. This is stored in XML format on your hard drive, and can be recalled at any time for reuse. If you want to protect your measuring files for the long term, you should include the Application Support folder and Profiles folder in your backup system. On the Mac, Time Machine can do this automatically.



Measuring

After selecting Measure, you'll be asked if you want to see a short introduction to the technique for measuring strips. Watch this short animated video at least once, to learn the trick of moving the instrument over the target, and minimizing measurement errors. Practice a few times, then move back and start again.





SpyderProof

Print the SpyderProof test images with different Rendering Intents, to learn what each offers. Rendering intents provide different methods of bringing unprintable colors into the printer's gamut. The choices are relative colorimetric, absolute colorimetric, perceptual and saturation. All four as also available in Photoshop, but Lightroom is limited to relative colorimetric and perceptual.

TIP:

To get Saturation Intent in Lightroom, use the checkbox in the App's Preferences to switch Saturation and Perceptual when building a profile, and choose Perceptual when printing from Lightroom, to get Saturation.

Profile Setup

You can choose Advanced Editing to modify the color profile. These adjustments support different purposes. For example, special profiles can be created for different types of photography or special printing effects, such as cross-tinted B & W images. These tools also allow you to tune profiles to optimize shadow detail, and other factors. Be sure to check the online help, for information on the many tuning functions.

Chapter 6: Really? Softproofing and Media


really?
Softproofing
and Media
datacolor


Photo: Oliwer Mews

Proofing on the Display

Judging images on the display only seems simple at first glance. It's possible to make painfully wrong decisions about how to edit an image when judging from the display, especially for inexperienced users. What appears to be good on the calibrated display can be a disaster in the print version. Colors can change beyond recognition, sometimes forming strange surface effects, the overall impact of the colors can be significantly muted, and certain colors lose their intensity.

The underlying logic of this ambiguity is reminiscent of René Magritte's painting "The Treachery of Images". The painting shows an image of a pipe with the words "This is not a pipe" underneath. A simple language game: One sees a pipe, but materially it is a piece of canvas. Just as the picture of a pipe is not a pipe, but a figure that represents a pipe, an image on a monitor is not a print. Rather, it is a representation of the pixel values, which, if the software works correctly – looks like a photograph. But just as a pipe is made of wood and not of canvas, the display's representation of the image is shown using colors of emitted light, while a tangible print is made with dyes or pigments.

Since almost anything can be calculated if the computer is powerful enough, you can view not only the standard RGB version of images, but a simulation displaying how the image will print on a particular ink and paper. Unlike a hard proof, which is a print on paper, emulating a different type of print on different paper (perhaps a newspaper), this is called soft proofing, since it's done by software, on screen.

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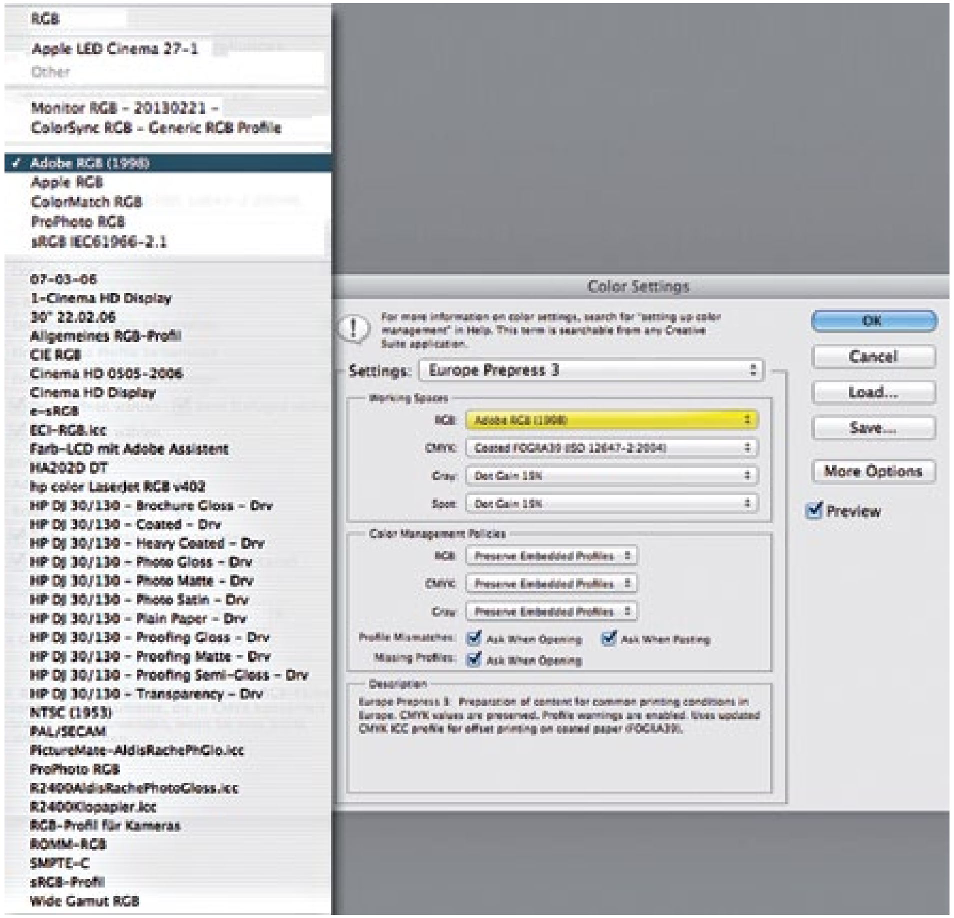
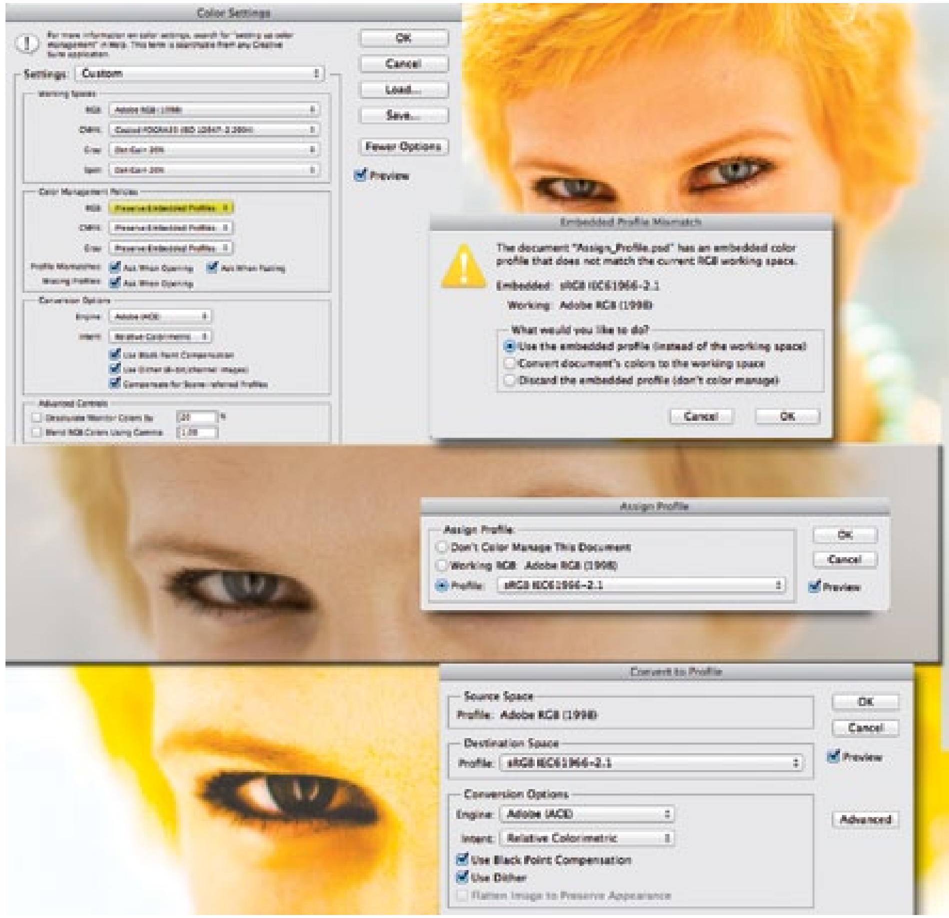


Color Settings in Photoshop

The previously generated display profile is automatically used by Photoshop and other applications to display images, thanks to system-wide color management on the Mac and recent versions of Windows.

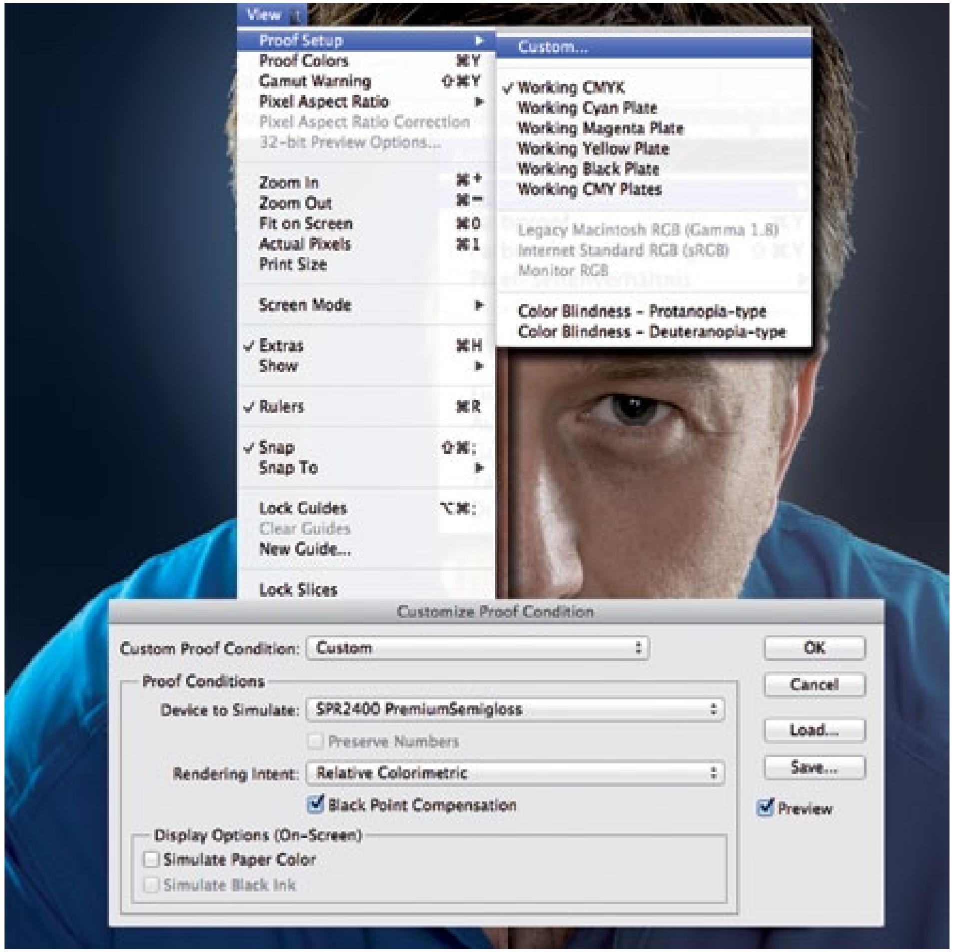
You should choose a color space in Photoshop that meets the needs of your imaging uses. It is important that the colors are not being converted indiscriminately between different color spaces. Adobe RGB is suitable for general use, sRGB for web graphics, mobile, and photo books, or certain other spaces for special uses, so that you see the correct color in externally supplied files.



Working Space Choices

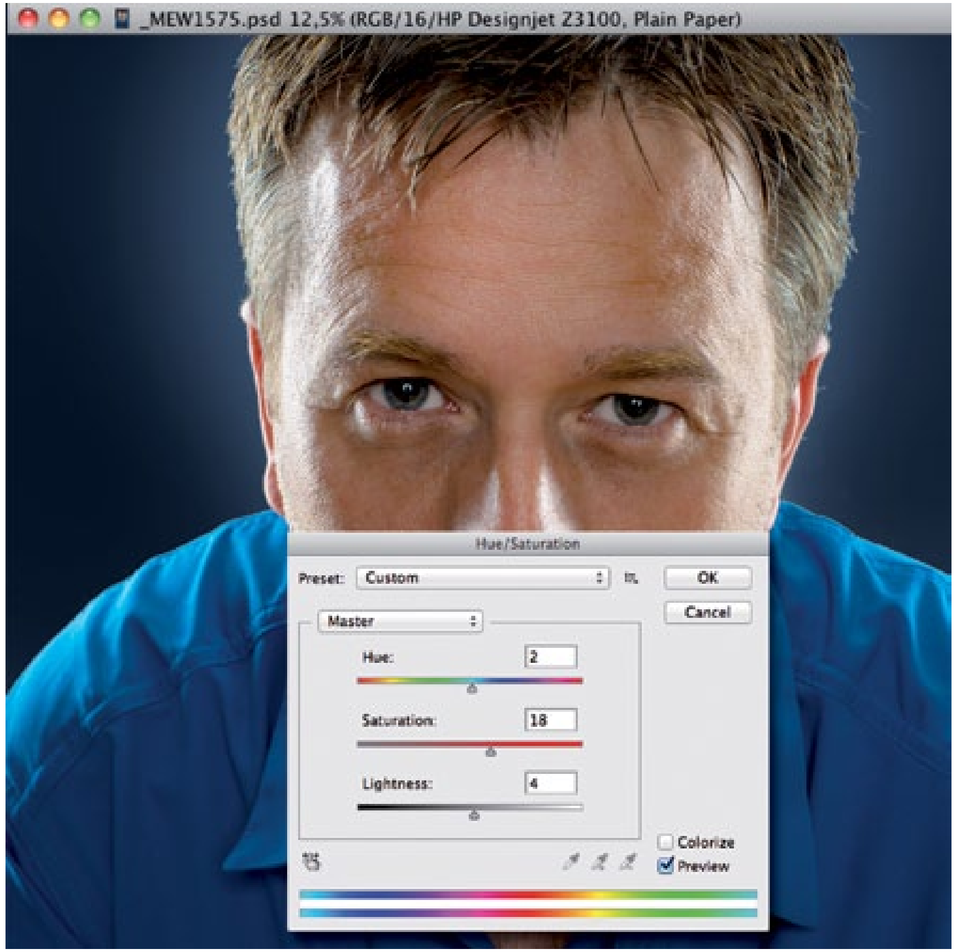
After you've defined your color working space, you're often dealing with images that were created in a color space different from the one you chose for Photoshop's default. When you open these images, a dialog box will appear, asking how you wish to handle the difference between the color space of the image and your working color space in Photoshop.

Always start by choosing to keep the embedded profile. Once open, you can make a visual inspection of the image to decide whether or not to convert to a different profile. Assigning a different profile is only appropriate if you believe the color space tagged to the image was incorrect, and you wish to correct it. For all other uses, the Convert command is the appropriate choice, to keep the colors the same, while changing the space they are represented in.



Configuring your Profiles

You can soft proof an image in Photoshop by choosing View/Proof Setup/ Custom, and selecting the printer profile for your upcoming printing. If you then select "Proof Colors" under the View menu, it will activate the soft proof function. This feature is particularly valuable for people new to editing images onscreen, as it will show you which colors will not change when printed, and which will. For an even closer match to the print, choose "Simulate Paper Color".



Editing using Soft Proofing

You can edit photos while in soft proof mode, making it possible to tune your image to a particular output. You can adjust colors, highlights and shadow detail for optimal effect with a printer/ink/paper combination. In Photoshop it is necessary to save an appropriately named version of the device-specific file: MyImageEpson3000Entrada, for example.

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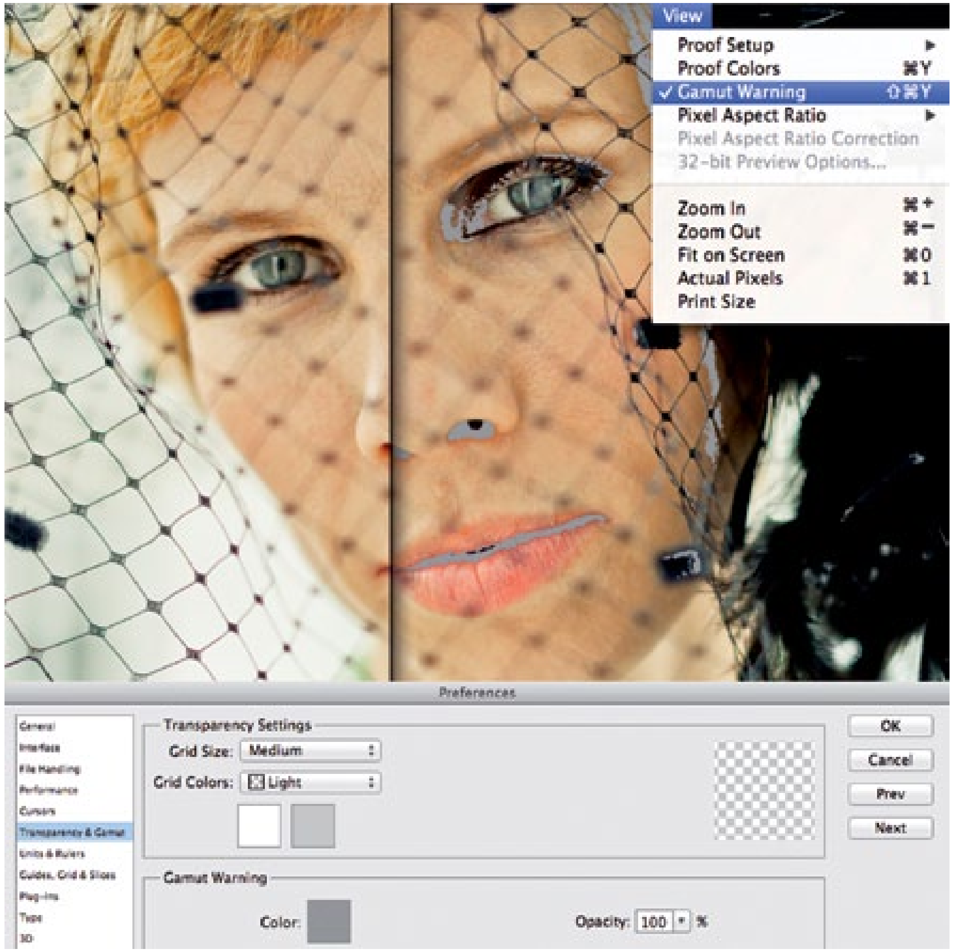
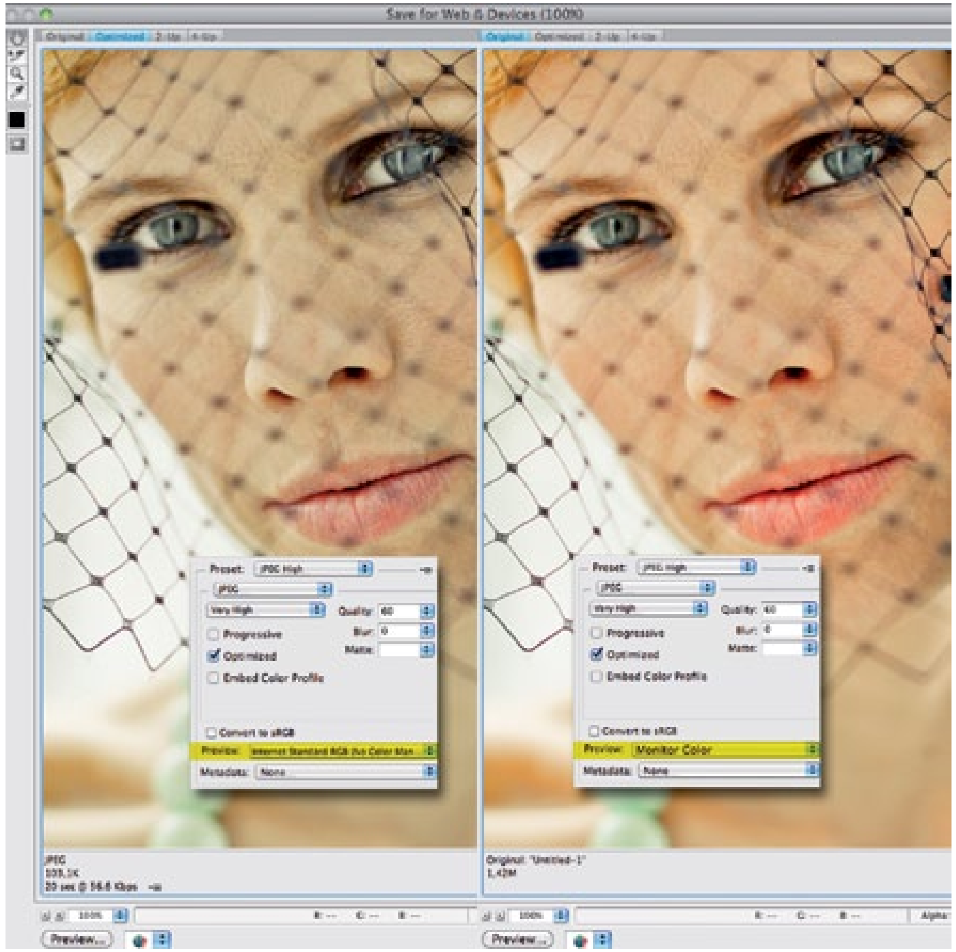


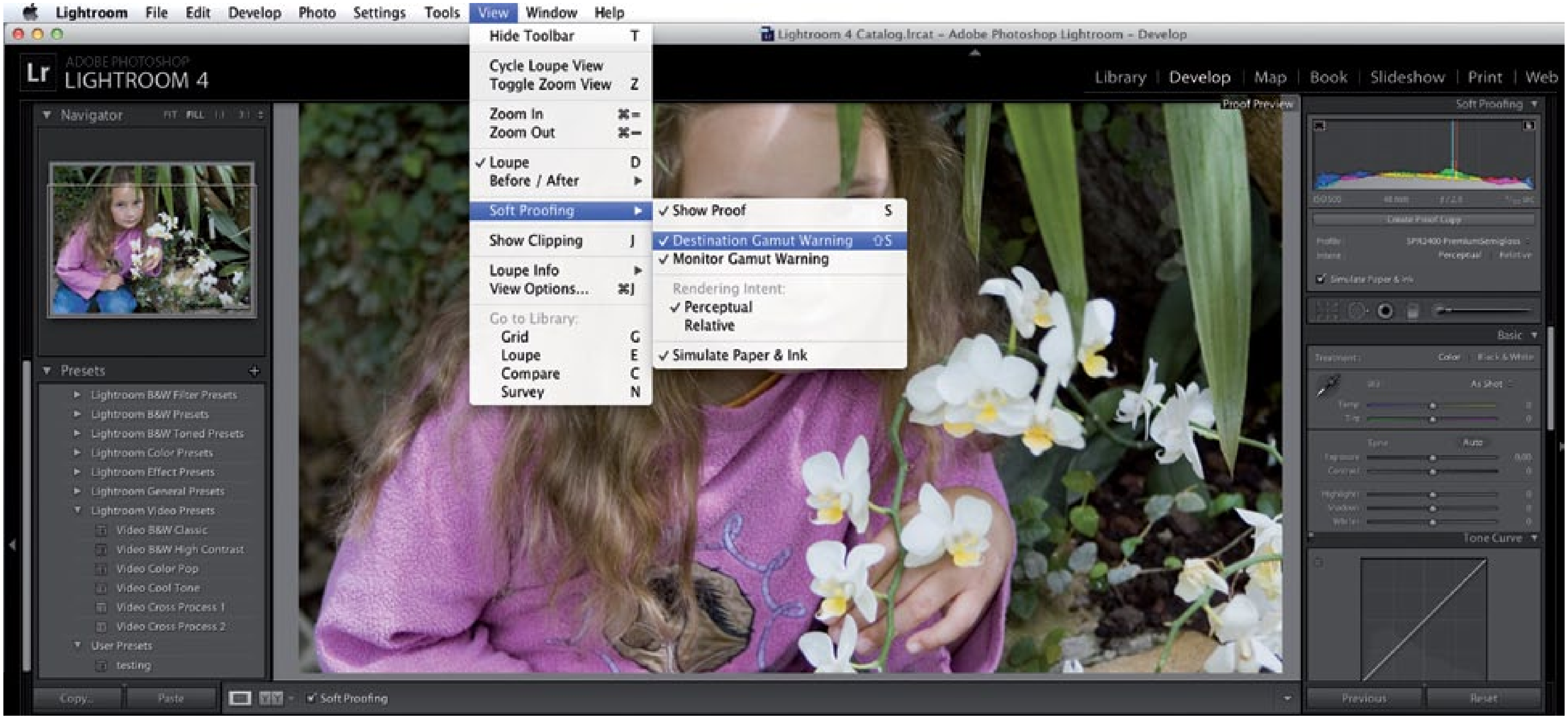


Gamut Warning

The Gamut Warning tool allows you to see what colors in your image are outside the printer/ink/paper combination's gamut (color range). It is then possible to use editing tools to bring these colors in-gamut yourself, instead of depending on a rendering intent to do it for you. Soft proofing and gamut warning are powerful tools; but they are only as good as your printer profile. Editing the soft proof view of your printer profile can improve the match, and the value of both tools.

Proofing for the Web

The process of saving images for use on the Web varies with different Application, and even different App versions. In Lightroom, sRGB should be chosen when exporting, along with an appropriate Web resolution, generally much lower than the original image resolution. In Photoshop it's possible to convert to sRGB for the Web using the Convert to Profile command, but there's also an Export for Web option that combines this conversion with other functions, such as resolution reduction.



Softproofing in Lightroom

Starting with version 4, Lightroom also has a softproofing function. While not offering some functions of the Photoshop version, it makes up, in convenience, for what it lacks in controls. To activate the soft-proof view, go to the Develop mode and select the Soft Proofing checkbox located below the image area. Subsequently, the title of the area at top right displaying the word Histogram will change to Soft Proofing. The histogram changes to reflect the output, instead of the image file. Output profiles are selected for soft proofing in the pulldown menu directly below the histogram window.

You can also select either Perceptual or Relative Colorimetric rendering intents. (see Tip in previous chapter) Then, check the Simulate Ink and Paper box to show the full effect of the profile selection.

Lightroom offers a "Create Proof Copy" option, making a virtual copy without taking up disk space, as a Photoshop output-tuned image version does. Lightroom also offers two gamut warnings, one with a tiny display icon, to show you where areas of the original image can't be shown correctly on your display; and another with a page icon, to show areas of your original image that can't be printed.

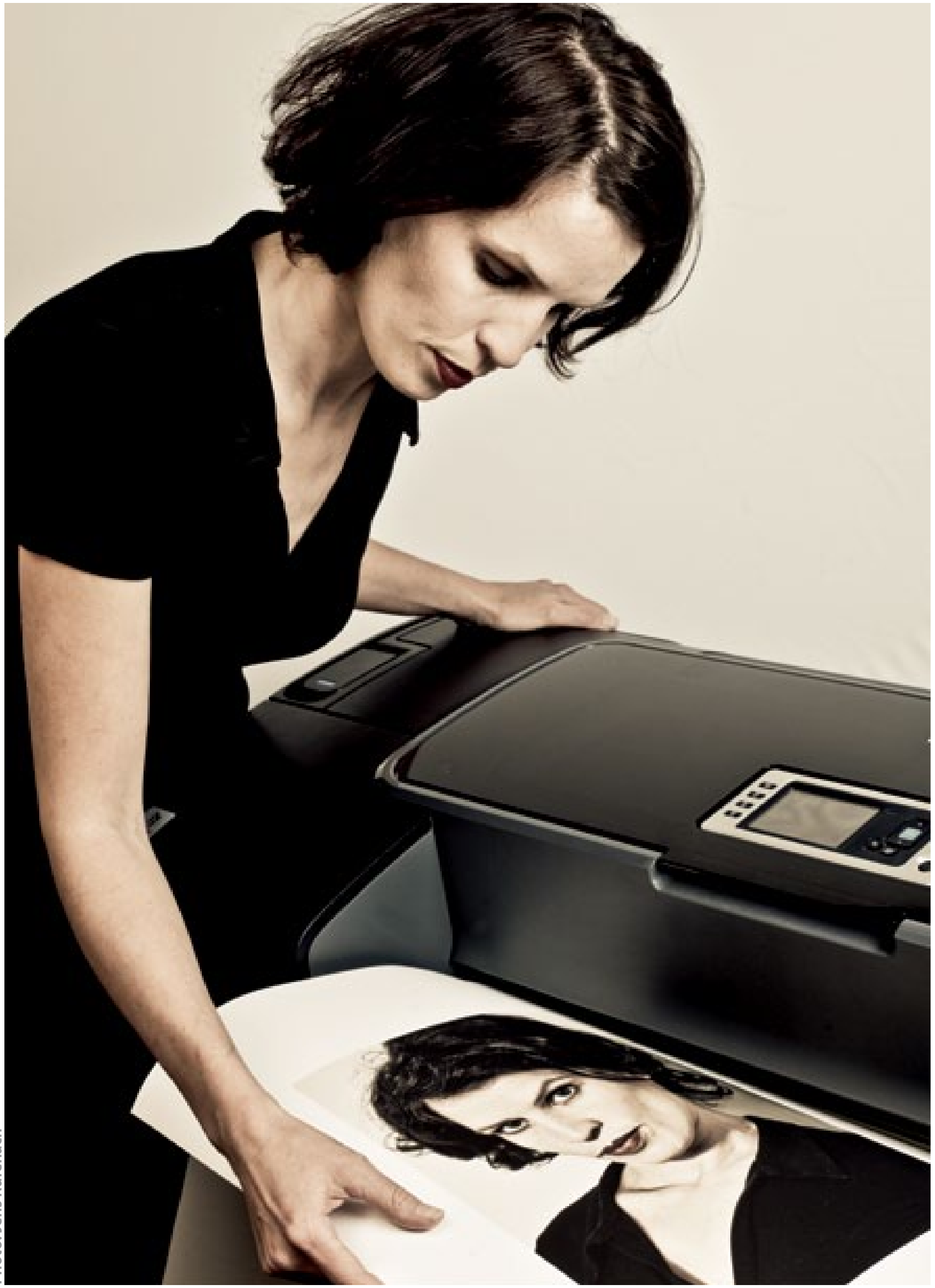


Photo: Jens Rufenach

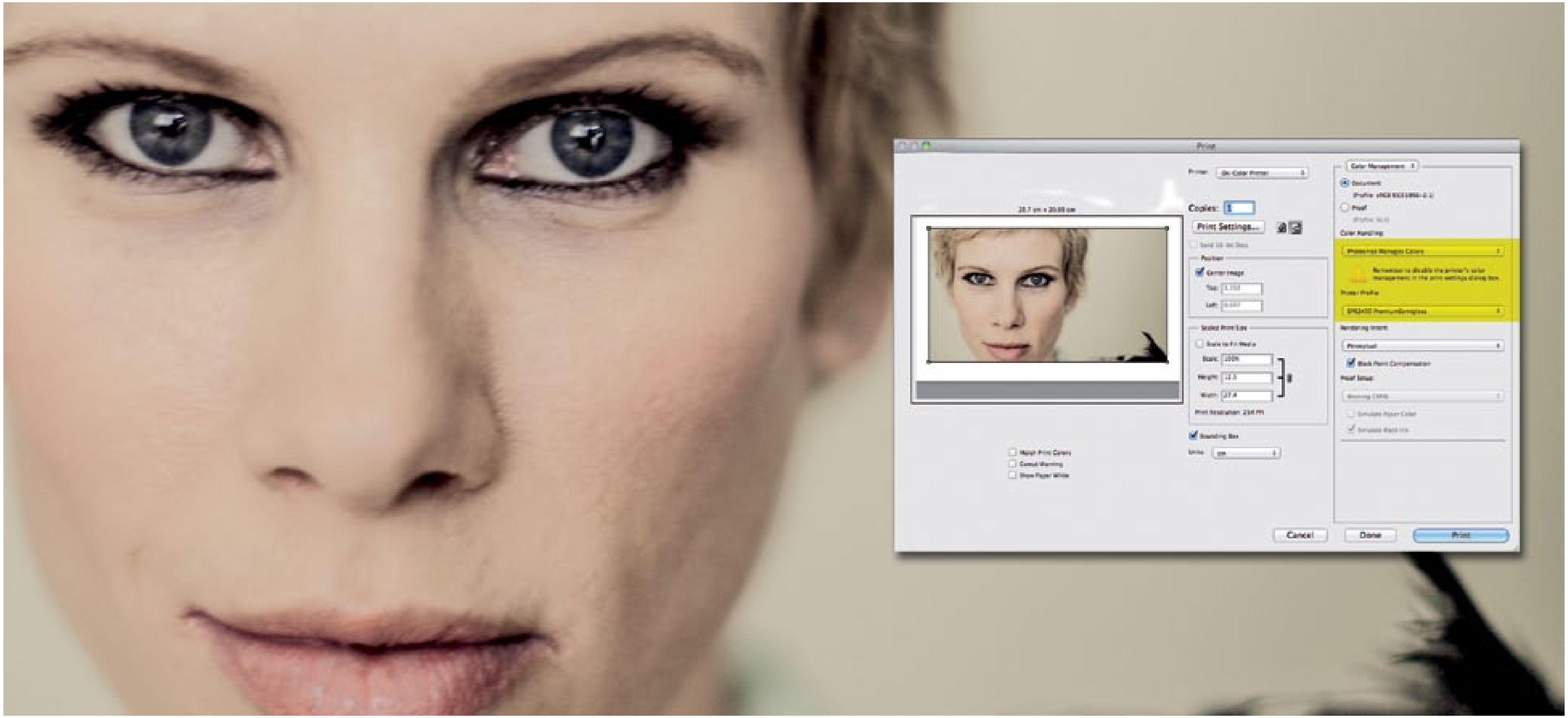
The Quality of Custom Prints

For a long time, inkjet prints were visually inferior to photo lab prints. Only in recent years did the six to twelve color inkjet printers produce prints that were beautiful at close viewing distances. Now there are new papers which deliver the appearance of baryta prints, the most desirable type of photo lab prints.

This makes custom printing exciting for advanced photographers without sleepless nights in the darkroom, and making excellent output much faster and easier. Those without space for a darkroom still have space for a digital darkroom. It's even possible to make adjustments live, in front of the customer. Digital printing saves much time and effort.

Unfortunately, not all that can be photographed, or viewed on screen, can be printed. This was also true with analog photography. However, it was far more difficult to predict exactly what colors and details would appear on the paper in the photo lab.

Those who work on the computer with careful color management, using quality paper, correcting their color images in soft proof mode, and sharpening appropriately before printing, can produce lab quality custom prints. The techniques discussed on the following pages will help your progress towards that perfect print.



RGB Printing

If you print your images on an ink-jet printer, make sure the photos are in RGB mode. These are not the colors of the inks in the printer; they are the color format that the computer knows how to communicate. CMYK files cannot be processed by computer operating systems, and are silently converted to RGB, with no color management. This is avoided by working in RGB.

You need only set up the print parameters in the Print dialog and make sure that the correct options are set. For Photoshop use:

Color handling – "Photoshop determines the colors";
Printer profile -choose either the manufacturer's profile for your paper or ideally your own custom profile

Rendering intent- the same that you chose in the "Proof Setup".

IMPORTANT TIP:

Be sure to disable color correction in the printer driver, to avoid a second, incorrect, color conversion.

Offset Printing

Offset printing, with its four standard colors, is certainly not the best option to print photos, but it's the affordable option when large quantities of images are needed. Whether printed as a magazine, a book, a newspaper, or some other form, a standards-based profile is available for different print types. These standards-profiles define a base-line color space for each type of printing device. The press profiles included in Photoshop can be used to soft proof, and convert, files for many production methods.

However, it's always best to consult with your print provider about their specifications for image preparation, including preferred color space, profile conversion, and color separations before preparing your images to send to print. Here we are dealing with lithographic printing, so, images will be converted to CMYK.

Some European printers prefer that you edit your images in ECIRGB or Lab color spaces instead of Adobe RGB or sRGB.

Doing your own custom printing comes at a price. You must set up the correct workflow, so that the print matches the display, edit the images, manager the printer, and wait while the files are printed. Printing at home is not inexpensive. Printers cost much more as they grow larger, but ink costs drop off in the larger size machines. It requires soul searching and budget calculations to decide what size printer you can justify. Those wanting to make a large number of small prints, a very few large prints, or bound books will usually be better served by a service provider.

Outsourced Prints

Images sent to most outside print sources need to be converted to 8 bits per channel, and converted to sRGB. These two reductions hint at the compromises that outsourced printing involves. If you provide images in another color space or bit depth, many labs will charge you a special conversion fee before printing, which can raise the print price significantly.

Photo Printers

When you send images to be printed by a high quality photo printing service, you pay significantly more than home printing, or low cost print services, but you reduce your role to preparing the images for the print provider. The print service may provide ICC profiles for soft proofing, but you must do the work of optimizing the images for print.

The Photo Lab

Many photo labs now offer far more than just paper images. Their product lines include, T-shirts, mugs, calendars, greetings cards and photo books in various formats. Prices for simple prints are very low compared to printing them yourself, but the color accuracy is often problematic. Most consumer labs do not provide color management information to the customer; or just say: "send sRGB". This makes soft proofing questionable. Image compression and automatic adjustments to make consumer images brighter and more colorful also compromise quality.

While it may be possible to have the auto-adjustments turned off, other production processes can't be avoided. When comparing the affordable prints to quality output, keep these factors in mind.

The World of Papers

In the past, everything was simpler. You were asked two questions at the photo shop, “Print size?” and “Glossy or Matte?”. Most photographers choose glossy even today simply because they’ve had little experience with matte. The colors appear brilliant in the image, and there will be an extra touch of luminosity, regardless of lighting. Using this logic, you would get, according to the photographic conditions, good but not always optimal, prints. Photos made of sunlit scenes would look great, but the surface brilliance doesn’t always reinforce the intent of the photo. Images of a rugged landscape would look more impressive if printed on textured materials such as canvas. Choosing the correct print media reinforces the picture’s impact, at least for those who know the differences in media and how to use them for enhancing their prints.

For example, Fine Art photos are rarely printed on a glossy surface. The fine artist wants to make as many details visible as possible, and the glossy surface works against this goal, because it adds an effect, rather like a subtle contrast boost. In the fine art world, there are only matte papers, with many different products offered, whose characteristics are sometimes hard to understand.

While the photographer printing in an analog home darkroom had only the choice of a “glossy”, “satin” or “matte” finish, printing on baryta paper required complicated processing finishing with a hot press to deliver desired results. All other materials such as canvas, handmade paper or fabric were used by highly advanced photographers, or photo labs specializing in these media. Today, anyone who owns an inkjet printer can print a photo on nearly any flat material that will fit in the printer. The recommended papers for these printers offer far greater choices than were ever available before. Apart from classic glossy and matte finishes, there are now different art papers, canvas and even transparency film available. These are often available in several weights, and may behave differently, in different weights. What media you can put in your printer varies with the inks in your printer, and its ability to handle thicker or stiffer stock.


Photo: Oliwer Mews

What papers you choose will depend on what your printer can accept, what works best with your images, and your experience with different media. The more experimenting you do, the wider your world will be.

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Photo: Oliwer Mews

High Gloss

Glossy paper is available in several gradations between high gloss and satin finish. High gloss is most common in photo labs and in packs of paper labeled "glossy". The images produced on this paper look and feel like traditional photo prints.

Glossy papers allow high maximum density, highly saturated colors, a maximum ink coverage and high maximum density, which together produce crisp contrasts. Unfortunately, these papers with their glossy surface are very sensitive to fingerprints, so that it's best to handle them with gloves or use a wide border. In addition, ink should not be applied as quickly to a glossy surface, making this type of printing slower. Some paper coatings have reduced this issue, but others still require setting your printer driver to only in one direction, instead of printing bidirectionally. Allowing drying time before handling is critical with glossy prints.


Photo: Oliwer Mews

Matte

Matte paper looks considerably more subtle than high-gloss and makes a somewhat more "elegant" impression. This paper finish plays to its strengths when displaying delicate details. Because of its large printable color space and its excellent light and shadow detail, matte finishes are preferred by many expert photographers. Matte papers are suited for printing images captured with high ISO settings, so that the noise in the image will integrate into the paper texture, giving a soft, film-like appearance of graininess.

However, matte surfaces tend to be sensitive to moisture, which limits their durability. Some printers automatically seal with a clear ink. If not, spraying the prints may be necessary. Matte papers come with names such as "matte", "semi-matte", "satin" and "pearl" or "luster".

Matte papers have an advantage in that they are more absorbent, delivering faster print drying. They have fewer reflection issues than glossy media, and less gloss differential (a situation where un-inked sections of the print have a different degree of gloss than inked sections). Matte papers are also less sensitive to fingerprints.

Photo: Oliwer Mews

Canvas

There were many attempts to establish textiles as a medium thoughout the history of photography. However, photographs printed on textiles remained a niche market until inkjet technology arrived. Classic canvas is 100% cotton; polyester-blend canvas is more common that 100% cotton canvas.

Plain weave canvas has warp threads and weft threads woven together, to make the typical surface. In twill weave, weft threads are woven over two or more warp threads to create a herringbone pattern.

Inkjet canvas comes in both gloss and matte finishes, and with or without a gesso layer, which covers much of the canvas texture, resembling the canvas in oil paintings.

Canvas is available in individual sheets, in small formats; but more often is printed from rolls and then stretched (gently!) on a wooden stretcher frame. Stretched canvas is pleasing, as well as being lighter than traditional framing, and smaller, due to the lack of matting. In addition, it eliminates the glass, lowering costs and allowing for easier shipping, but making spraying of prints important.

Inkjet canvas is often used for the reproduction of paintings. Reproductions of classic, as well as contemporary, paintings on inkjet canvas are becoming popular, but it is also an excellent medium for photo prints.

Inkjet Film

Backlit Film is the most common type of inkjet film.

Transparent polyester films printed with inkjets get their color saturation from backlighting. Without a light source, the colors are dull and washed out. The level of detail is similar to photo paper, and the color often surpasses paper, so it's clear why backlit films are becoming increasingly popular for both business and private display.

The problem is the color fidelity. A color shift occurs in the black and magenta channels caused by the different thickness of the inks. So, you should be sure to work with the specific ICC profiles made for the backlit film material. Backlit film is usually printed on its rear side, providing scratch-resistant surfaces suitable for the outer and the inner liner. Indoor materials remain colorfast for about a year. With special treatment, outdoor films can be made colorfast for up to three years, but will have a lower scratch resistance. A special type of transparency film is self-adhesive, clear film, which already looks brilliant on its own when adhered to white acrylic. Backlighting enhances the effect, but is not required. Such films are used primarily in bright rooms, such as the workplace, which can also be used at night. Another special form is self-adhesive window film, like we remember from holiday decorations. These allow unpleasant views to become colorful stained glass. Some adhesive films can be used multiple times, so you can change them periodically, perhaps seasonally.

There are also technical films such as metal foil, for example, which produce a visual effect emulating old, or very high quality photographic processes.

Photo: Oliwer Mews

Fine Art Paper

Those who don't enjoy typical glossy or matte papers may find the field of fine-art papers interesting. These are primarily heavyweight grades, with the surface color presented in soft, natural tones, or sometimes with artificial brighteners. These papers are often expensive, have a soft texture and a special feel in the hand, like the watercolor papers they descended from. Because they show the finest details, they are ideal for printing color photographs and black and white images, especially for art reproduction with high image depth.

For those who print their work as art, not as commercial output, longevity and fade resistance is important. Earlier in inkjet development, a wide variety of pricey papers were called fine art papers. Not all of them were good for fine art work, but the best of the current generation are excellent, and can print reproductions of watercolor paintings that are difficult to tell from the original. We should consider not only how these papers look behind glass, but their tactile qualities as well. A key consideration is their archival quality. For high quality photo prints, color stability is guaranteed for many years. For current inkjet technology, it's possible to make a color-stable print, with an estimated shelf life of over a hundred years.

Handmade Paper

Most people think of handmade paper for fine letter writing, rather than photographic prints. It's less bright than many other papers, and usually has a textured surface. Originally this paper was made with fiber pulp in a vat by hand. Now it can be made by machine as well, and has become more affordable. The structure of the handmade paper types gives prints made on these papers a special feel and a unique color aesthetic. It is often made from cotton rag, is acid-free, and ideal for artwork. There are multiple different surface textures available, which can result in confusion for many photographers because it's not easy to figure out which subject goes best with a particular paper. Paper manufacturers, Hahnemühle in particular, have tried to clarify the choices through paper naming. This results in the textured paper named "Albrecht Dürer" on account of his watercolor paintings (though he is better known for his drawings) or the paper "German Etching", which is particularly suitable for images with an embossed flavor.

When uncertain, don't worry too much about the structures and kinds of paper. Only a few images will benefit from a strong paper texture. It's usually the interplay of colors and details on the paper that determines the visual impression.

Spyder eBook

All About Color Management

CALIBRATE
YOURWORLD

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