

Mastering the Camera Raw Plug-In in Photoshop® CS

Where Does Raw Come From?

The Raw format provides a file from digital cameras and scanners which has been processed as little as possible before it's saved to memory. Prior to Raw, digital cameras and scanners offered a choice of other formats such as TIFF or JPEG. When images were saved in these formats, a lot of image processing choices had been made by the time the file was recorded. With Raw, the file is much closer to the image originally seen by the camera or scanner sensor, and we can make a series of informed choices as the image is opened which affect the way the final image appears. It's almost as if we have an exposed negative which we can choose to process in a variety of different ways to yield different interpretations of the original image.

The Raw format has been adopted by a variety of camera and scanner manufacturers, all of whom provide their own software for reading their own, proprietary Raw files. Photoshop CS will open Raw files from a variety of manufacturers' devices, using the Camera Raw plug-in, and provides more choices and ease of use than most manufacturers' software packages can match. This plug-in, first offered as an extra cost option for Photoshop 7, is now built into Photoshop CS, and has been significantly enhanced. As new cameras and new Raw file formats are released, Adobe updates the plug-in and makes an updated version available for download. *Note:* this camera Raw format is not the same as the Photoshop Raw format.

The Best Way to Get Started

If you shoot in Raw format with your digital camera or scan into a proprietary Raw scanner file format, you can sort and select your images using the File Browser to preview them, or you can pick a file directly. I prefer to use the File Browser, because I like comparing multiple image previews before I select files to open. It's here I select the files I'm going to open, and rotate vertical shots to correct orientation. There's another advantage to using the File Browser which we'll discuss later.

When you double-click on a Raw file, the dialog box shown on the next page opens, with your image previewed in the dialog. In this demonstration, I'll walk through the normal steps I use to open and prepare a Raw file in this window, in their recommended order, starting with the Basic (default) setting, and then moving to the Advanced settings.

❶ Open the image, and set its white balance.

Setting the white balance tells Photoshop what neutral color should be in the image. There are several ways to do this, and it's best to master all of them, since different images will require different approaches to get the best result. Try each of the following.

- a) Use the presets in the pulldown menu. Use these when you know what the color of light was, such as

Daylight, or Cloudy, or when you want to experiment with different settings to see how they change.

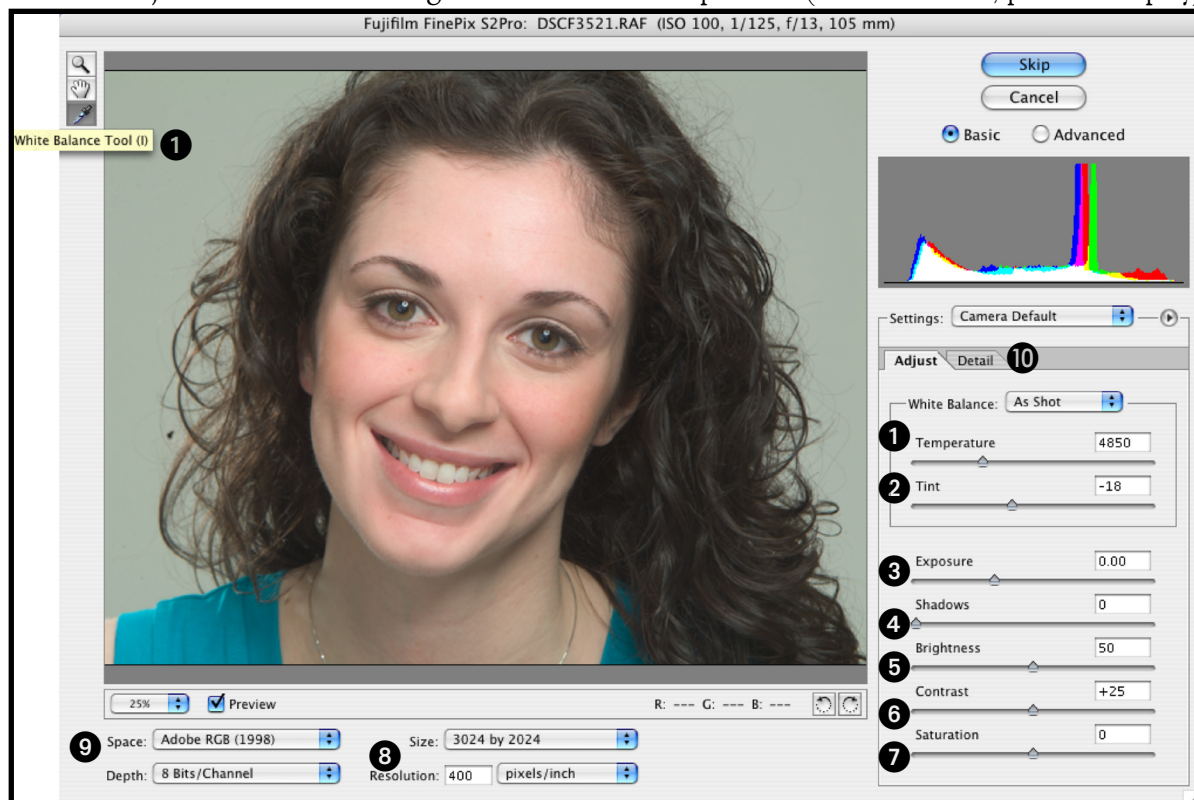
- b) Use the Auto preset, also accessed in the same pulldown menu. This lets Photoshop analyze the image for you, and the program will do its best to find neutrals in the image and set them to as neutral a rendition as possible. While Auto does a good job, there are images where it can be fooled, and other images (such as warm sunsets) where Auto delivers a much cooler image than you'd normally want.
- c) Use the Temperature slider to change the color temperature of the image. If you have a keen eye for color balance, and are previewing your images on a calibrated and profiled display, this can be a very accurate way to balance the color in your image.
- d) Use the White Balance Tool (eyedropper icon) at the top left of the Raw dialog window. Find a part of the image which should be neutral, such as a grey, a white, or a black, and click on that part of the image. Photoshop will set the color to neutral, just as if you were using the middle eyedropper in the Curves dialog window. I usually start with this tool, and only when I can't find a neutral to use for click-balancing do I move to other methods.

② Set the Tint, if needed.

Once you've gotten your image as neutral as possible, you may decide it's too cold. Or, it's still too warm. Or too something. You can fix this easily. The Tint slider controls the amount of red and green an image has, just as moving the Temperature slider moves the overall color of the image from yellow (warm) to blue (cold). Using both sliders in combination will let you give or correct almost any color cast in an image.

③ Set the Exposure.

This slider lets you change the exposure values in the image, especially in the lighter areas of the picture. Use this tool in conjunction with the histogram above it and the preview (on a calibrated, profiled display), in order



to get a perfect exposure for your image. It's always better to make a good original exposure than to make a bad exposure better; however, this tool can save your bacon if you've incorrectly exposed an image or a whole series of images. The numbers correspond to f/stops on a camera, so setting a -1.5 value would be the same as giving the image 1½ stops less exposure.

You can evaluate your image solely by eye, but there's a powerful aid built into the Exposure slider which makes your work easier. To use it, hold down the Option/Alt key while clicking on the Exposure slider. Your image will go solid black. Continue to hold down the Option/Alt key, and move the slider to the right. As you move it, the areas with the lightest values will start to highlight in colors, and as you continue to the right, will change to solid white, indicating that it will be a solid white in the final print as well.

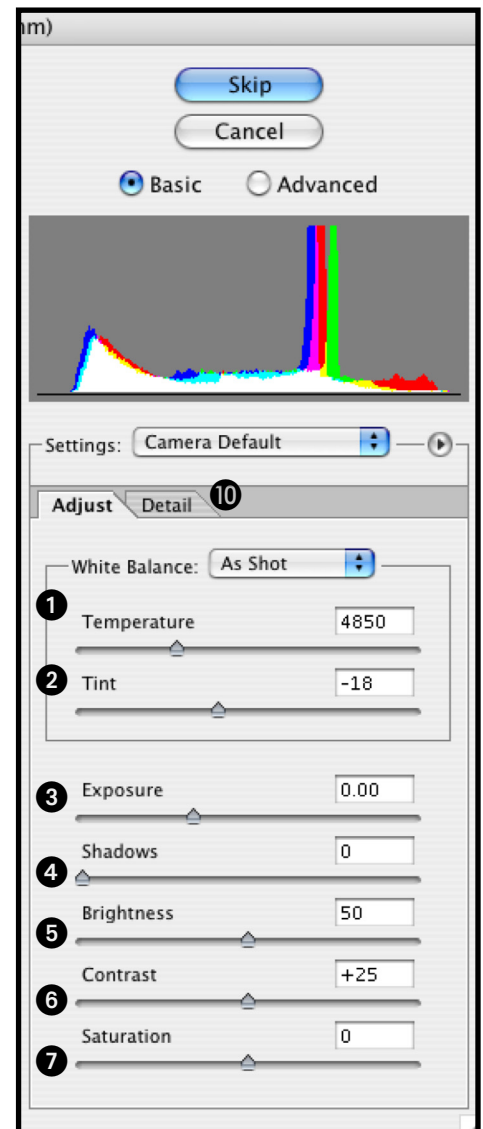
On our test image, the first things that will show solid white are the white reflections from the gold chain the model is wearing. These are called specular highlights, and they're OK to let go to a solid white. However, if you keep moving the slider to the right, eventually the woman's forehead will also be solid white and lose all detail, which is usually undesirable.

When adjusting an image this way, I look first at the overall feel of the image and then at the histogram. I look for the light areas, and picture in my mind's eye what I intended when I created the image. Next, I look for areas of specular highlights so I'm expecting them to go white in the preview. Then, I hold down the Option key, and see where the first solid white areas show up. If these areas are supposed to be solid white, lacking detail, fine; if not, then I back off a little bit, just before they go solid white.

Then, I let go of the Option key, and see what my adjustment has done to the image. If the image looks too light in the lighter tones, I back off my adjustment a little more. I'm not as concerned here with the dark values, because I'm going to adjust those next, using the Shadows slider. Although I recommend that you make the adjustments in the order shown, I can fine tune these slider settings as I work with the image in the dialog box without fear of damaging my image, and continue to refine it as I work with the other sliders in this window. Better yet, I know that I'm never changing the original Raw file, because I can't, so even if I come back later and decide I need to adjust the settings, I haven't damaged my original.

④ Adjust the Shadows.

The Shadows slider uses the same Option/Alt key to let you see when you start to lose detail in your shadow areas. Hold the Option/Alt key down, and move the Shadows slider to the right. As you move it, your image will



turn solid white. Then, as you continue moving the slider, the darkest areas of your image will start to appear in the preview window, turning black. As more of your image turns black in the preview window, more of it will print solid black, with absolutely no shadow detail. It's usually desirable to hold as much shadow detail as possible, so this is a great way to make sure I don't overdarken my shadows when I'm going for a snappy picture. If you see colors appear, but not black, it's because only one or two of the three channels is going completely black.

In the sample image, as I move the slider to the left, the very darkest part of the model's hair goes to black, and as I move the slider further, more and more of the black hair loses detail. Usually this is undesirable, so I back the slider off a great deal, to where just single strands of hair are going solid black.

⑤ Adjust the Brightness.

The overall brightness or darkness of the image can be adjusted with the Brightness slider. Instead of clipping highlights or shadows to eliminate detail, as the previous two sliders do, Brightness compresses the shadows and expands the highlights when the slider is moved to the left, giving the effect of making the picture look darker. Moving the slider to the right expands the shadows, and compresses the highlights, making the image look brighter. This should be used after you set the highlight and shadow endpoints using the Exposure and Shadow sliders. Some people will prefer to make these adjustments later, using a Curves Adjustment Layer for more precise control.

⑥ Adjust the Contrast.

Contrast adjusts the midtones in an image. I rarely use this slider, but it's occasionally handy when doing batch processing of quantities of images shot under the same conditions. Higher values increase contrast, lower values decrease it. If you use it, be sure to set the Exposure, Shadow and Brightness values first. This is another place where some people will prefer to use a Curves Adjustment Layer for more precise control.

⑦ Adjust the Saturation, if needed.

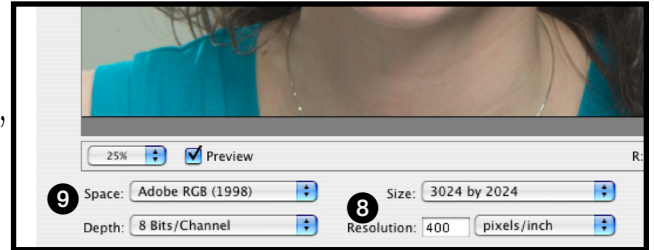
This tool is used for two very different approaches to images. In its primary use, moving the slider allows me to boost or decrease the vividness of the color in the image. I rarely use this for images exposed under normal lighting. However, it can be used to boost the quality of an image exposed in poor lighting, and sometimes when an image is underexposed.

A second use of this slider allows you to set the saturation at -100, creating a grayscale image from a color file. If your digital camera allows you to shoot a black and white image, as mine does, you could shoot using the JPEG format, and you'd have a nifty black and white. However, if your camera lets you shoot B&W in Raw format, the Raw plug-in in Photoshop will read all the info in the Raw file, showing a color preview of the file you carefully shot in B&W. This is a great way to have both color and black and white from the same file. Move the slider to -100, evaluate the image to see if you need to further fine tune the settings for the image, and open as a black and white.

8 Adjust the size and resolution.

Set your resolution first, so you don't forget! While the default setting for resolution is 240 pixels / inch, you'll notice in the screen shot that I set the resolution to 400 pixels / inch, because I'm going to print this image on a Fuji Pictography, which requires my files to be precisely either 267 or 400 pixels / inch. If you routinely prepare images for press output, setting this number at 300 is recommended.

The size of the file is shown in the pulldown menu; the native size shows as a set of two numbers without either a plus or minus sign following these numbers. In the example, the file's original size is 3024 x 2024. If I open this file using this setting, and the resolution set to 400, I will get a file



that I can print at approximately 5x7 inches. If I know that I'm going to need a bigger print size, I can use the same pulldown menu to set a larger setting, and the quality of the interpolated image will be better if I do it here, as opposed to resizing the image later, once it's opened in Photoshop. You can also choose a smaller setting, useful, among other things, when batch processing a group of images for the Web. Of course, if you're sending a file off to a place like Pictopia (www.pictopia.com), which uses proprietary software algorithms to deliver incredible output from small files, you'll actually get better quality if you open the image at its native resolution (in this case, 3024 x 2024), adjust it as you desire, convert it to the correct Pictopia color profile and send it off. In other words, be sure you check with your service provider to make sure you're preparing your file to get the best possible results from their workflow.

9 Set the correct color profile and bit depth.

Much discussion and debate about correct settings for color goes on, but my preferred workflow is to ALWAYS set my cameras to capture as much color information as possible. Why would you choose to record less than all the color in a scene? The few times I've chosen a smaller color gamut to shoot in, I've regretted it, because letting the camera manage color for me instead of managing it myself in Photoshop almost always produces inferior results.

I find that the Adobe RGB setting serves my needs in the majority of cases, so I encourage you to try that setting first, while making sure your digital camera isn't set to sRGB, a default setting that records a smaller range of color. Many consumer and prosumer cameras don't have a setting to allow you to change this, and claim to default to sRGB (a claim that experience shows isn't always valid), so you'll have to experiment with some sample images to see which works best for you.

Start by setting the Space pulldown menu to Adobe RGB, and open your image. If the color looks excessively red, (skin tones look sunburned, for example) when you open it, then your file may be more properly viewed in sRGB. Try again in sRGB, and see which one you like better. If you're not working on a calibrated and profiled display, you'll need to make prints to see which one works better for you.

After you set the color Space, set the bit Depth to either 8 bit or 16 bits/channel. I use 16 bits/channel whenever I can, as I want to preserve maximum quality all the way through the workflow. Of course, this makes for bigger

files requiring more time to process, more RAM and more storage space, so this workflow isn't for everyone. Still, it does produce the best quality for the most finicky users.

In an 8 bit (2^8) file, Photoshop allows you to have 256 values from pure black (zero) to pure white (256) in each channel. When you multiply $256 \times 256 \times 256$ (for the three channels of an RGB file), you get 16,777,216. You'd think that 16 million+ values would be enough for anybody, right? However, if you open a file in a higher bit depth than 8 bit, such as 16, the numbers get even bigger, and when adjusting a file or doing color correction on it, the extra values help preserve the quality of the file for final output.

In a 16 bit file (2^{16}), each channel can have 65,536 different values from pure black to pure white. Multiplying these three channels together ($65,536 \times 65,536 \times 65,536 = 281,474,976,710,656$) makes for one almighty lot of values. While we can't see all these values with our eyes, Photoshop uses them to good advantage. Note that if your camera or scanner captures in anything over 8 bit, such as 12 bit capture, Photoshop still interprets it as 16 bit. Use 16 bit whenever you're going to be doing a lot of image manipulation or adjustment. Some people advise using 16 bit all the time. Your decision should be based on your workflow, not somebody else's advice.

⑩ Set the settings in the Detail tab.

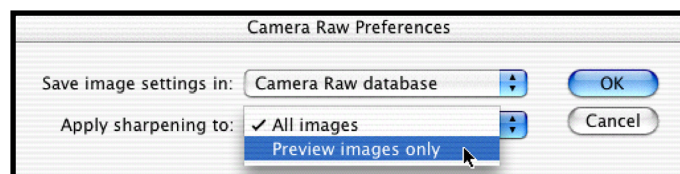
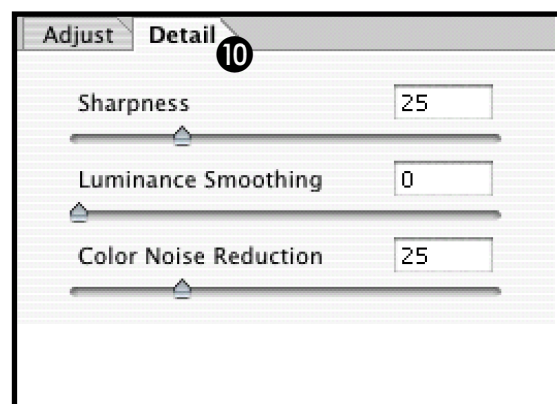
Sharpness

Many people prefer to do sharpening as the final adjustment to an image just before they go to print. If you're one of those people, you need to go to this tab, and turn off the sharpening by setting the value to zero. Alternately, you can go to the Camera Raw Preferences, and set the sharpening preference to Apply Sharpening to Preview Images Only, as shown in the screen shot below. By default, this preference is set to sharpen all images.

If you're not going to edit the image extensively once it's open in Photoshop, you can often do your sharpening here. If you're planning on extensive editing after opening and before printing, sharpening should be done as the last step. If you prefer to have more control in your sharpening, you should do it using Unsharp Mask, because you have 3 controls you can set to finetune sharpening. Your call as to the best decision, based on your workflow's needs.

Luminance Smoothing and Color Noise Reduction

Use these two controls to reduce image noise, the digital artifacts that degrade image quality. Image noise is somewhat analogous to film grain, and is often produced by using a less-sophisticated digital camera or, by using an expensive digital camera at its higher/highest ISO settings. When using these two tools, always zoom in very large to see the noise, and see the result of moving the slider to the right to boost the noise reduction.



Luminance smoothing reduces grayscale noise. By default this slider is set to zero. When you zoom in, if you see grainy looking splotches that don't have a color cast to them, use the Luminance Smoothing slider. If the clumps and artifacts are colorful, use the Color Noise Reduction tool instead. Many images will benefit from using both; start with Luminance and see if you need Color Noise Reduction on top of it.

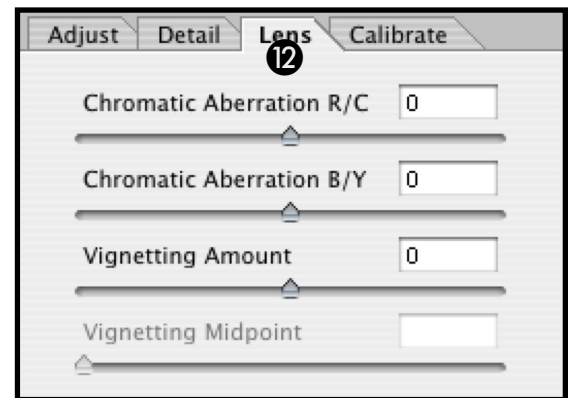
Using the Advanced Mode

When you select the radio button for Advanced Mode, two additional tabs appear, Lens and Calibrate, with multiple options for adjustments. These are powerful tools; it's a shame more people don't take advantage of them.

12 The Lens Tab

Chromatic Aberration

Chromatic aberration is produced when a lens focuses different colors of light differently. This results in varied effects, one of which is that the different frequencies of light are all focused, but each color's image is a slightly different size in the picture. You can see this in some images where areas of the image away from the center show color fringing. The fringing may appear as one color on one side of the image, and a complementary color fringe on the other side. The two Chromatic Aberration sliders are used to fix this fringing.



To use these sliders correctly, do the following:

1. Zoom in to an area near the edge of an image you're editing. This area should contain very dark or black detail, against a light or white background so you can see the fringing.
2. If you see red/green fringing, hold down the Option key to hide blue/yellow fringing, and move the slider to see the fringing diminish and eventually disappear.
2. If you're adjusting blue/yellow fringing, hold down the Option key to hid the red/green fringing.
3. Reduce both by as much as possible.

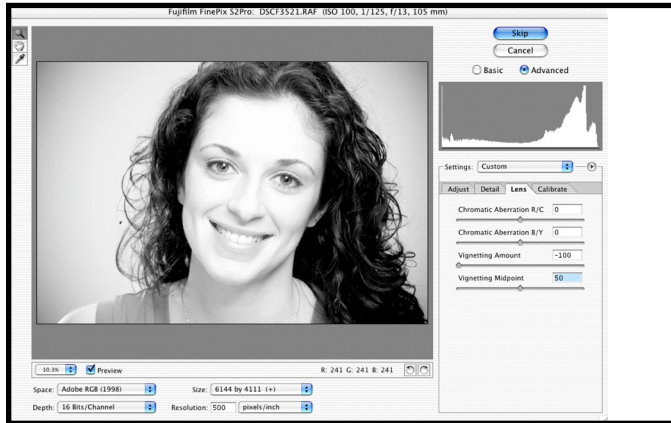
Vignetting Amount and Vignetting Midpoint

When an image is vignetted, its corners are darker or lighter than the center of the image. While this is an effect that some people like for some pictures, notably portraits, it's not desirable when the lens produces this effect every time. Vignetting is more common with wider angle lenses, but not limited to them.

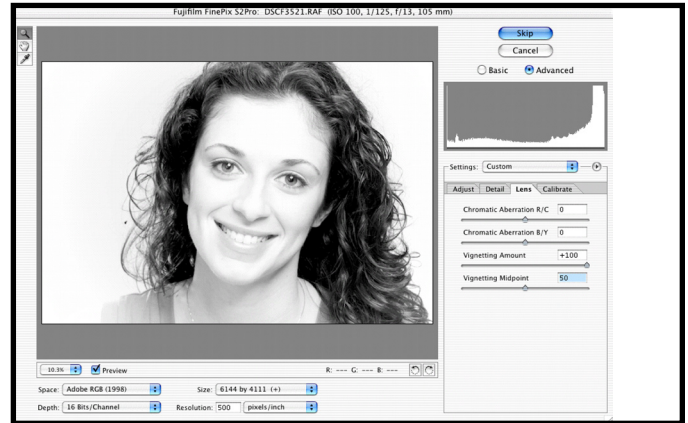
If you see that images from a particular lens are vignetted, and you want to remove the vignette, move the slider to the right to lighten the corners of the image; move it further to the right to give it a white vignette. If, on the other hand, you want to add a dark vignette to the corners of your image, move the slider to the left, and watch the corners darken. As with all sliders, you can also type in a numerical value instead.

Note that when you move the Vignetting Amount slider off of zero, either direction, the next slider below, which

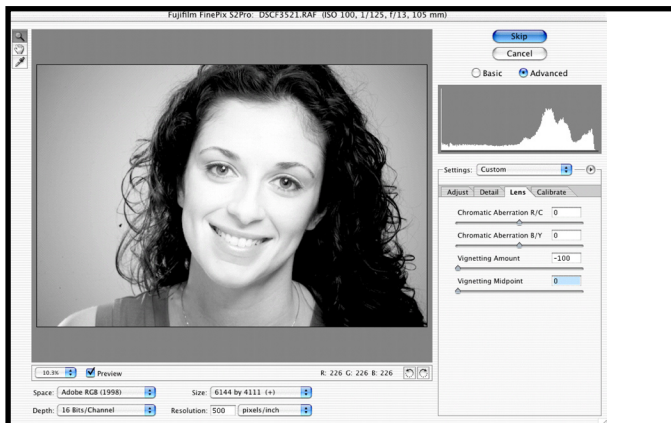
has been grayed out until not, assumes a value of 50. When you vary the effect of the Vignetting Midpoint slider by changing the values, moving the Midpoint slider to the left makes the center of the vignette smaller, similar to moving the centerpoint of a white-to-black gradient blend so that the white area is smaller, and the area darkened is larger. Moving the slider to the right moves the centerpoint of the gradient blend toward the darker end, which makes the area darkened smaller. Confused? So was I. See the screen shots below for comparisons.



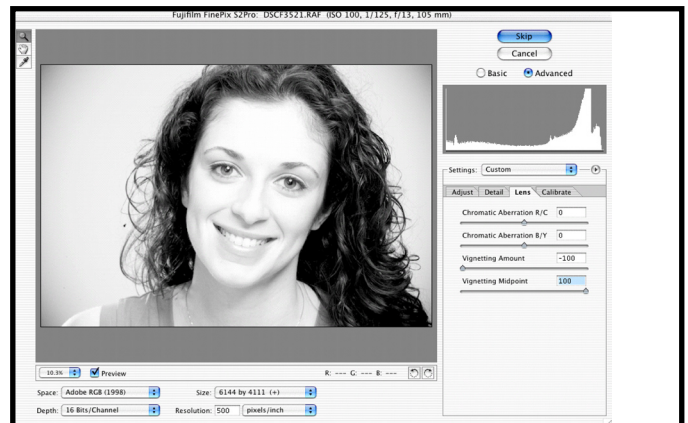
Vignetting Amount -100, Vignetting Midpoint 50 (default)



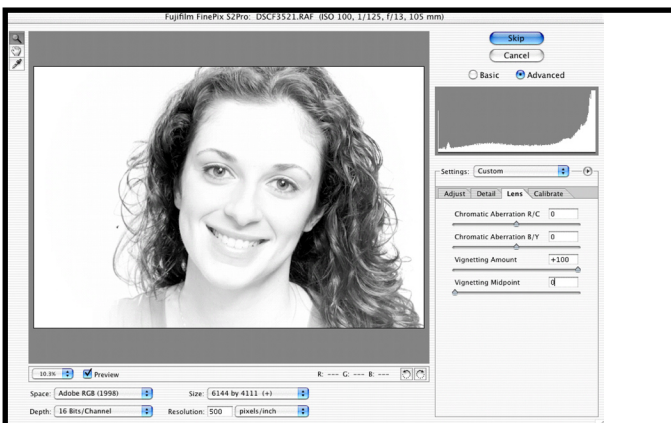
Vignetting Amount +100, Midpoint 50 (default)



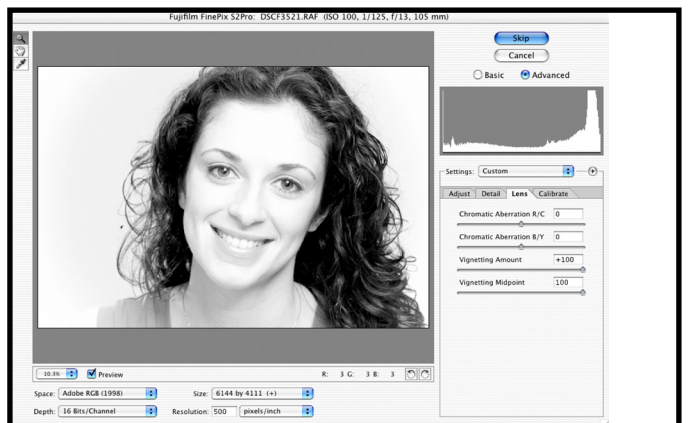
Vignetting Amount -100, Vignetting Midpoint at Zero



Vignetting Amount -100, Midpoint 100



Vignetting Amount +100, Vignetting Midpoint at Zero



Vignetting Amount +100, Midpoint 100

13 The Calibrate Tab

Shadow Tint

This slider is used to correct color in shadows. Sometimes, even after you've achieved a perfectly neutral image in the highlights using the Temperature and Tint sliders, there will be a color cast in the shadows. Use the Shadow Tint slider to remove this color cast. Although the color that is affected depends on the white balance you've set in your image's highlights, usually moving the Shadow Tint slider to the left will add green to the shadow areas, and moving it to the right will add red. As always, adjustments like this are best done on a calibrated and profiled display.

The Saturation and Hue Sliders

Every camera supported by Photoshop's Camera Raw plug-in has two color profiles associated with it in the plug-in, one for daylight and one for tungsten light. These are a part of the Camera Raw plug-in, and are not accessible (nor are they replaceable). These profiles may not be an exact match to your particular camera's color rendering behavior, as chips vary between units of a same camera model. In addition, the Auto White Balance function of our camera may not be able to calculate an exact match to the colors in the scene you are photographing.

When you set a neutral white balance in your camera before shooting, you can usually get a closer color match than when you rely on the Auto White Balance feature of your camera. However, even then, sometimes you'll need to finetune the colors. You make these adjustments using the Hue and Saturation sliders.

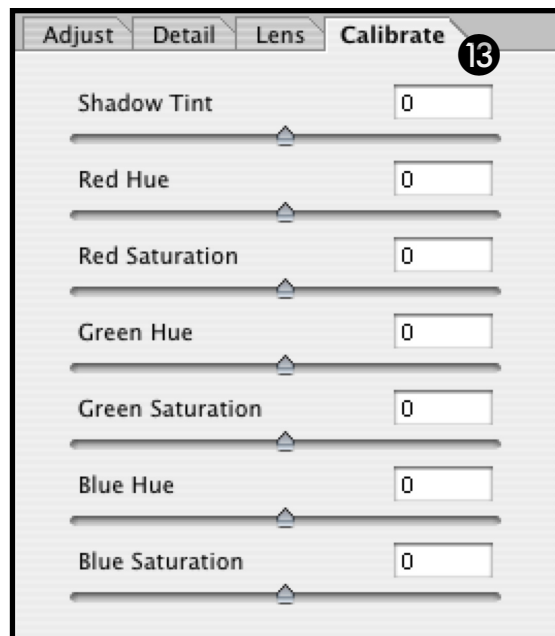
The Hue sliders change color, while the Saturation sliders increase or decrease the intensity of the color. If you're not used to the HSB/HSL models of color, you're not alone. However, if you'll take the time to experiment with these sliders, you'll find that they're often very useful in finetuning your images. Adjust the Hue first; then the Saturation. To try this out, install the HSBHSL plug-in (Photoshop>Plug-ins> Adobe Photoshop Only>Filters>HSBHSL, and then experiment with it in the Color window. See what happens as you move the sliders around, and it will give you a much better intuitive feel for using this tool.

About the Camera Raw settings

Storing the Settings for Future Use

The settings you use for opening Camera Raw files are stored in two different places, either the Camera Raw database (the default) or a sidecar XMP file. This is changed in the Camera Raw preferences. These stored settings are used by Photoshop to open an image exactly the same way as you opened it the last time, except for the four image attributes which you have to set yourself (target color space, bit depth, pixel size and resolution). The file path for Mac OS X is:

Users/*user name*/Library/Preferences



The settings you use for each image are indexed by image content, not location, so if you move the file elsewhere or rename it, the settings you used last time stick to it, as long as you are using the same computer. If you need to move the settings with the files you'll need to use the XMP preference instead.

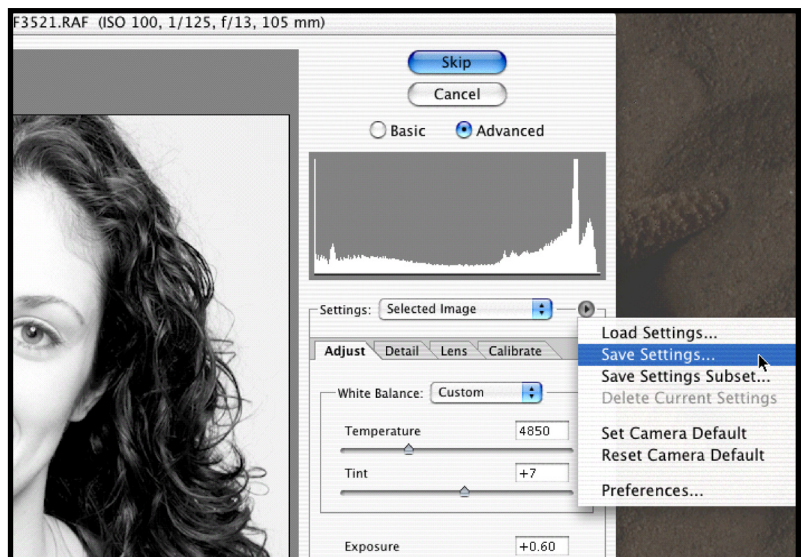
The XMP file is stored in the same folder as the raw file with the same name and an XMP extension. This can be useful when archiving raw files long term, and for exchanging raw files in multi-user workflows. Use this when you need to send your Camera Raw settings to other people, and also when you want to store metadata in the same XMP file. Note: The Camera Raw plug-in will write your settings to the Camera Raw database when you open files from a read-only volume, such as a CD or DVD, whether or not you've set the preference to XMP.

Using Camera Raw settings for a batch of images

It's nice that Photoshop saves the settings for each image you open, but what if you want to open a batch of images with the same settings? Photoshop allows you to save the settings you used, so you can use them again. If you regularly make certain adjustments to a set of images, this can be a great timesaver. Here's how you do it.

To Save Photoshop Camera Raw settings

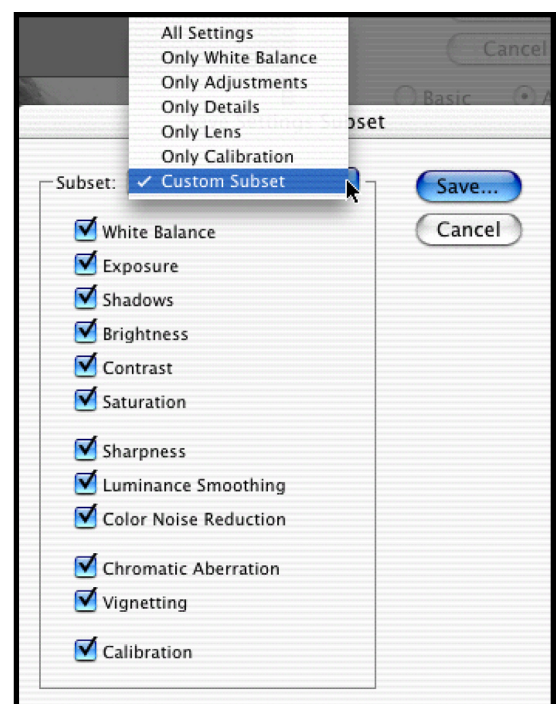
1. Make all your adjustments which you want to save.
2. Choose Save Settings, as shown in the screen shot.
3. A Save dialog box appears, and you give the settings a name.
4. The settings are saved into the Camera Raw plug-in folder, available for immediate use on other files. If you save them into another location, they will not be retained, and you'll have to use the Load command to load them each time you want to use them.
5. Use the Reset Camera Default command from the plug-in menu to return to default settings.



To Save a Subset of Camera Raw Settings

Photoshop will also let you save a subset of the settings you've used, for use later. To do this, follow these steps:

1. Choose the Advanced Mode.
2. Select Save Settings Subset from the Flyout menu shown in the screen shot above.

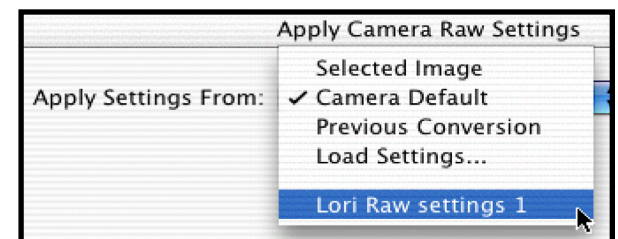
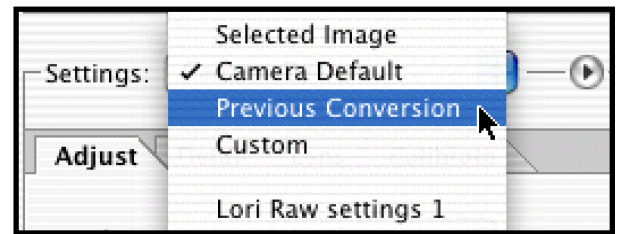


3. Either select one of the presets as shown in the screen shot to the right, or select Custom Subset, and select which checkbox items you want.
4. Give this set a name, and save for future use.

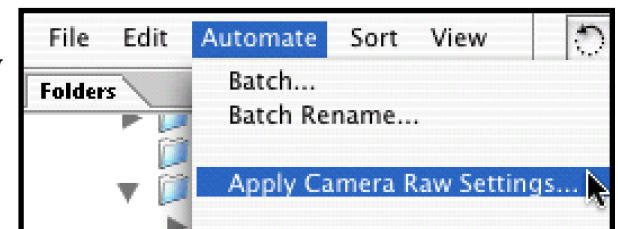
Batch Processing Raw Files

After opening a first file and adjusting it to your taste, you can apply the same settings to the next file by opening it into the Camera Raw dialog box, then selecting Previous Conversion. If you'd rather use a saved, named custom setting, whatever custom settings you've saved will show up in this same menu, as shown.

Opening more than a couple images this way can be tedious; fortunately, Photoshop offers automation options for processing a whole set of files at one time. Here's how.



1. In the File Browser, select the images to which you wish to apply the same conversion settings.
2. From the File Browser menu, choose Automate > Apply Camera Raw settings.
3. Alternately, you can Control-Click on the first image, and choose Apply Camera Raw Settings from the contextual menu. To apply different settings, open the first image into the Camera Raw Dialog, and make the changes you want. Then, hold down the Option key, and click on the Update button (into which the Open button has changed), and Photoshop applies the settings you've set without opening the image.
4. Select all the images to which you want to apply the same settings, and under the Automate menu, Apply Camera Raw settings, using the Previous Conversion. This will apply the settings to all the selected images.
5. If you want to update a subset of the settings, you can select Advanced mode in the Apply Camera Raw Settings dialog box.
6. Create an action or a droplet if you need to apply the same settings to large numbers of files, and save them in another format, such as TIFF.



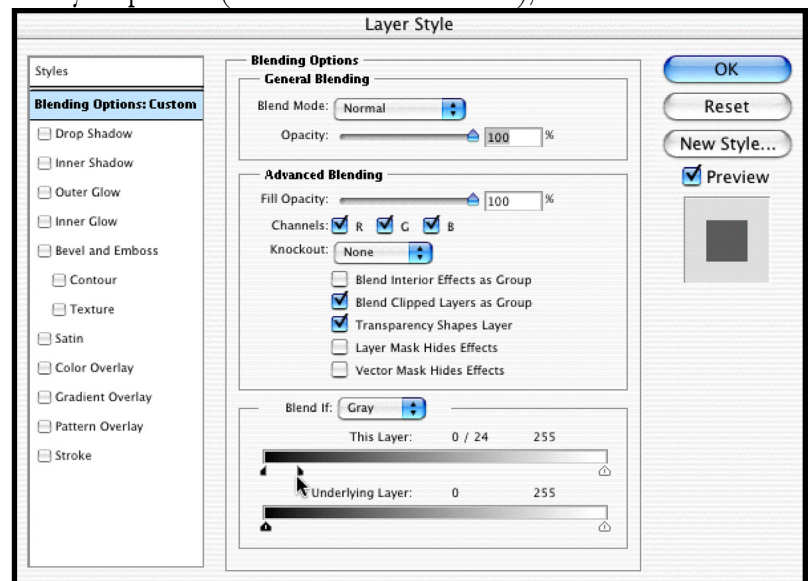
A Useful Topic

Dynamic Range Expansion Using Camera Raw

In traditional film photography, when faced with a very contrasty scene, photographers were advised to expose for the shadows and process for the highlights. Adequate exposure in the shadow areas ensured detail; shortening the development time prevented overdevelopment of the highlight areas and subsequent blowing out of detail in highlight areas. Photographing a contrasty scene with a digital camera can be even more difficult to hold detail in both highlight and shadow areas than with film.

This problem can be solved by shooting in Camera Raw format, and processing two versions of an image in Photoshop. The first version is processed to retain good shadow detail, and the second preserves highlight detail. Then, the two versions are combined in Photoshop, and blended using a Luminance Mask selection.

1. Open the image in Camera Raw, and adjust it so that it has good open shadow detail. Don't worry about the highlights if they block up. Keep the file in 16 bit mode.
2. Copy the image to the clipboard and close the file.
3. Reprocess the image so that it has good highlight detail (blocked shadows are OK).
4. Paste the shadow detail image from the clipboard into the highlight detail image, creating a new layer.
5. Turn off viewing of the top layer (shadow detail layer).
6. Select the bottom layer (highlight detail layer).
7. Create a Luminance Mask from the bottom layer (Command–Option– Tilde).
8. Select the top layer and delete the now selected blown–out highlights. Next, type ⌘ D (Deselect) so that there is no selection.
9. Double click on the Background Layer in the layers palette (to rename and unlock it), which will enable Opacity Adjustment for both layers and allow custom tonal balance adjustments.
10. Edit for the desired appearance. It sometimes helps to adjust the Layer Style Blending Options, as shown in the screen shot to the right. Hold down the Option/Alt key while moving the slider, and the two pointers will separate, giving finer control over the blending.



Conclusions

Photoshop's Camera Raw plug-in opens raw files from multiple vendors' digital cameras, and is updated regularly with custom information for each new raw-capable camera as new cameras are released. This universal access removes the need to run camera manufacturers' proprietary software, which is often less stable and more buggy than we would like. Camera Raw files can be sorted quickly and easily using the File Browser in Photoshop, and opened directly from the file browser. Additionally, customized settings for individual or batches of images can be applied using Camera Raw in the File Browser, so that the images can be opened and saved using actions or droplets.

It's the best raw deal you've ever seen, now isn't it?